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# Capability Assessment toward Sustainable Development of Business Incubators: Framework and Experience Sharing

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**Abstract:** Business incubators have been widely developed to advise, support, promote, and provide a nurturing environment for new business start-ups and entrepreneurs. The development of a framework for capability assessment allows the management of each incubator to understand its strengths and room for further improvement. Moreover, assessment results across a community, such as a nation or state, can provide insights into resource allocation and various management policies so that policymakers can support the development of business incubators under their supervision. This article describes the development of a capability assessment framework for business incubators (BIs) in Thailand. A case study demonstrating how the capability assessment is analyzed is also presented in the article.

**Keywords:** capability assessment; business incubator; maturity model; sustainability; Thailand



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## 1. Introduction

There are various roles and duties of business incubators depending on the structure of the unit. One of the widely accepted business incubator configurations is the InfoDev configuration developed by World Bank. InfoDev addresses the roles of a business incubator as: To help clients (entrepreneurs) develop a business model, set up a plan, and find a source of funding; to provide access to experts who can give technical advice; and to create the appropriate environment for active engagement. However, business incubators do not have a primary role as an investor. InfoDev's configuration aims to harmonize with the four stages of the entrepreneurial life-cycle: Germination, pre-incubation, incubation, and post-incubation [1]. The UBI Global benchmark 2015/2016 report identifies the three critical success traits of an incubation program as attracting high-potential startups, ensuring enough resources for operations, and creating a supportive entrepreneurial environment among startups [2].

In East Europe and Central Asia (ECA), InfoDev interviewed nine businesses from eight countries with distinct performance incubators. The results showed that the current business incubators in those countries are mainly supported by the federal government, such as the ministry of ICT, ministry of education, and/or ministry of science. The study also showed that the role of business incubators in the private sector is increasing in many countries. Moreover, some business incubators can reach financial self-sustainability after 2–4 years of operation, and experienced experts, such as CEOs and high-level executives, tend to gratefully participate more with incubator activities [1].

In Brazil, ANPROTEC (Brazilian Association of Science Park and Business Incubators) is composed of private and public members that promote innovation to increase Brazil's

economic and social welfare value by providing a variety of activities and services to support entrepreneurs and companies. ANPROTEC is currently a member of the International Association of Scientific Parks and also represents Brazil in the Triple Helix Association (THA). The financial income of ANPROTEC comes from membership, training courses, research, and events. A major feature of incubation in Brazil is the degree of private/public coalitions of partners that support incubation efforts. The Brazilian case has strong national incubator associations. For instance, the Federation of Industries for the State of Sao Paulo (FIESP) operates a dozen incubators [3].

The International Business Incubation Association (InBIA) is a global nonprofit organization in the USA. For over 30 years of service, the goal of InBIA has been to enrich the entire ecosystem by providing industry resources, education, events, and global programming to help their members better serve the needs of their unique communities and regions. Currently, InBIA consists of business incubator developers and managers, corporate joint venture partners, venture capital investors, and economic development professionals. There are more than 2200 members in 62 countries. The Services of InBIA include training and education for members, such as the Business Incubation Management (BIM) Certificate, NewCo Academy Courses, Online Courses, and Customized Training. In addition, InBIA also provides information for their members about industry news and resources and hosts International Conferences on Business Incubation (ICBI). InBIA's income is from membership, training courses, research, and events.

In South Korea, the Korea Business Incubation Association (KOBIA) facilitates technology-based start-ups in collaboration with the Korean Intellectual Property Office (KIPO). The organization trains start-up managers (business incubator managers) as well as students through short-cycle start-up schools or start-up competitions for university students [4]. The association plays this role in five areas. First, the policy area aims to support higher education institutions and research institutes to establish incubators for research commercialization. Second, the business area targets the expansion of the role of incubator entities to support marketing programs. Third, the education area puts an emphasis on the development of an entrepreneurship curriculum in higher-education institutions. Fourth, the international networking area focuses on overseas marketing. Fifth, the public area aims to provide online access and develop the communication tools [5].

In Taiwan, the Chinese Business Incubation Association (CBIA) is a non-profit and membership basis organization. CBIA promotes efficient management, the exchange of information and experience, and resource sharing for the incubators in Taiwan. In addition, CBIA creates networks, conducts research, and provides assistance to policy-makers. CBIA also develops appraisal system and related training programs for incubator professionals. The CBIA's mission is the development of incubation centers, assistance to incubated enterprises in diversified fields, arrangement of specialized activities and skill training courses, provision of educational and practical assistance and materials for incubators and their tenants, publications related to business incubation, and contract establishment with relevant domestic and foreign partners for exchange of experiences (Chinese Business Incubation Association) [6].

The discussion above exemplifies how the executives and management team of business incubators attempt to make the better uses of their capabilities and resources to drive the future development rather than rely on external supports, particularly from government. This attempt has been considered as the pathway toward sustainable development of future business incubators.

Thus, the current capabilities of each incubator need to be assessed in various dimensions. The management team can use the assessment results to guide the future development of each incubator toward sustainable operations.

This leads to two major research questions. The first one is how the capabilities of business incubators can be assessed. The second one is what dimensions of capabilities and their measuring parameters should be used for assessment. Responding to these two research questions, this study reviews different assessment frameworks and presents the

development of a capability assessment model for incubators in Thailand. The later section of this paper provides managerial implications on how the assessment framework and model can be strategically implemented.

## 2. Incubator Development and Evolution in Thailand

Thailand's business incubator was first initiated in 2002 at the country's National Science and Technology Development Agency (NSTDA) where the Business Incubator Centre was established to support startup companies and firms with innovative and technologically driven products. Later in 2004, the Office of the Higher Education Commission (OHEC) under the Ministry of Education initiated the University Business Incubator (UBI) program to reinforce the country's technological commercialization from both public and private higher education institutions [7].

There are currently three platforms of business incubators in Thailand: (1) Business Incubation Center (BIC), (2) University Business Incubator (UBI), and (3) incubators in the private sector. The first two platforms are operated by governmental agencies. The third one is managed by different private firms. BIC is under the supervision of NSTDA. UBI is run by OHEC. For the third platform, there are various companies that support the country's business incubator.

BIC has incubated 74 start-ups and supported established companies with a total of 320-million-baht annual revenue, such as Flexoresearch (an R&D service provider for the pulp, paper, printing, and packaging industries) and KEEN (a bio-remedial firm) [8]. For UBI, the country's fifty-six higher-education institutions have participated in the UBI platform (<http://www.mua.go.th/users/bphe/bs/ubi.html> (accessed on 20 March 2020)). The third platform of non-governmental agencies is run by private companies/firms in different industrial sectors, for instance, telecommunication service providers and real estate companies. These are companies such as AIS The Startup, The FinLab Accelerator Program, Digital Ventures Accelerator, AddVentures, and Ananda Urban Tech.

A critical problem of the country's university business incubator is a lack of strategic support and insufficient, fragmented, and uncertain financial resources. This is due to the lack of understanding of the risky nature and financial support of start-ups, particularly the technologically based ones. Financial resource support provided by UBI has been spread too thin (due to program rigidities) and has been spent inefficiently (such as duplicate trainings) [7,8].

## 3. Areas of Capability Development for Business Incubators

Academics have adopted various theoretical lenses spanning different disciplines to study the complexities of the business incubation process and to understand the mechanisms that make a business incubator more effective [9–13]. Those frameworks used in incubator capability assessment can be found to be divergent. For instance, Mian [14] proposed the assessment framework of the University Technology Business Incubator (UTBI) and determined four features that combined the goal approach, the system resource approach, the stakeholder approach, and the internal process approach. On the other hand, Irshad [15] in the "Incubator Support Programme Evaluation Report 2008" by the Ministry of Economic Development of New Zealand utilized three key phases of incubator lifecycles as the framework (the startup phase, the growth phase, and the maturity phase).

According to the literature review, the capability of business incubators can be grouped into seven areas as hereafter described.

### 3.1. Strategy and Organizational Structure

Strategy and organizational structure are key components of the survival and sustainability of incubators. Incubators need to create their own differentiation strategy, position themselves as specialists, and focus on particular domains [16–21]. Eccles, Perkins, and Serafeim [22] also highlight the three fundamental elements of organization culture as innovation, trust, and capacity for transformational change. In other words, the dimension

of strategy and organizational structure should be created with a focus on specialized areas, the continuity of process, and the adaptation to dynamic environmental changes.

### 3.2. Finance

The conceptual resource-based views of Barney [23] and Gassmann and Becker [24] are applied. Both contributions lead to the connection between the incubation process and resource allocation. In general, incubators utilize two types of tangible and intangible resources. Tangible resources are used through the flows of finance, infrastructure, and explicit knowledge [25–27], while intangible resources are managed through the flows of implicit knowledge and branding [28,29]. These authors' works point to the importance of financial resources for the incubation process. The incubators need efficient financial management, which involves investment and subsidy as well as salary and wages. Moreover, based upon a relevant literature review and preliminary interviews with the sampled incubators, these authors found that incubators earn revenue from five sources, namely (1) subsidy, (2) activity-based revenue, (3) asset-based revenue, (4) fundraising, and (5) revenue from investments.

### 3.3. Knowledge Body

Since the degree of incubators' service excellence and specialization depends on their proprietary knowledge body [29], the incubator's capability assessment requires the determination of the management of the knowledge body [25,30,31]. This dimension employs Nonaka's A Dynamic Theory of Organizational Knowledge Creation [32] as the conceptual framework to understand the management of the knowledge body within incubators. Nonaka's work found that there is more explicit knowledge than tacit knowledge at the ratio of 80:20. The tacit nature and explicitness of knowledge can be shifted over time depending on the emergence of new knowledge from influential situations. This continuous shifting of knowledge forces firms to adopt the process of knowledge management through the cyclic of a continuous knowledge management process, which is composed of socialization, externalization, combination, and internalization (SECI) [33].

### 3.4. Human Resource Development

Human resource development (HRD) involves the process of improving working approaches, knowledge, skills, and attitudes among employees in order to achieve organizational objectives [34–36]. Human resource development needs techniques, tools, and measures in order to align the goals of individuals and organization as well as to support and solve problems for employees. Tseng [37] investigated the relationship between HRD and incubator management and development and revealed that the effectiveness of the incubation process is influenced by HRD's six roles: As a catalyst, a failure rate reducer, a multiplier effect generator, a pilot demonstration center, an entrepreneurship and innovation promoter, and a productive endeavor inspirer.

### 3.5. Infrastructure

This dimension adopts Smilor's incubation model [38] to understand the roles of infrastructure for incubators. The model indicates that business incubators need a support system that contains four elements: (1) Administrative (such as documentation and file processing); (2) secretarial (such as service work); (3) facilities (such as space, tools, equipment, and other supporting objects); and (4) business expertise (such as technical knowhow and market knowledge). These four elements support the agility and the continuity of services and other activities provided for incubatees [39–41]. Hence, incubators need to invest in facilities in order to be able to provide services with minimum dependence on other incubators within the network.

### 3.6. Network

It is essential for business incubators to foster a relationship with other agencies, such as research centers, industrial agencies, government agencies, funding organizations, experts, and the market. Moreover, the management of an incubator needs to engage with the networks of local, national, and international incubators to obtain benefits from the pool of shared resources [41–44]. This dimension attempts to understand the adoption of networks among incubators by focusing on the New Economy Incubator Model developed by Lazaroeich and Wojciechowski [45]. The model highlights that incubators who have a broad network at the regional, local, and international levels tend to have a high degree of service excellence.

### 3.7. Services

The core function of business incubators is to support incubatees to survive and thrive in the market through the delivery of service excellence [46–49]. This dimension of services employs the Customer Satisfaction Model developed by Zeithaml et al. [50]. The model highlights that service quality can be divided into three levels, depending upon the distance between customer perceptions and expectations. The base level of meeting basic customer requirements is achieved when organizations reach the customer requirements and prevent customer complaints. The mid-level of satisfying unstated customer needs is accomplished when organizations reach the customer requirements and develop customer confidence. The top level of achieving customer delight is reached when organizations provide services that exceed customer expectations and build customer loyalty.

## 4. Methodology: Development and Validity of Assessment Model

This study addresses two research questions of how the capabilities of business incubators can be assessed and what dimensions of capabilities and their measuring parameters should be used for assessment. In this study, the operation of business incubators from many countries have been reviewed from the literature and their official websites. Although various operations of business incubators can be found, the characteristics can be categorized into seven dimensions as described in Section 3.

Three rounds of focus group interviews were held to test the content validity of seven dimensions and to obtain insights on how business incubators in Thailand should be developed toward sustainability. Fifty managers and executives from various business incubators across the country were invited to participate in three rounds of the focus group interviews organized and moderated during March–April 2018, lasting for 4–5 h per round. The first round focused on opportunities and challenges of business incubators in Thailand, aiming to shed light on the potential of Thai business incubators toward sustainability. The second round discussed the necessary capabilities required toward the future development of business incubators. The participants were allowed to reveal their perspectives of ideal business incubators. As a result, all participants agreed with the seven dimensions as earlier described. For the third round, participants were asked to discuss about the assessment model including what proper indicators and measuring parameters should be used for assessment. The 5-point scale was introduced, and participants were encouraged to give the description of each of the five levels (from initial, defined, established, systemized to matured) of each dimension.

Findings from the three rounds of focus groups led to the conclusions on seven dimensions along with their descriptions, parameters, and measuring indicators. Then, the assessment model was validated through the workshop organized during December 2018 with business incubator managers and operational teams. The assessment model was tested with a prepared case study. The details of model development and the case demonstration are presented in Sections 5 and 6, respectively.

The scales developed in this study may have to be adjusted in the future as many disruptions arrive and the role of business incubators may have to change overtime.



Consequently, the validity of assessment model might have to be revisited from time to time in order to adapt with changing circumstances.

### 5. Capability Assessment Model: Lessons Learned from Thailand

A capability assessment model for business incubators that is widely accepted and used internationally is still being debated. However, there are a few related studies. Each study has similarities, but they use different assessment models. For instance, ANPRO-TEC in Brazil uses the CERNE framework (Centro de Referencia para Apoio a Novos Empreendimentos) by setting four levels of capabilities according to the process and the ability in operation. In New Zealand, The Humaira Irshad (2014) [15] and Incubator Support Programme Evaluation Report (2008) by the Ministry of Economic Development [51] defined three levels of capability according to the lifecycle of incubators from the early state, growth state, and maturity state of operational capability.

The community of business incubator managers is still in search of the ideal incubation strategy and models. The UBI Global benchmark 2015/2016 highlights that it is a much more complex endeavor due to the particularities of each center's business model [2]. The different contexts have different types of problems and diverse cultural underpinnings embedded in their structural systems and social relations. Therefore, the consequences of the same incentives and assessment mechanisms applying/functioning in different individual contexts might not be identical [52]. This is the same case for applying any model for capability assessment of incubators in countries that have specific contextual factors. Mian et al. [9] pointed out that although a model needs to develop a unified theory of incubation, which covers the business incubation mechanisms, the key challenge is how to address varying policy objectives, organizational forms, and contexts.

In this study, the capability assessment model is developed by incorporating multidimensional perspectives into the consideration. Not only the vision, mission, and objective of business incubators, but also the opportunities and possibilities to further develop the incubators are considered.

The capability dimensions and maturity levels required for the operation of an incubator were defined during a brainstorming session with experts and top management from leading incubators in Thailand. The meeting was held to define the capability dimensions and their description. The following seven dimensions were agreed up-on (as shown in Figure 1): (1) Strategy and organizational structure; (2) finance; (3) knowledge body; (4) human resource development; (5) infrastructure; (6) network; and (7) services.

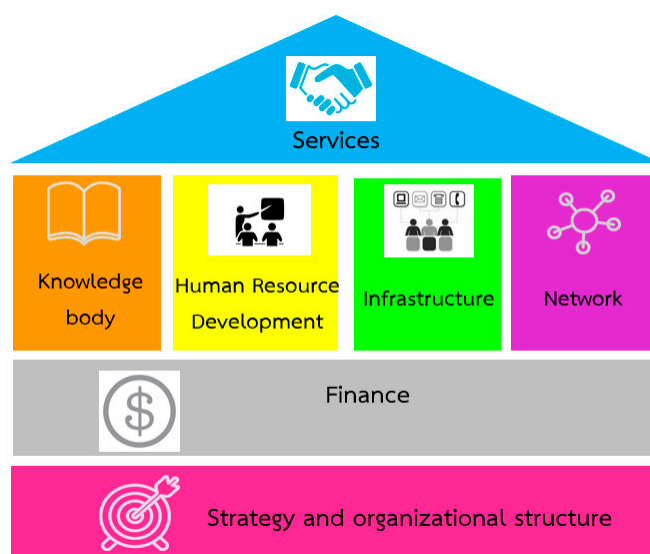







Figure 1. Dimensions used in capability assessment model.

The experts then discussed and agreed upon the capability rating scale by using five maturity levels ranging from initial (the lowest level), defined, established, systemized, and matured (the highest level). The description of an incubator in each level is shown in Table 1.

**Table 1.** Maturity level used in the capability assessment model for incubators in Thailand.

Level	Description
 Initial	An incubator is established with minimum infrastructure to operate. Staff are assigned to cover basic day-to-day operations only. The organization still lacks organizational structure, clear work procedures, etc. The organization requires 100% financial support from the government to operate.
 Defined	An incubator has defined the work procedure aligned with strategic goals and targets. However, the strategic implementation plan is still not effectively in place. The achievements are measured based on outputs not outcomes. Currently, an incubator has sufficient infrastructure but faces challenges in coping with the increasing demand requested by incubatees.
 Established	An incubator has a well-established organizational structure and is perceived as a stable organization. The strategic implementation plan is in place with clear KPIs. Key risks are identified. An incubator is capable of providing a wide range of services throughout the value chain and stages of incubatees. An incubator begins to focus the outcomes on economic value. An incubator is able to generate incomes from services accounting for around 20% of the annual expenses.
 Systemized	An incubator has a well-established organizational structure following the international standards, such as having an advisory board, applying a systematic approach for risk management, etc. An incubator is actively linked with other incubators, domestically and internationally. An incubator is also capable to strategically adapt to changing environments. The issues related to sustainable development of an incubator are always brought up for discussion. An incubator is able to generate income from services accounting for around 21–50% of its annual expenses.
 Matured	An incubator has been perceived as a sustainable organization with many achievements contributing to economic value creation. An incubator is able to effectively adapt its strategies to cope with changing environments. An incubator is able to generate income from services of more than 50% of its annual expenses. An incubator takes an active role in many incubator networks and has been internationally recognized for one of the best practice incubators.

## 6. Description of Capability Assessment Model for Business Incubators in Thailand

This study proposes seven dimensions to be employed in the capability assessment model for business incubators in Thailand. They are strategy and organizational structure, finance, knowledge body, human resource development, network, services, and infrastructure.

### 6.1. Dimension 1: Strategy and Organizational Structure

The organization can be sustained with a corporate culture consisting of three elements: Innovation, trust, and capacity for transformational change [53,54]. It is crucial to establish a corporate identity to build the corporate culture. The corporate identity features reframing identity, codifying new identity, and leadership commitment. Leadership commitment is essential since any changes or any operations in the organization require an organizational structure that appoints the leader who is distinctly responsible for managing and attending to the specific matters. Furthermore, leaders in the sustainable organization are different from the leaders in the traditional organization. Leaders from the sustainable organization exercise long-term vision in decision making and have tolerance against changes and risks.

The detailed description of each maturity level under Strategy and organizational structure are illustrated in Table 2. At the initial level, business incubators have the operation plan but still lack a distinct goal. At the established level, business incubators have a strategic roadmap, risk assessment, and capability to solve the immediate problems.

At the matured level, they can adapt their strategies due to the changing situations as well as predict the future shortcomings that may affect the business incubators.

**Table 2.** Maturity levels and their description on “Strategy and organizational structure” dimension.

Level	Strategy and Organizational Structure
Initial	The routine works have been assigned to responsible persons. The day-to-day operations are fine but still lack strategic goals and an organizational structure.
Defined	The work procedure has been defined. The strategic goals and targets are set and are in line with the direction of the governance of the organization. However, the strategic implementation plan is still not in place.
Established	An incubator has a well-established organizational structure and is perceived as a stable organization. The strategic implementation plan is in place with clear KPIs. Key risks are identified. The organization is capable of effectively handling routine problems.
Systemized	An incubator has a well-established organizational structure, which follows the international standards, such as having an advisory board, applying a systematic approach for risk management, etc. The organization is also capable to strategically adapt to changing environments.
Matured	An incubator can integrate change management as a part of day-to-day operations. It is capable to strategically initiate and transform with a forecasting and predictive systems in place in order to cope with changing environments.

#### 6.2. Dimension 2: Finance

The sources of funds supporting business incubators can be divided into five categories: (1) Government-related subsidies; (2) activity-based revenue (e.g., business consultant fee, training fee); (3) asset-based revenues (spaces and equipment rental fees); (4) grant from graduated incubatees or large private corporations; and (5) revenue from other investments.

This study considers the percentage of revenue that business incubators are able to generate by themselves. The detailed description of each maturity level under Finance is illustrated in Table 3. At the initial level, business incubators obtain a subsidy from an outside source of funds. At the established level, business incubators can generate some revenue by themselves, but they still need some subsidization from the external sources of funds. At the matured level, business incubators will create enough revenue to run their operational activities and allocate support to other business incubators.

#### 6.3. Dimension 3: Knowledge Body

The key elements to assess the knowledge body include basic knowledge, value-added knowledge, knowledge for innovation, knowledge management system, knowledge of international standards, and knowledge sharing.

The detailed description of each maturity level under Knowledge body is illustrated in Table 4. At the initial level, business incubators have a knowledge body that is able to solve fundamental problems of incubatees. At the established level, they have a knowledge body that is able to support the incubatees to enter the new market or create innovative products. The knowledge body at the established level also includes proprietary intellectual service. At the matured level is the creation of a new knowledge body and alteration and application the knowledge body to be practical for each incubatee.



**Table 3.** Maturity levels and their description on “Finance” dimension.

Level	Finance
Initial	An incubator requires 100% financial subsidy from the government to support its operations.
Defined	An incubator mostly requires financial subsidies from the government to support its operations. Some limited revenue is generated from providing services through contracted government projects.
Established	An incubator requires major financial subsidies from the government to support its operations. However, the incubator can generate some revenue by providing services through not only contracted government projects, but also other projects hosted by private organizations, communities, non-profit organizations, etc. The amount of revenue generated is around 20% of required annual expenses.
Systemized	An incubator is capable to generate revenues from its own services accounting to around 20–50% of required annual expenses and relies less on the financial subsidiary from the government. An incubator also allocates the budget to support the future growth of an organization.
Matured	An incubator is capable to generate revenues from its own services accounting more than 50% of annual expenses required and relies less on the financial subsidiary from the government. An incubator also allocates the budget to drive the future growth of an organization as well as support other incubators contributing to the development of incubator networks.

**Table 4.** Maturity levels and their description on “Knowledge body” dimension.

Level	Knowledge Body
Initial	An incubator has fundamental business knowledge with abilities to provide services to incubatees but still lacks the system for storing and archiving knowledge.
Defined	An incubator has a system to store and archive knowledge, but it still needs an additional system supporting data analysis and synthesis for value creation of knowledge applications.
Established	An incubator has a knowledge management system in place to store, archive, analyze, and synthesize knowledge.
Systemized	An incubator has applied the knowledge management system with case evidence that presents the incubator’s abilities to create economic value from knowledge sharing within an organization as well as with other outside incubators.
Matured	An incubator has extensively applied the knowledge management system with many cases that evidence the presentation of the incubator’s abilities to create economic value from knowledge sharing within an organization as well as with other outside incubators. Its effective approach in managing knowledge has been internationally recognized as one of the best practice examples.

#### 6.4. Dimension 4: Human Resource Development

Human resource development includes the efficiency of human resource management as well as the development of human resources (skills and career path). The maturity level of human resource development for a business incubator can be clarified in five levels. The detailed description of each maturity level under human resource development is illustrated in Table 5. At the initial level, the support for human resource development is very limited and unplanned. At the established level, an incubator specifies the personnel capability characteristics required for each job position as well as providing the support for staff to complete training and skill development activities. At the matured level, each person is not only aware of his/her role, duty, and responsibility but is also able to set personal working goals in line with the business incubator’s goal.

**Table 5.** Maturity levels and their description on “Human resource development” dimension.

Level	Human Resource Development
Initial	The process supporting human resource development is not well defined. There is no clear plan or program for training or coaching new staff (impromptu).
Defined	The process for human resource development has been defined but the activities are mainly done through on-the-job training.
Established	The process for human resource development has been well-structured in order to assure the alignment between the personnel goal and the organization’s goal. The career advancement path is also defined and presented to staff.
Systemized	All staff have clear knowledge about the role of business incubation. Their understanding is in line with international standards. Each staff member is allowed to conduct self-assessment in order to determine his/her level of competencies and identify his/her competency gaps for further improvement.
Matured	All staff understand their roles and responsibilities. They are willing to engage in organization activities in which they strive for success and sustainable development of an organization.

#### 6.5. Dimension 5: Infrastructure

The key elements of infrastructure are comprised of administrations that are related to standard operation procedures (SOPs) for providing services to incubatees as well as facility management (e.g., office, maker space, equipment). The detailed description of each maturity level under Infrastructure is illustrated in Table 6. At the initial level, business incubators have rental space services, essential facilities, and staff. However, it is inadequate for all incubatees. At the established level, there is sufficient infrastructure and ability to appropriately and sufficiently meet the requirements of all incubatees. At the matured level, they can construct or procure the new resources and modify or develop the existing resources to be concurrent with the external changing factors and continuous requirements of the incubatees.

**Table 6.** Maturity levels and their description on “Infrastructure” dimension.

Level	Infrastructure
Initial	An incubator has some working space, equipment, and infrastructure, but it is not adequate. It still needs to acquire some more resources.
Defined	An incubator has most of its required working space, equipment, and infrastructure. However, these are not enough to support the increasing demands of incubatees.
Established	An incubator has most of its required working space, equipment, and infrastructure, and it can support the increasing demands. Yet an incubator still needs to improve the efficiency and effectiveness of its resource usage.
Systemized	An incubator can effectively manage the working space, equipment, and infrastructure that it has and is able to provide in a form of virtual services.
Matured	An incubator can regularly update current, or acquire new, working space, equipment, and infrastructure to cope with the change requirements of industries and incubatees.

#### 6.6. Dimension 6: Network

It is essential for business incubators to have a relationship with other agencies, such as the knowledge institutes, research centers, industry sectorial agencies, government institutions, fund agencies from both government and private sectors, experts from various areas, and the market. Moreover, it is necessary for the management of incubators to engage in the networks of local, national, and international incubators.

The detailed description of each maturity level under Network is illustrated in Table 7. At the initial level, business incubators have very limited alliances. At the established level, they will be part of the national level alliance network that can make an impact or create national level economic value. At the matured level, business incubators have roles as critical mechanisms or the central nodes of alliance networks.

**Table 7.** Maturity levels and their description on “Network” dimension.

Level	Network
Initial	An incubator has limited networks of partners that are not sufficient to cover possible services requested by incubatees.
Defined	An incubator has the networks of adequate partners to support the majority of services needed. However, the economic impacts from the collaborations are very limited.
Established	An incubator is a part of networks that can help create economic value from the projects of its incubatees.
Systemized	An incubator is a part of international networks that can exchange knowledge and/or activities that lead to economic value creation.
Matured	An incubator can be a node of international networks that can be a center of economic value creation.

#### 6.7. Dimension 7: Services

The analysis of service capacity is based on balancing customer perceptions with expectations. The acceptance and satisfaction of services is considered to range from meeting basic customer requirements, satisfying unstated customer needs, achieving customer delight that exceeds expectations, and building customer loyalty.

The detailed description of each maturity level under services is illustrated in Table 8. At the initial level, the variety and capacity of services offered by an incubator are still limited. There are the knowledge transfer activities to the locals and the public promotion of the duties of the business incubators. At the established level, an incubator can provide services covering the whole value chain of operations as needed by incubatees. At the matured level, there are unique services. They can see opportunities and offer services that support the dynamics of the business environment.

**Table 8.** Maturity levels and their description on “Services” dimension.

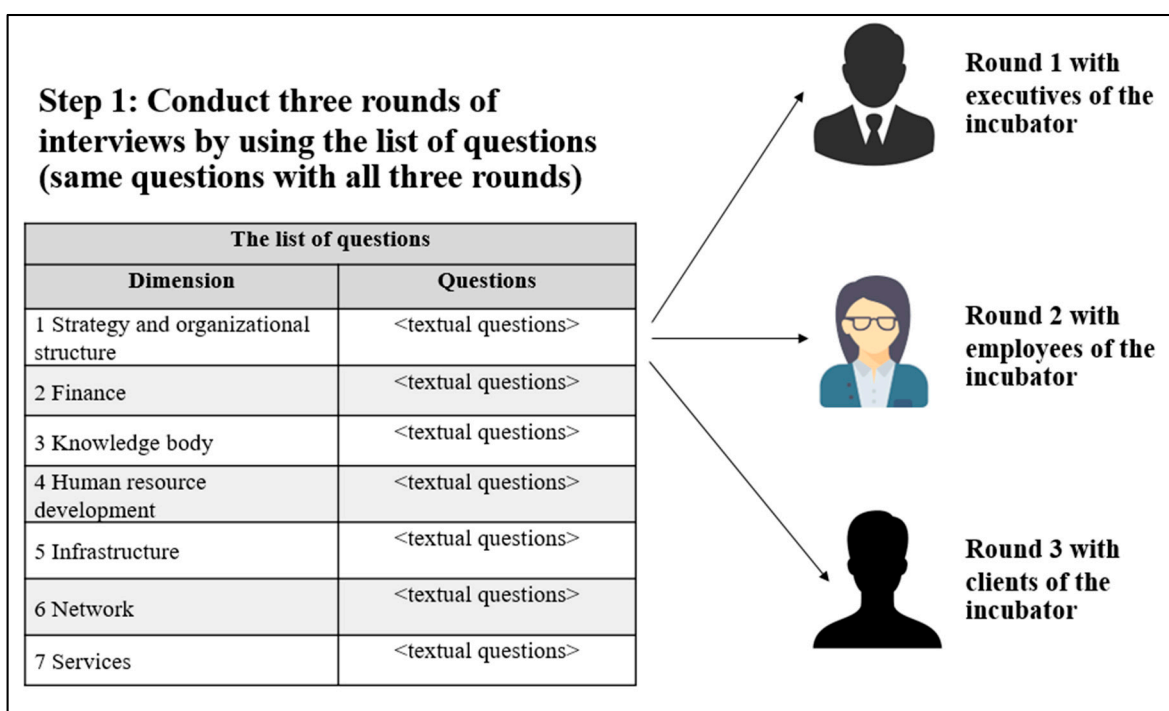
Level	Services
Initial	The variety and capacity of services offered by an incubator are still limited. The activities are mainly focused on knowledge sharing to create public awareness.
Defined	An incubator has the abilities to identify and solve some basic problems of incubatees. However, the scope of its services still does not cover the whole value chain addressing the different development phases of incubatees.
Established	An incubator is able to offer services that cover the whole value chain, addressing every phase of the lifecycle (from beginning to survival) of incubatees.
Systemized	An incubator offers proactive services to help current incubatees as well as to encourage people to become new incubatees. The system is in place to monitor the operation progress and risks. An incubator also provides the linkage connecting services offered by other incubators within its network.
Matured	An incubator offers a full range of services with some unique or specialized services. An incubator can seize the future opportunities and be able to actively adapt their services to match the changing business environment. In a case in which there is a request, an incubator can also provide services to incubatees who are working with other incubators within its networks.

## 7. Case Demonstration for Assessing the Maturity Level of a Business Incubator

This case study demonstrates how to operate the proposed model to assess the capability level of a business incubator. This demonstration case will be presented in three steps: (1) Data collection; (2) analysis; and (3) result presentation of the capability assessment level.

### 7.1. Step 1: Data Collection

To collect the inputs for assessment, the triangular interview approach is applied. The interview sessions are organized into three rounds. The first round is with executives of the incubator and the second round is with employees of the incubator. The third round is with clients of the incubators (see Figure 2). The interviewees are asked questions related to the seven dimensions of the capability assessment model. All interviews are recorded and transcribed.



**Figure 2.** Data collection—triangular interview approach.

The outputs of interviews in step 1 represent the case background and the conditions in which each business incubator operates. One example is shown in Table 9.

### 7.2. Step 2: Analysis

Interview transcription in step 1 is analyzed along the seven dimensions. Key interview quotations are then extracted and assessed according to the maturity levels specified for each dimension (see Figure 3). For example, in Figure 3, quotations regarding to dimension 1 Strategy and Organizational Structure have been analyzed and can be connected with the definition of level 3 Established.

Table 9. Case description.

**XYZ University Business Incubator \***

This university business incubator (referred to as XYZ in this case example) has been established for a decade. It is operated under the supervision of the university committee with the mission to promote and support new entrepreneurs through potential commercialization of the university research.

With this mission, XYZ plays a role in enhancing the capabilities and competitive advantages for businesses, co-developing innovation projects between academia and practitioners, and forming a network of experts from various fields.

XYZ has a flat structure, governed by the science park of the public university. This incubator is composed of five units including 1. Technology Licensing (TLO) 2. Innovation Design Office (IDO) 3. Office of Industrial Liaison (OIL) 4. University Business Incubator and 5. Development Unit for Startup (DUS). The executive meeting for strategic modification is held every three years. The board consists of executives from governing university, government, association, and business sector.

This incubator has large service areas; however, the primary services are focused on food products, agricultural products, IoT (Internet of Things), local wisdom, and area-based creativity. Nowadays, XYZ still rents the building space from the governing university. Over the past years, XYZ has prepared sufficient facilities, laboratories, and equipment to serve the entrepreneurs' basic needs along with customized designs and services for individual entrepreneurs.

The incubator produces a case study report every six months. However, most reports are still related to local food, agricultural products, and herbs. Internal knowledge-sharing activities among academic researchers, employees, and entrepreneurs are regularly held. Moreover, it has international linkages with countries in Asia, including Taiwan, Indonesia, and Vietnam, in activities of site visits, business matching, and cooperation.

The incubator used to experience financial obstacles, but it overcame them by seeking a variety of revenue sources and cutting unnecessary expenses. During the first three years, the incubator received 100% total funding support from the government. Nowadays, the incubator can generate revenue by itself and needs less support from the government. Furthermore, this incubator plans to operate with self-reliance in the long run.

As for internal management, this incubator provides financial rewards and honors for researchers and employees. Although the incubator accepts that the financial incentive might not be high, it attempts to use other non-financial incentives such as freedom, open and flexible working conditions, and training.

Currently, the proportion between the number of employees and the number of incubation projects is 1:12. The rate of terminated projects (when incubatees do not keep in touch for longer than three months) is 12%. This incubator does not clearly limit the period of incubation service, but it recruits applicants in 3–4 rounds a year. For each round, the interviews are conducted by professionals to screen applicants into 20 incubatees. However, this incubator still provides services by itself without any linkages with other incubators or with its networks.

\* Based on the actual organization but the name has not been disclosed.

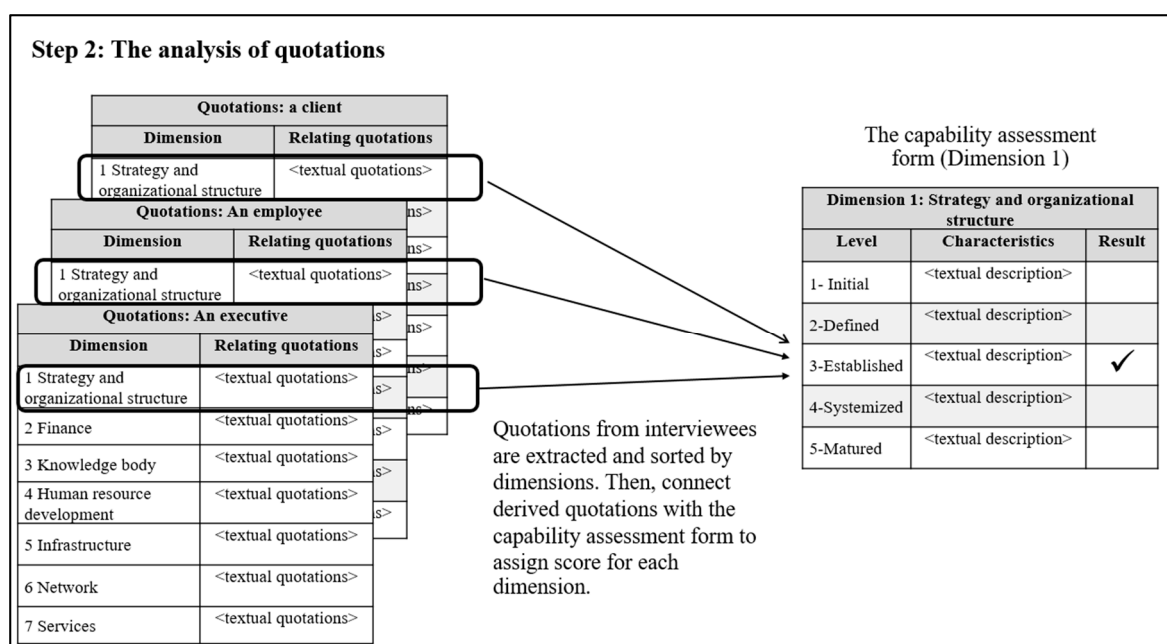


Figure 3. Case analysis.

As the result of step 2, Table 10 shows the analysis linking the interview quotations to the maturity assessment level for each dimension.



**Table 10.** Linking the extracted quotations to the assessment.

Dimension	Quotations	Assessed Level-Characteristics
Strategy and organizational structure	<i>"Nowadays, the direction of our strategies is the same as the governing university."</i>	3-Established level The organizational structure has been set and it has been perceived as a stable organization. The strategic implementation plan is in place with clear KPIs. Key risks are identified. The organization is capable of effectively handling routine problems.
Finance	<i>"Today, the proportion of revenue between from government and from itself today is 50:50. We have sufficient budget for operations and we also have some savings."</i>	4-Systemized level An incubator is capable of generating revenues from its own services accounting for around 20–50% of total annual expenses. An incubator also allocates the budget to support the future growth of an organization.
Knowledge body	<i>"Once the incubation has been accomplished, the Development Unit for Startups(DUS) will collect the information, decode into explicit knowledge and profile in both digital and paper formats for future knowledge exchange activities." "For intellectual management process, we follow the university policy and the mutual agreement between the incubator and entrepreneurs."</i>	2-Defined level An Incubator has a system to store and archive knowledge, but it still needs the additional system supporting data analysis and synthesis for value creation of knowledge applications.
Human Resource Development	<i>"However, we accept that some personnel feel insecure to work for here due to unclear career path."</i>	2-Defined level The process for human resource development has been defined but the activities are mainly done through on-the-job training.
Infrastructure	<i>"Most services provided us are regarded as in wall services." "When we do not have tools as the clients request, we attempt to acquire them from governing university."</i>	2-Defined level An incubator has most of its required working space, equipment, and infrastructure. However, these are not enough to support the increasing demands requested by incubatees.
Network	<i>"We have domestic networks with experts, academic researchers in other universities, other public science parks, trade councils, and even the ministry of culture." "However, our international linkage activities have been taken occasionally."</i>	3-Established level An incubator becomes a part of networks that can help create economic value from its incubatee projects.
Services	<i>"We offer three types of services including research and development (R&amp;D), preparing for market entry, and creating customers' perception."</i>	3-Established level An incubator is able to offer services that cover the whole value chain, addressing every phase of the lifecycle (from beginning to survival) of incubatees.

### 7.3. Step 3: The Presentation of Capability Assessment Results

The numeric results of capability assessment in Step 2 as shown in the right column of Table 10 are presented in a radar chart as shown in Figure 4. For example, the right column in Table 10 reveals that XYZ University Business Incubator performs seven dimensions at

levels of 3, 4, 2, 2, 2, 3, and 3, respectively. These numeric levels of seven dimensions are visualized in the form of radar chart format (see Figure 4 below).

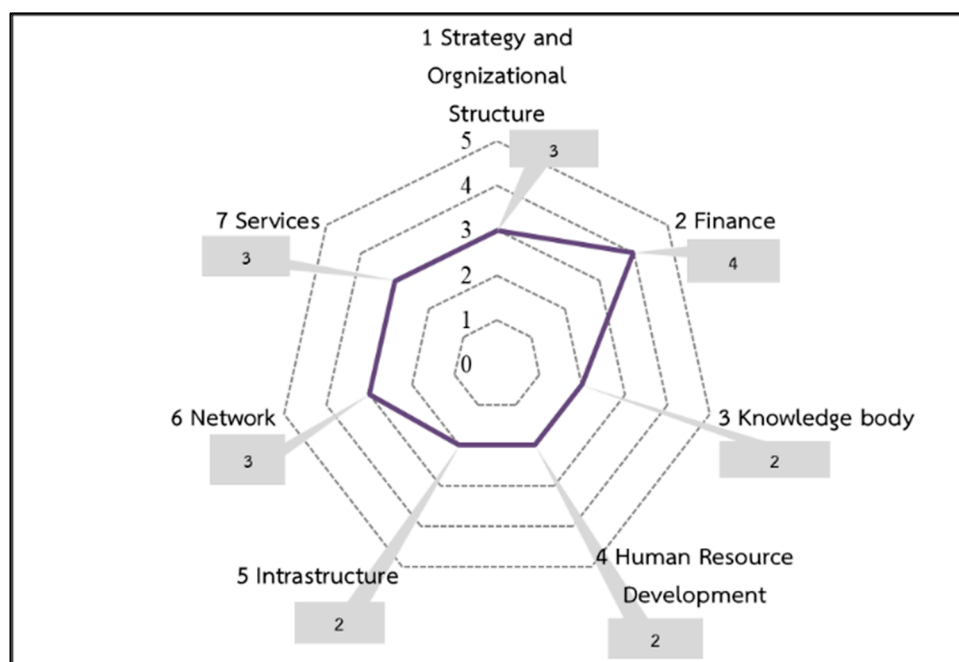


Figure 4. A radar chart representing the capability level of XYZ University business incubator.

## 8. Discussions and Managerial Implications

This section addresses the managerial implications of capability assessment from three aspects: (1) The development of a proper strategy and strategic roadmap toward becoming an effective business incubator; (2) the cluster development among business incubators according to their capabilities and not just by size or geographical location; and (3) the development of a knowledge-based community among incubators. The details of each aspect are hereafter described.

First, the radar chart (as shown in Figure 4) reveals the current capability level of business incubators in each dimension. In a case in which the capability level is below expectations, managers need to focus on how to close the gap. The wider gap the between the assessed level and the expectation, the more seriously managers need to pay attention. In other words, the results on a radar chart analysis can lead to the priority for closing the gaps. The extended approach of technology and strategic roadmapping can be applied [55–57]. Managers can begin to draft a strategic roadmap by using a radar chart as the reference to identify what gaps they need to bridge and when to do so (see Figure 5 below). The extended details of integrating capability assessment into road mapping can be found in the study by Chutivongse and Gerd Sri [58].

Second, the capability assessment results can be analyzed together with operational performance (such as number of incubatees, number of graduate incubates, the survival rate, etc.). The consideration of both capability and performance can be visualized in the form of a performance–capability matrix (see Figure 6). This matrix reveals the positions of business incubators indicating how high/low are their performances and capabilities. This matrix leads to four clusters. Business incubators in different clusters require different strategies to drive their development. Clustering can help policymakers or business incubator promotion agencies at the national level to customize their decisions on effective budgeting and resource allocation to strategically serve the needs of business incubators in each cluster rather than focusing on their size or geographical location. Figure 6 also shows the possible pathways to drive business incubator positioning in Q3 to eventually become the high-capability/high-performance incubator (Q1).

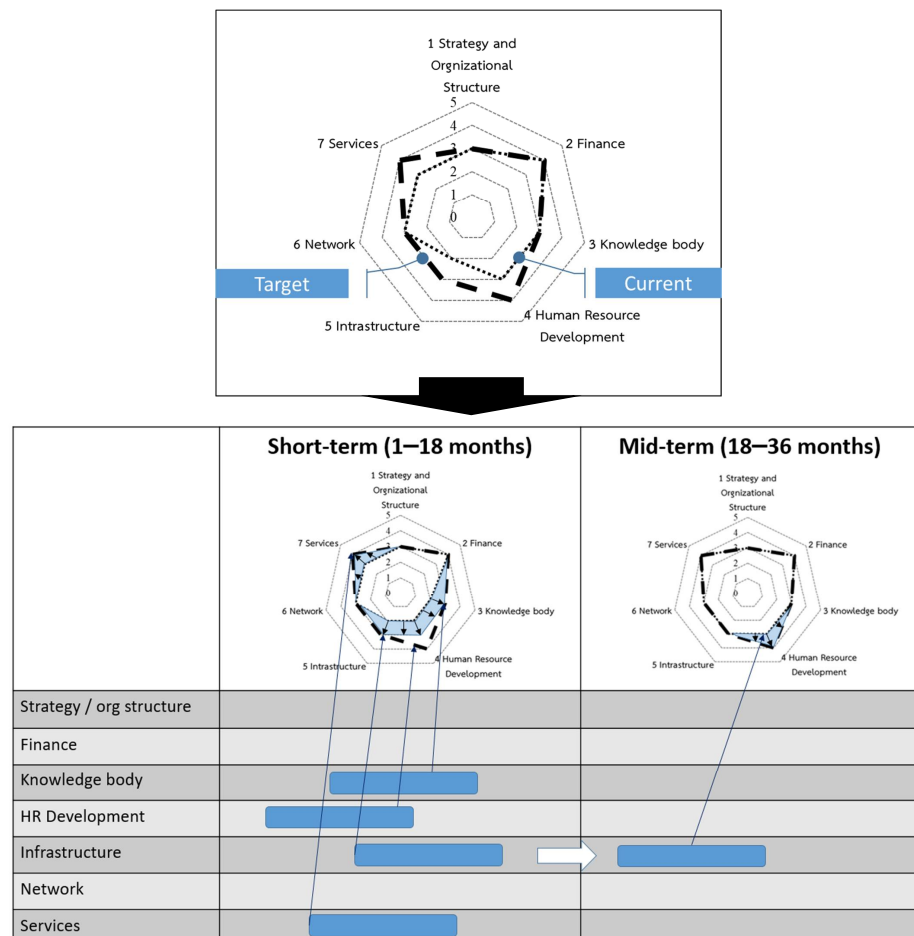


Figure 5. A strategic roadmap guiding development activities for the specified incubator.

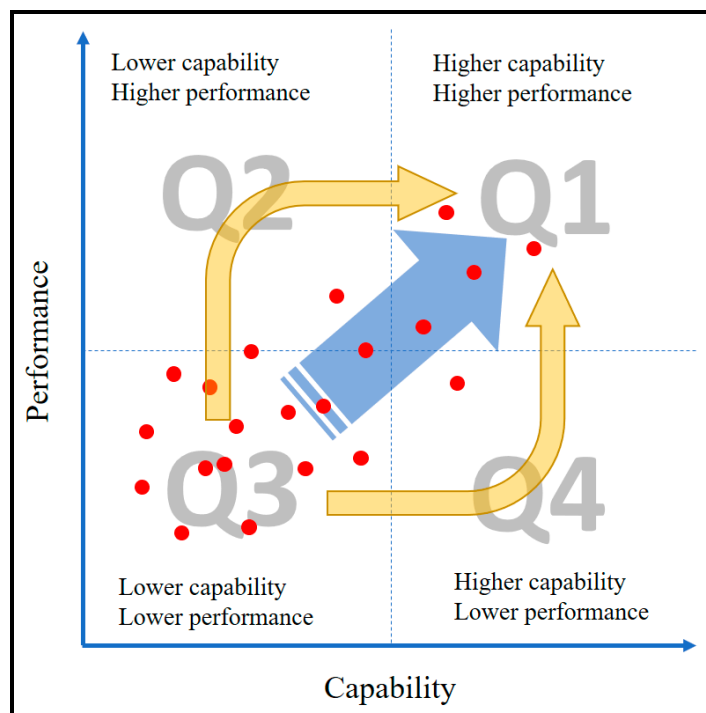


Figure 6. The performance–capability matrix.

Third, the capability assessment results can be used to develop the knowledge-based community among incubators by focusing on knowledge exchange [59] and the development of knowledge cluster [60]. The incubator with the highest level of capability in each dimension is considered as an incubator champion that is expected to act as a coach or a mentor sharing experiences on its developmental journey with other business incubators. Furthermore, the incubator champion can actively engage in community development by leveraging its capabilities and resources to work with other incubators to develop their capabilities. Engaging activities include holding regular meetings and seminars to transfer knowledge, setting up a talent mobility program, or collaborating in some projects with less capable incubators. These approaches have been practiced into develop the sectoral innovation system [61,62]. Figure 7 reveals that business incubator U performs better than business incubators C and N in the three dimensions of finance, services, and network. Business incubator U is expected to act as the incubator champion who shares experiences and its journey of development in light of how to manage finance effectively, improve service quality, and coordinate with partners of business incubators C and N.

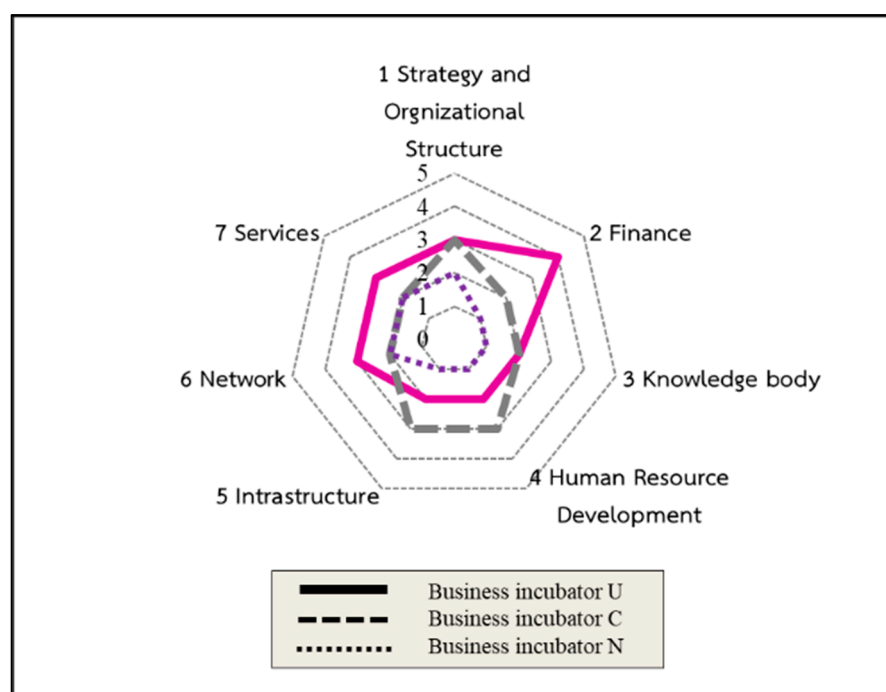


Figure 7. The radar charts of Business incubators U, C, and N.

## 9. Conclusions

The assessment of business incubators is significant for the country's incubation development. In this paper, the proposed model for capability assessment of business incubators is developed and applied to business incubators. The demonstration of the model is contextualized with the case of a business incubators in Thailand since these business incubators still rely on governmental supports through various forms (e.g., funding, creating business networks and communities, developing specialties in particular areas, etc.). For the long-term development, these incubators have to find the ways to become self-reliance in order to sustain their operation. It is very important for the management and executives of any business incubator to understand their current capabilities and limitations so that they can properly plan for their future development.

The capability assessment model consists of seven dimensions: (1) Strategy and organizational structure; (2) finance; (3) knowledge body; (4) human resource development; (5) infrastructure; (6) network; and (7) services. Each dimension is divided into a capability rating scale by deploying five maturity levels ranging from initial, defined, established,

systemized to matured levels. The assessment result in the form of radar chart reports the current status of incubators' capabilities. Managers and executives of any incubator can use it as the reference to determine the areas for development and the degrees to which it needs to be developed. The proposed model can be utilized as the assessment platform for both individual units and national levels. Due to the dynamic of business environment, monitoring progress and re-assessing the capabilities are periodically recommended.

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