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Exploring the development of an agribusiness ecosystem for Singapore: Lessons from Taiwan

Kuo-Chang FU
Singapore Management University, kcfu.2018@phdgm.smu.edu.sg

EXPLORING THE DEVELOPMENT OF AN AGRIBUSINESS ECOSYSTEM FOR SINGAPORE: LESSONS FROM TAIWAN

FU, KUO-CHANG

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Fu, Kuo-Chang

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Dissertation Committee:

Wee Liang TAN (Supervisor / Chair)
Associate Professor of Strategic Management
Singapore Management University

Annie KOH
Professor Emeritus of Finance
Singapore Management University

Hao LIANG
Associate Professor of Finance
Singapore Management University

Tzong Ru LEE
Professor of Marketing
National Chung Hsing University

SINGAPORE MANAGEMENT UNIVERSITY

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I hereby declare that this dissertation is my original work

and it has been written by me in its entirety.

I have duly acknowledged all the sources of information

which have been used in this dissertation.

This PhD dissertation has not been submitted for any degree

in any university previously.

Fu, Kuo-Chang

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Exploring the Development of an agribusiness Ecosystem for Singapore: Lessons from Taiwan

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Abstract

Singapore has a small land area of slightly over 700 square kilometers, of which only 1% is used for agriculture. It has been heavily reliant on imports to meet its food deficits. In 2019, the Singapore government launched the 30/30 initiative which aims to expand locally produced food to meet 30% of its national nutritional needs.

The COVID-19 pandemic and complex global circumstances have prompted a heightened level of apprehension about food security in Singapore. Due to the pandemic's impact, geopolitical tensions and instability within the global supply chain, Singapore is now compelled to re-evaluate its approach to food security. There has been a substantial focus to enhance Singapore's agribusiness ecosystem.

Taiwan, a comparable island located in Southeast Asia, has achieved a self-sufficiency rate of about 31% in 2020. Given the similarities between Singapore and Taiwan, Taiwan’s experiences in ecosystem development are a noteworthy reference.

This study tries to examine the question of “What lessons could Singapore draw from Taiwan in the development of its agribusiness Ecosystem?” To achieve this objective, the study will explore three sub-research questions, namely: 1) What domains constitute the agribusiness ecosystem? 2) What are the primary challenges confronting agribusiness entrepreneurs and what are the potential solutions? 3) What insights can

Singapore derive from Taiwan’s experience in establishing an agribusiness ecosystem?

This study was conducted over three phases. The first phase involves reviewing literature on enterprise ecosystems to establish the theoretical framework for the study. The second phase involves developing an interview protocol and conducting interviews with founders of targeted enterprises to comprehend the composition of domains and elements of each domain in Taiwan’s agricultural enterprise ecosystem. Finally, the third phase involves consolidating the findings from the interviews, contextualizing the model, and providing recommendations for Singapore’s agribusiness ecosystem.

This study yielded several implications. Firstly, Isenberg’s Entrepreneurial Ecosystem (EE) model was found to be applicable to Taiwan's agricultural enterprise (AE), with its six domains of the model being identifiable in the Taiwanese context. Secondly, the study highlighted the importance of individuals involved in the AE, particularly the role of connectors. Lastly, the study highlighted that Isenberg’s model must be contextualized to the specific industry and geography to which it is applied.

The significance of this study lies primarily in three aspects. First, it addresses a theoretical gap in the field of agribusiness ecosystem research. Second, it consolidates Taiwan's experiences in the development of agribusiness ecosystems. Third, it offers as a reference for Singapore when developing its agricultural enterprise ecosystem.

Given Singapore's pressing need to address its food security issues, there is a critical need to establish an enterprise ecosystem that can effectively integrate technology, innovation, sustainability, investment, and other key factors necessary for success in agribusiness.

Keywords: Entrepreneurial Ecosystem, Agribusiness Ecosystem, Taiwan, Singapore

Content

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Chapter 1 Introduction

1.1 Research Background

(1) Realistic background

In recent times, the COVID 19 epidemic and various global complexities have had a significant impact on global supply chains. As a result, the issue of food security and the food supply in Singapore has gained widespread public attention. Singapore's land area of just over 700 square kilometres, with only 1% of its land designated for agricultural production. The country's food self-sufficiency rate is currently below 10%, with 90% of its food supply being imported. In comparison to other Southeast Asian countries, Singapore's food self-sufficiency rate is notably lower. In 2017, South Korea's self-sufficiency rate for food was 48.9% while Japan's was 37% in 2018. Taiwan, which has a significant presence in Southeast Asia, had a self-sufficiency rate of 31% in 2020. Countries with more extensive land areas and advanced agricultural technologies generally have higher food self-sufficiency rate.

Singapore's focus on developing high-value-added manufacturing and limited agricultural area is due to its limited land size. Being a city-state with a high level of urbanization, Singapore faces challenges in ensuring food security due to its reliance on importing food from various countries. The global fluctuations in food prices and instability of food supply pose significant threats to Singapore's food security. For instance, the Russian-Ukrainian war in early February 2022 greatly affected the global food supply chain leading to concerns about food shortages and price increases in Singapore. As a result, there was a widespread "panic buying" among the general

public. Although the Singapore government provided assurance about sufficient food supplies, this incident highlighted the importance of ensuring stable food supplies amidst the current turbulent global situations. Singapore's heavy reliance on food imports, with more than 90% of its food coming from abroad, further underscores the urgency of addressing this critical issue.

Prior to the outbreak of the epidemic, the Singapore government has been closely monitoring food supply and food security, exploring effective solutions to address food sustainability. It has to ensure accessible and affordable food for its residents. In 2019, the Singapore government introduced the "30 by 30" goal, aiming to domestically produce 30% of its national nutritional needs by 2030, a significant increase from the current rate of less than 10%. Achieving this target would require Singapore has to increase its local food production by approximately three-fold within a decade. The epidemic has propelled the Singapore Food Agency's efforts towards realizing this objective, with the Singapore government committed to diversifying food imports and expanding methods of food cultivation to bolster local supplies. The latter is of particular significance in achieving the "30 by 30" vision.

In the context of the global climate crisis and disruptions to global supply chains resulting from the epidemic, the reliability of food imports has become uncertain, emphasizing the need to increase domestic production and achieve self-sufficiency to ensure price stability and maintain quality. The Singapore government is pursuing various avenues to increase local food production, including supporting agricultural research and development of high-yield crops, promoting the construction of urban

aerial farms and utilization of vacant roof top of HDB car parks for farming purposes, and building new facilities and sustainable farms. In April 2022, the Singapore Food Agency committed SGD 30 million to support farmers in implementing advanced technologies to increase the production of eggs, leafy vegetables, and fish. However, it is pertinent to evaluate the effectiveness of these measures and subsidies from an academic perspective. It would be valuable to study the ecosystems of other countries with well-developed agricultural industries and learn from their past experiences. Such insights could serve as a reference for relevant government bodies in expediting the achievement of the "30 by 30" goal.

The study revealed that, Taiwan, being an island similar to Singapore in Southeast Asia, has a self-sufficiency rate at approximately 31% in 2020. Taiwan is renowned as the “fruit kingdom” in Asia and processes a well-established agricultural and aquaculture industry that surpasses domestic demand, particularly for pork and poultry eggs. The country could export high-quality pork, vegetables, tea, rice, fruits. The agricultural products exports reported in Taiwan’s 2020 Statistical Yearbook was US$132 million. The author contends that by studying Taiwan’s agricultural ecosystem and its past experience, valuable insights can be gleaned to develop Singapore’s agribusiness ecosystem, making Taiwan an excellent case study.

In order to promote the rapid development of the agricultural industry, the first step is to mobilise the agricultural enterprises. Singapore must encourage its residents to actively involved in agricultural entrepreneurship and agricultural production. However, for agricultural enterprises to develop and remain sustainable, they require

the support from an ecological system that has agriculture at its core, forming a positive network cycle that complements the strengths and weaknesses of each enterprise. Taiwan's agricultural ecosystem structure has been developed over several years of experience. Given the many similarities between Taiwan and Singapore. it would be worthwhile for Singapore to refer to and build upon Taiwan's agricultural ecosystem.

(2) Theoretical background

The academics literature on agricultural ecosystem is scarce, and it lacks comprehensive coverage of all aspects of this ecosystem. However, in the last two decades, there has been a plethora of research and studies on entrepreneur ecosystem, entrepreneur enterprise infrastructure and entrepreneur environment. Many of these studies share a belief that the concept of the ecosystem is transferable to any industry. However, in practice, there are often differences between various ecosystems, and what works in one ecosystem may not prove effective in another (Mason & Brown, 2014).

Given the aforementioned limitations and nuances of ecosystem research, this study aims to explore and comprehend the domains comprising in the agribusiness ecosystem, contextualize the agribusiness ecosystem model and offer it as a benchmark for the advancement of Singapore's agricultural industry.

1.2 Research Question

The study inquiry centres on the lessons that Singapore can extract from Taiwan's agribusiness ecosystem development. The title of this study is "Exploring the Development of an agribusiness Ecosystem for Singapore: Lessons from Taiwan".

The primary objective of this study is to leverage on Taiwan's agribusiness

ecosystem development experience, contextualize the agribusiness ecosystem model and offer it as a reference for Singapore when developing its agricultural enterprise ecosystem. From this perspective, the author will conduct the research by addressing the following three sub-research questions:

(1) What domains are included in the agribusiness ecosystem?

(2) What are the main difficulties and solutions faced by agribusiness entrepreneurs?

(3) What are the implications of Taiwan's agribusiness ecosystem that Singapore can refer to?

1.3 Research Settings

Agriculture, as a primary industry has been a crucial source of livelihood since the dawn of civilization. However, the conventional small-scale agricultural model, which predominantly relies on labour intensive practices, has become outdated and faces issues such as inefficiency and wastage of resources. For country like Singapore, being a country with limited and valuable land, labour, and capital, requires advanced agricultural technologies and a well-established agricultural ecosystem to bolster its agricultural industry. While Singapore has well-established entrepreneurial ecosystem, its knowledge, and experience in the agricultural industry remain limited. Thus, it becomes imperative for Singapore to learn from the past experiences of other countries to form the structures and accelerate the performance of its agribusiness ecosystem Taiwan, which shares several similarities with Singapore, has been selected as a case study for this study. This study aims to examine the various factors in Taiwan's agricultural ecosystem and the research setting are as follows:

At the first phase, the author will commence by undertaking a literature review on the enterprise ecosystem in order to establish a theoretical foundation for this study. The work of Isenberg (2011) will be referenced as it posits that the domains of an enterprise ecosystem comprised of policy, finance, culture, supports, human capital, and markets. The interactions between these domains are complex and unique, ultimately shaping the entrepreneurial environment. The vast majority of enterprise ecosystems are composed of these fundamental elements.

For the second phase, the author will utilize Isenberg's (2011) model to design the interview outline and conduct interviews with founders and co-founders of the target enterprises. Since this study aims to draw lessons from Taiwan's agricultural ecosystem and apply them to Singapore's development, the questionnaires will be incorporating the characteristics of Taiwan's agricultural enterprises. After selecting nine Taiwan agricultural SMEs that meet the research criteria, the author will conduct in-depth interviews with their founders to comprehensively understand the roles and composition of the domains and elements in Taiwan's agricultural enterprise ecosystem.

At the third phase, the author will undertake a review and analysis of the interview outcomes. Through an evaluation of the appropriateness of the model and identification of areas that require further improvement, the author will present those findings as a reference for Singapore when developing its agricultural enterprise ecosystem.

1.4 Chapters and Organizational Structure

This study comprises of five chapters, starting with the introduction and followed by literature review, research methods, findings, and discussions.

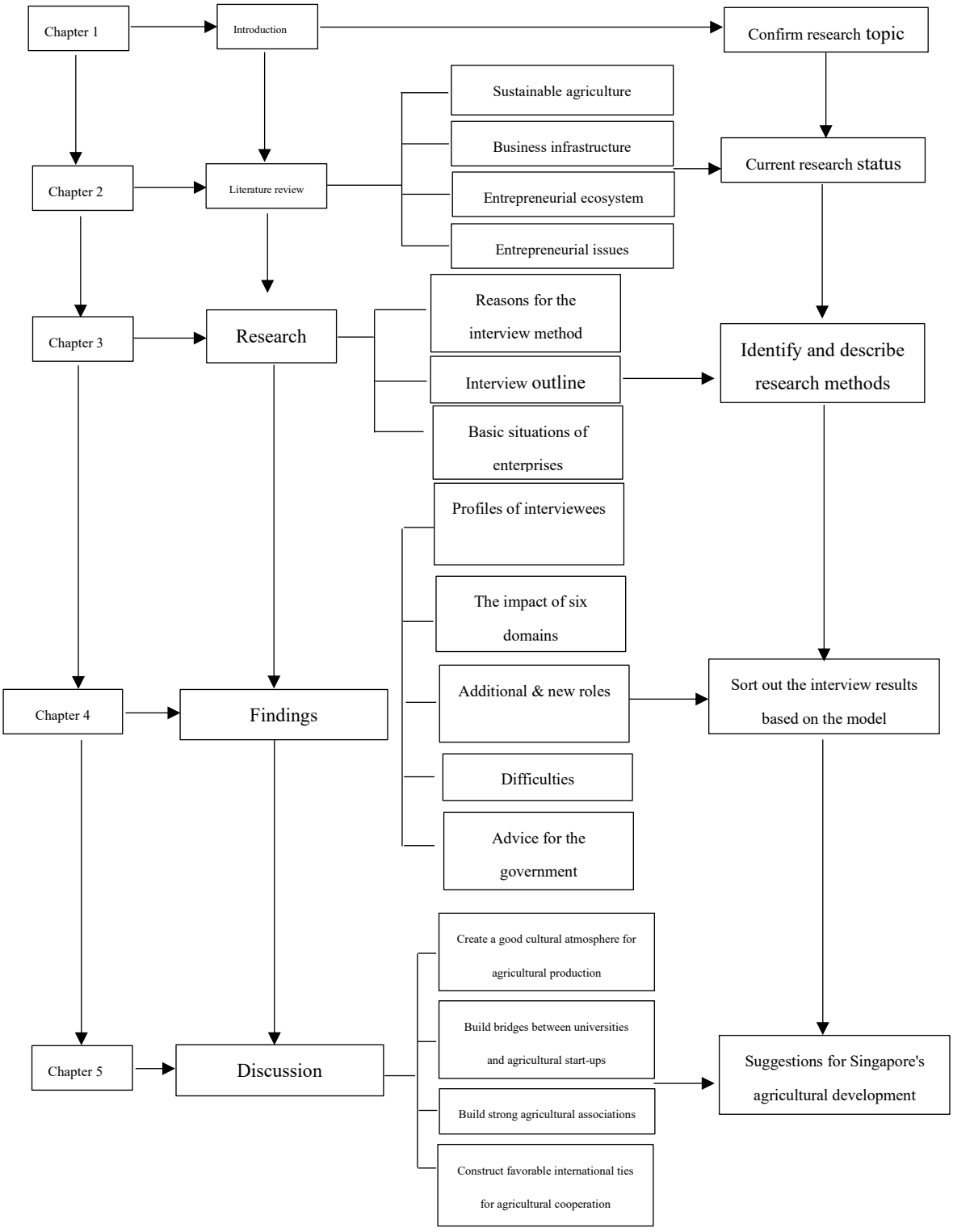

Figure 1-1 Organizational structure

1.5 Significance of Research

The study carries significant implications in three key aspects. Firstly, to contribute

to the existing literature on agribusiness ecosystems by filling a theoretical gap. Departing from the traditional theories and models, this study adopts from the perspective of the ecosystem to explore the domains and elements in the agricultural enterprise ecosystem, thereby enriching existing theories. Previous studies on entrepreneurial ecosystems have not delved into specific industries, with a common belief that the constructed ecosystem model will be generic and applicable to all industries. However, research of Tan et al. (2000) indicates that factors such as geographical and industry may affect the ecosystem and business infrastructure. The limited existing research, from the perspective of agricultural enterprises, fails to cover all aspects. This study, from the perspective of agricultural enterprises, proposes the concept of agricultural enterprise ecosystem, contextualizes the model and thus fills the theoretical gap in this industry.

The second significant aspect of this study is to consolidate Taiwan's experience in developing agricultural ecosystems. Taiwan's highly established agricultural industry can be traced back to the 1960s when to the government initiated the building of the ecosystem. To accomplish this, the government sent a delegation of scholars, technicians, and businesspeople to the United States and other countries to learn from their experiences. In the 1980s, the government attracted these individuals back to Taiwan, bringing with them their knowledge and experience in agricultural technology, organizational structures, and policies, there by laying a solid foundation for Taiwan's agricultural talents and knowledge base. Over the course of twenty years, Taiwan has emerged as a well-known agricultural region in Asia, with one of the most developed

agricultural ecosystems. Through the interviews conducted in this study, adjustments and enhancements to the entrepreneurial ecosystem model will be proposed to fully apply to Taiwan's agricultural ecosystem.

Lastly, the findings in this study could be a reference for Singapore when developing its agricultural enterprise ecosystem. Singapore faces the urgent challenge of food security and has proposed the 30/30 vision to produce 30% of its food domestically by 2030. As such, there is a pressing need to develop an enterprise ecosystem that integrates technology, innovation, sustainability, and investment among other factors. By considering Taiwan's experiences and Singapore's current situations, this study offers a practical case study for Singapore when developing its agribusiness ecosystem.

Chapter 2 Literatures

The author conducted literatures research on three areas: (1) sustainable agriculture; (2) infrastructure of business; and (3) entrepreneur ecosystem. These literature reviews led the author to appreciate the contextual and problematic nature of the research area, thereby underscoring the imperative for this study.

2.1 Sustainable Agriculture

Agricultural industry is an integral component of a nation's economy, as it directly contributes to the country's economic growth and productivity. Moreover, it holds a crucial role in ensuring sustainability. Smith and Donald (1998) argued that since agriculture is the primary source of food and shelter for humans, no other industry can play a greater role in promoting sustainability. Despain (1995) also emphasized that agriculture serves as the foundation for society, education, research, and policy activities. Thus, agriculture has been the subject of significant research on sustainability and remains an active field of study.

2.1.1 Definition of Sustainable Agriculture

In 1987, the Brundtland Commission released a report entitled "Our common Future", which introduced the concept of sustainable development: meeting the present needs without compromising the ability of future generations to meet their own needs. The concept of "sustainable agriculture" was formally proposed for the first time in 1985, when the California State Assembly authorized the Sustainable Agriculture Research and Education Program. The 1990 Farm Bill defined sustainable agriculture as an integrated system of animal and plant production activities at a specific location

that can, in the long run, meet humanity's needs for food and fiber; improve the quality of the environment and the natural resources on which the agricultural economy depends, maximize the efficient use of non-renewable resources and internal resources in farms, incorporate as much as possible into the natural ecological cycle, maintain the economic viability of the farms' operations, and improve the overall quality of farmers' social life. In April 1991, the Food and Agriculture Organization of the United Nations (FAO) and the Dutch government jointly issued "The den Bosch Declaration and Agenda for Action on Sustainable Agriculture and Rural Development" which proposed a new strategy for sustainable agriculture and rural development in developing countries called "Sustainable Agriculture and Rural Development (SARD)". The United Nations Conference on Environment and Development held in Brazil in 1992, further promoted the theory and practice of exploring sustainable agricultural development with the issuance of the "Rio Declaration" and "Agenda 21" (a non-binding action plan for sustainable development). The currently accepted definition of sustainable agriculture is a manner of using and maintaining the natural resources, along with technological and institutional changes, to ensure that the agricultural needs of present and future generations are met. Sustainable development (including agriculture, forestry, and fisheries) helps to preserve land, water, animal, and plant genetic resources and is defined as environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

2.1.2 Key Factors to Sustainable Agricultural Development

Since the mid-1980s, there has been a rapid development in theoretical research

and sustainable agriculture (SA) practices on a global scale. In establishing sustainable agriculture. As proposed by Pretty (2008), the fundamental principles for sustainable agriculture can be encapsulated as:

(1) Integrate biological and ecological processes such as nutrient cycling, nitrogen fixation, soil regeneration, allopathy, competition, predation and parasitism into food production processes;

(2) Minimize the use of those non-renewable inputs that cause harm to the environment or to the health of farmers and consumers;

(3) Make productive use of the knowledge and skills of farmers, thus improving their self-reliance and substituting human capital for costly external inputs;

(4) Make productive use of people's collective capacities to work together to solve common agricultural and natural resource problems, such as for pest, watershed, irrigation, forest and credit management.

In addition, the literature review of Gomiero, Pimentel, & Paoletti (2011) suggested that there are eight practices that are important to sustainable agriculture:

(1) Agroecology: The holistic study of agroecosystems including all the environmental and human elements. It focuses on the form, dynamics and functions of their interrelationship and the processes in which they are involved.

(2) Agriculture Intensification: Approaches to minimize demand for farmland by increasing yield by improving crop efficiency

(3) Integrated Agriculture: Approaches that combine management practices from conventional and organic agriculture. As an example, animal manure may be used

instead of chemical fertilizer when possible.

(4) Organic Agriculture: Approaches that aim at preserving soil fertility, reducing soil erosion, conserving water, biodiversity, landscape, ecological functionality, and reducing global change.

(5) Permaculture: Approaches that aim at producing an efficient, low-input integrated culture of plants, animals, people and structure, and integration that is applied at all scales from home garden to large farm.

(6) Precision Agriculture: An information and technology based agricultural management system to identify, analyze and manage site-soil spatial and temporal variability within fields for optimum profitability, sustainability, and protection of the environment.

(7) Perennial Crops: Approaches that rely on the cultivation of perennial crops, so that the detrimental effect of soil tillage and agrochemical usage could be avoided or at least greatly reduced.

(8) Transgenic Technology: The applications of genetic technology to boost agriculture productivity and cope with new environmental challenges while at the same time benefiting the conservation of natural resources.

2.1.3 Status of Research on Sustainable Agriculture

Initially, a cohort of scholars convened to deliberate upon the notion and execution of sustainable agriculture with the objective of rectifying the ecological and economic in equilibrium resulting from the overtly specialized contemporary science and technology and the reductionist inclination. Douglas outlined three diverse standpoints

on agricultural sustainability. The first perspective entailed catering to the sustenance needs and seeking maximum productivity within the farmers' interests. The second viewpoint, dubbed managerial sustainability, revolved around the harm inflicted upon the environment. Lastly, the third stance, termed social sustainability, was characterized by the sustenance or reconstruction of ecologically and economically sound rural systems.

Yunlong Cai and Schmidt (1994, 1995) expounded on three agricultural sustainability concepts, namely: 1) the ecological sustainability definition, which underscored the significance of biological natural processes and ecological productive economic systems; 2) the economic definition of sustainability, which prioritized the sustenance of agricultural producers' profitability in the long run; 3) social sustainability definition, which concentrated on fulfilling fundamental human needs for food and shelter, in addition to contentment derived from security, equality, freedom, education, employment and entertainment.

Based on the aforementioned comprehension of agricultural sustainability, Smith and McDonald (1998) contended that the delineation of agricultural sustainability should be centered on four key aspects, namely: intergenerational and intergenerational equality, adequacy of food supply, effective management of the environment, and socio-economic viability.

Chinese scholars have consolidated their research and presented comprehensive definitions of sustainable agriculture. Hongguang Wang (1993) characterized sustainable agriculture as "an agricultural paradigm that integrates aspects such as yield,

quality, benefits and environment to design agricultural production strategies. This is achieved by ensuring that resources and the environment are not destroyed, the interests of future generations are not compromised, and people's expectations regarding agricultural products are met.

Xunhao Liu (1995) viewed sustainable agriculture as a fusion of production sustainability, economic sustainability, and ecological sustainability. Yuezhen Liu (1998) posited that China's sustainable agriculture, situated in a framework of high production, quality and efficiency, is attained through the utilization of science and technology. This is achieved by sustaining an increase in production, enhancing soil fertility, balancing the farmers' ecosystem, and focusing on the utilization and preservation of agricultural resources. The ultimate aim is to achieve a balance between the economy, society, population and resources, environment and development.

Furthermore, numerous scholars have conducted research on the approaches to stimulate sustainable agricultural development, as well as the determinants that influence sustainable agricultural development. Ryszkowski et al. (2002) undertook investigations on various aspects, such as whole plants, farmlands, and farming system among others, and their respective environments to comprehend their influence on agricultural productivity. Additionally, studies have been conducted to explore the correlation between the input and output of the research system, as well as the equilibrium between production efficiency and resource value over the long term, with the ultimate objective of obtaining an optimal blend and evaluation model.

In the study conducted by Jiao Jinpeng Jiao (2019), a strong positive correlation

was observed between the development of farmland water conservancy facilities and environmental preservation, and between green agriculture and sustainable agricultural development. These findings hold substantial implications for the advancement of sustainable agricultural development.

Siwei Hu et al. (2022) conducted a quantitative analysis of a substantial number of Chinese and English literature obtained from CNKI and Web of Science, which indicated that current research on sustainable agricultural development primarily focuses on four areas: 1) enhancing the resilience of food system and ensuring food security, 2) intensifying agricultural ecology and promoting sustainable intensification, 3) developing urban agriculture and enhancing the multi-functionality of agriculture; and 4) balancing the trade-off and synergies of agricultural ecosystem services. Yin Changbin et al. (2015) posited, from the perspective of ecological civilization, that the future direction for the sustainable agricultural development should involve the strengthening of agricultural resource protection, the promotion of conservation and utilization of agricultural resources, to establishment of a comprehensive agricultural industry chain, and the implementation of sustainable projects. Furthermore, the authors proposed the strengthening of the ecosystem, such as through the provision of ecological compensation.

Certain scholars examined the research and measurement methods regarding agricultural sustainable development and related variables. Yujie Chen et al. (2022) established a comprehensive evaluation system composed of four main evaluation directions: agricultural production, agricultural economy, environmental resources, and

social population. They employed the entropy weight method and grey relational analysis to assess the sustainable development of agriculture in a given region.

Jianqun Miao et al. (2016) developed an evaluation index system for sustainable agriculture development in the southern hilly and mountainous regions basing on practical investigations.

Hailan Liu (2019) devised a model and index system to evaluate regional agricultural sustainable development, which incorporated geographical indications, using a combination of quantitative and qualitative techniques, such as kernel density analysis, Pearson correlation coefficient, questionnaire survey, analytic hierarchy process, and factor analysis.

Guoqing Wu (2001) introduced the concept of ecological security in the context of sustainable agricultural development. The proposed evaluation index system comprises three measurements of resource ecological environment, namely pressure, quality, and protection and remediation capabilities, as well as the determination of unsafe standard values and the calculation of unsafe indexes.

In general, sustainable agricultural development involves the intricate interplay among economic, social, resource and ecological factors. Research on sustainable agricultural development is multidisciplinary and draws upon diverse perspectives encompassing ecology, economy, and food security. Additionally, it involves coordination among various departments such as land, economy, environment, and energy department, signifying the need for smooth functioning of the mechanisms and cooperation’s among all domains in the agricultural ecosystem. Therefore, both

theoretical and practical approaches are necessary for all elements in agricultural ecology to play their part in achieving sustainable agricultural development.

2.2 Infrastructure of business

As sustainable agriculture is increasingly studied in theory and practice, many experts and government organizations have recognized that there are numerous limitations in the implementation and research, even within the agricultural industry. This is because of the complexity of the modern socio-economic system, which creates intricately linked relations between agriculture and various domains within its ecosystem. To promote sustainable agriculture, a possible approach is to focus on business infrastructure. The government has long aimed to stimulate people's interest in agricultural entrepreneurship and as a key factor in revitalizing the capitalist economy (Drucker, 1985; Reynolds, Storey, Westhead, 1994). In the academic community, research on agricultural entrepreneurship, its requirements and processes could provide insights and understanding to policymakers in the agricultural environment and facilitate the formulation of supportive policies (Hoy, 1997). To understand the entrepreneurial environment of agricultural enterprises, the concept of business infrastructure could be used to identify the dimensions of the entrepreneurial environment and the related domains.

2.2.1 Definition of business infrastructure

As defined in the Cambridge Academic Content Dictionary (2020), infrastructure is (1) the basic systems and services that are needed in order to support an economy in Economics, (2) the basic systems and services that a company or industry needs in order

to work effectively in workplace, and (3) the equipment, software, etc. that a computer system needs in order to operate and communicate with other computers in information technology. This study is focused on the second definition of infrastructure.

At the foundation stage, agricultural basic infrastructure is akin to a comprehensive industry sector, and its development could impede the sustainable progress of the agricultural industry (Wenke Chen & Houchun Lin, 2000). Shuguang Bao and Xingyuan Feng (2021) conducted a comprehensive evaluation of China's investment in agricultural infrastructure, highlighting funding mechanisms such as industrial funds, public-private partnerships (PPP), and local special bonds. Nonetheless, they observed issues like insufficient cash flow, as well as inadequate support and guidance.

According to Ziqiang Li et al. (2022), the Global-Malmquist-Luenberger (GML) index was employed to investigate the impact of agricultural infrastructure on the total factor productivity of food ecology. The study found that all dimensions of agricultural infrastructure were found to be effective in enhancing the total factor productivity.

Fusheng Zeng and Fei Li (2015) conducted a comprehensive analysis on the cost-saving effect of agricultural infrastructure by employing a visual model effect and structural effect based on the total cost function model of grain production. They found that increasing the stock of agricultural infrastructure could significantly reduce the average cost of food production (scale effect), and that it has the ability to replace labor, and also has complementary effects on the capital and intermediate factors.

In the evaluation of infrastructure, it is necessary to consider specific locations. A

universal assessment method cannot be utilized to evaluate numerous cities and counties throughout the nation. Moreover, a comprehensive evaluation of a specific metropolitan region may not be applicable to its urban and suburban areas.

2.2.2 Composition of business infrastructure

At a basic level, business infrastructure can be classified into both hard and soft aspects. In China, the former primarily comprises of essential facilities, such as transportation, communication and is reflected in infrastructure indicators adopted by institutions such as the World Bank and the Global Competitiveness Report by the World Economic Forum. However, the soft aspect is equally crucial for businesses. For instance, accordingly to the Chinese National Federation of Industries (2020) Whitepaper, Taiwan's shortage of blue-collar workers was among its most pressing "deficiencies". Furthermore, numerous anecdotal reports suggest that the creativity of knowledge workers poses a significant hurdle to successful innovation in high-technology industries. Thus, differentiation both the hard and soft aspects is essential for understanding the multifaceted and diverse nature of infrastructure. Figure 2-1 illustrates this infrastructure division.

	Hard	**Soft**
General	Case: Per capita road coverage	Case: Percentage of workers with college diploma / college degree
Specific	Case: Number of available refrigerated trucks	Case: Percentage of workers with degrees in science, technology, engineering and mathematics

Figure 2-1 Division of infrastructure

Infrastructure can be further categorized into general and industry specific. For instance, the labor force can be classified into general labor and special skill labor. A sufficient supply of general labor does not necessarily ensure the appropriate supply and quality of labor for specific industries. Therefore, classifying the type of labor can help to assess the adequacy and supply of labor. This approach is also applicable to other infrastructure projects. For example, in the case of the tourism industry, the main infrastructure projects consist of general infrastructure, such as labor force and public transportation facilities, and tourism-specific infrastructure, such as the number of beds, hotel types, and quality of buffet (Beerli & Martin, 2004). Similarly, in agriculture, the main infrastructure will also include specific infrastructure, such as seeds and fertilizers.

Furthermore, some studies categorize business infrastructure based on the stages of enterprise development, that is: entrepreneurial infrastructure and non-entrepreneurial infrastructure. Since most of the agricultural enterprises in this study are small and medium-sized and are in the initial stage of entrepreneurship infrastructure, this study will focus on researching the entrepreneurial infrastructure to construct a holistic classification or framework.

2.3 Entrepreneurial Ecosystem

2.3.1 Essential concepts

There exist numerous analogous notions pertaining to the entrepreneurial environment, entrepreneurial support system, entrepreneurial infrastructure, and entrepreneurial ecosystem. Among these, the notion of entrepreneurial ecosystem is laden with the most implications. In anticipation of presenting the Entrepreneurial

Ecosystem, the author first endeavors to introduce two comparable notions: entrepreneurial infrastructure and entrepreneurial environment.

(1) Entrepreneurial infrastructure

The theoretical framework of the entrepreneurial ecosystem stems from the concept of entrepreneurial infrastructure. The latter refers to the fundamental systems and services necessary for enterprises or industries to operate effectively in their respective domains. For instance, studies in the field of tourism have indicated that key infrastructure components include private and public transportation facilities, hotels of varying categories, and available beds. In this regard, Van de Ven (1993) is recognized as one of the pioneering researchers in the field of entrepreneurial infrastructure. According to his seminal work, entrepreneurial infrastructure is composed of three essential components: (1) institutional frameworks that legitimize, regulate, and standardize novel technologies; (2) public resource endowments consisting of basic scientific knowledge, financial mechanisms, and a pool of skilled labor; and (3) proprietary research and development, manufacturing, marketing, and distribution functions performed by private entrepreneurial firms to commercialize innovations for profit. According to Tan et al. (2000), entrepreneurial infrastructure within a specific geographic region encompasses the various facilities and services aimed at stimulating the establishment of new joint ventures and promoting the growth and development of small and medium-sized enterprises (SMEs) shown in table 2-1. To develop a generic entrepreneurial infrastructure model, the relevant literature was reviewed and subsequently applied to Singapore. He conducted interviews and surveys with

representatives from 12 local SMEs in Singapore, and based on the interview results, established a "mapping" function to predict the possibility of these entrepreneurs participating in entrepreneurial infrastructure, and finally explored and sequenced the impact of six variables on entrepreneurial participation. Respectively, the factors affecting entrepreneurs' presence in entrepreneurial infrastructure are awareness of the need for legitimate business assistance, corporate awareness of the existence of resources or facilities, the urgency of needs faced by entrepreneurs and SMEs, the availability of resources or facilities, institutional or project capacity and resource capacity.

Table 2-1 Some Elements of Infrastructure

Tasks	Resources	Information/Knowledge
Supporting firms, such as distributors and accounting agencies Various intermediate firms, such as intellectual rights agencies Other outsource choices, such as business plan writers	Banks & other savings & loan institutions Government-based loans Angels & venture capitalists Business incubators Labor force banks & other HR agencies	Government agencies University research centers and specific training programs Professional associations. Programs of business development and other consulting services Venture capitalists & business incubators

Source: Adapted from Tan, Tan, & Young (2000)

(2) Entrepreneurial environment

Although the infrastructure theory offers valuable insights, it is considered to be somewhat limited in scope. Consequently, the theory of entrepreneurial environment was proposed to incorporate additional elements that extend beyond the enterprise or entrepreneur. In a seminal article, Gnyawali & Fogel (1994) introduced the construct of "entrepreneurial environment" which encompasses (1) the broader economic,

sociocultural, and political factors that shape people's inclination and ability to undertake entrepreneurial activities, and (2) the availability of assistance and support services that facilitate the start-up process. The theory of entrepreneurial environment is distinct from that of entrepreneurial infrastructure. Thus, it examines the overall economic, sociocultural, and political factors that influence entrepreneurial pursuits, as well as the availability of assistance and support services for start-up ventures. The focus was on external factors within an environment, and not just connected factors.

(3) Entrepreneurial ecosystem

The construct of the "Entrepreneurial ecosystem" is widely discussed in academic literature. As defined by Stam (2015), an entrepreneurial ecosystem is composed of interdependent domains and factors that are coordinated to facilitate productive entrepreneurship within a specific geographical area. Unlike infrastructure, which typically comprises interrelated components, the entrepreneurial ecosystem is characterized by its interdependence and coordination. Nevertheless, a closer examination of the components of each concept reveals some areas of overlap.

(4) Comparison of similar concepts

Table 2-2 presents the "construct content" of three articles, highlighting some of their similarities. For instance, the components identified as "institution factors" within the entrepreneurial infrastructure construct correspond to "government policies & procedures" in the entrepreneurial environment and "government & regulatory framework" in the entrepreneurial ecosystem.

Let's look at the components of the three similar concepts (see table 2-2 for

details). Entrepreneurial infrastructure has three components, which include institutional arrangements; public resource endowments such as basic scientific knowledge, financing mechanism, and a pool of competent labor; and private skills necessary for commercialization, such as proprietary R&D, manufacturing, marketing and distribution functions by private entrepreneurial firms.

Entrepreneurial environment is composed of five components: government policies & procedures; socioeconomic conditions; entrepreneurial & business skills; financial assistance; and non-financial assistance. Entrepreneurial ecosystem has six components: policy; finance; culture; supports; human capital; and markets.

Table 2-2 The content of three constructs

Authors	Van de Ven (1993)	Gnyawali & Fogel (1994)	Isenberg (2011)
Constructs	Entrepreneurial Infrastructure	Entrepreneurial Environment	Entrepreneurial Ecosystem
Contents (components/domains)	1.Institution factors 2.Resources for the development of basic knowledge 3.Resources for adequacy financing 4.Resources for labor competence 5.Functional skills necessary for commercialization	1. Government policies & procedures 2. Socioeconomic conditions 3. Entrepreneurial & business skills 4. Financial assistance 5. Non-financial assistance	1.Policy 2.Finance 3.Culture 4.Supports 5.Human capital 6.markets

The table above reveals the presence of overlapping factors across the three concepts under consideration. Specifically, the factor denoted as “institution factors” in the context of entrepreneurial infrastructure corresponds to both “government policies & procedures” in the realm of entrepreneurial environment and “government & regulatory framework” within the ambit of entrepreneurial ecosystem.

2.3.2 Common analysis framework

Mason and Brown (2014) presented a widely used analytical framework for assessing the entrepreneurial ecosystem in their background paper, commissioned for a seminar jointly organized by the Organization for Economic Co-operation and Development (OECD) and Ministry of Economic Affairs and Climate Policy of Netherlands. Their study characterizes the entrepreneurial ecosystem as a constellation of interrelated entrepreneurial domains (both nascent and established), entrepreneurial entities (for example, firms, venture capitalists, business angels, banks), institutions (for example, universities, public sector agencies, financial bodies) and entrepreneurial processes (for example, business creation rate, numbers of high growth firms, levels of "blockbuster entrepreneurship", incidence of serial entrepreneurs, extent of sell-out mentality among firms, and levels of entrepreneurial ambition) that formally and informally converge to facilitate, mediate and govern the functioning of the local entrepreneurial environment.

The authors posited that conventional transactional support mechanisms such as financial aid have limited efficacy in promoting high-growth enterprises and advocated for innovative approaches to bolster entrepreneurial ecosystems. Drawing on a review of relevant literature, the authors delineated the core characteristics and theoretical models of entrepreneurial ecosystems, identifying salient features such as entrepreneurial domination, corporate cycle, and information-rich environment as well as other vital factors including culture, availability of start-ups and growth capital, presence of large companies, universities, and service providers. The authors

emphasized four innovative features of the entrepreneurial ecosystem as a new analytical approach: 1) as a metaphorical tool to offer a comprehensive understanding of how clusters of economic activities are formed, with a fresh perspective emphasizing the external environment of a company rather than its internal attributes and operations; 2) shifting the focus from the "enterprise" to the ecosystem in which it is situated as a whole, highlighting the moderating effect of externalized and relational aspects of firm performance and the nature of ecosystem dynamics; 3) underscoring the significance of examining the broader ecological environment in which a business functions, coupled with robust growth in specific types of environments; and 4) downplaying the importance of firm size.

In addition to the shared characteristics previously expounded, Mason and Brown (2014) maintained that each entrepreneurial ecosystem is unique. To elucidate, strategies that prove effective in one enterprise may not necessarily yield desirable outcomes when implemented in other organizations. In terms of policy implications, the authors suggested that the value of the entrepreneurial ecosystem as a guide for policy, especially policies relating to high-growth firms, was not readily apparent. Furthermore, political backing for the entrepreneurial ecosystem could potentially exacerbate spatial and internal disparities within the ecosystem.

Isenberg (2011) widely used framework for characterizing entrepreneurship ecosystems posits that such systems should comprise various domains: policy, finance, culture, supports, human capital, and markets. These domains, in turn, are implemented by policymakers and public leaders, financial institutions, cultural influencers, support

organizations, educators, and corporations (see Figure 2-2 for further details). The model defines an "entrepreneur" as someone who creates economic value through growth and is motivated by aspirations, as well as an individual who is willing to take risks and perceives themselves as superior to others in the market due to possession of critical assets, information, or business ideas. Within this framework, the government is tasked with establishing a system that allows for entrepreneurial competition while ensuring deserving ventures, capable of generating external benefits for the industry and society, receive necessary resources, while others do not.

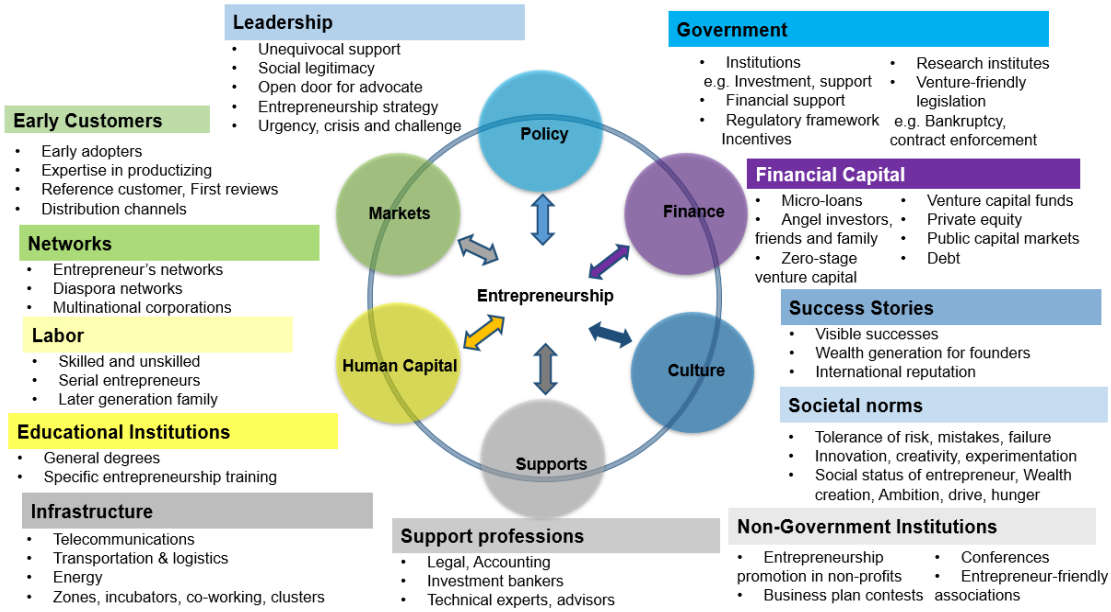

Figure 2-2 Isenberg's Entrepreneurship Ecosystems model

2.3.3 Research perspective

Tsujimoto et al. (2018) conducted a review of 90 papers related to ecosystem analysis and summarized their findings into four perspectives. The first perspective is the industrial ecology approach, which is centered on the concept of industrial ecosystems. The second perspective is the business ecosystem approach, which is grounded in organizational boundary theory. Within the business ecosystem perspective,

platform management has emerged as a key focus among influential scholars, constituting the third approach. The fourth perspective is the multi-actor network approach, which employs social network theory. To analyze dynamic behavioral relationships among various actors, including government; private enterprises; universities; consumers, entrepreneurs, and investors. The authors' conclusion is that the multi-actor network perspective offers the most promising avenue for researchers seeking to identify the factors that contribute to business success. This implies that a successful business or enterprise ecosystem should involve multiple actors, including those listed above.

2.3.4 Impact of entrepreneurial ecosystems on enterprises

The impact of entrepreneurial ecosystems on enterprises is significant. Specifically, such ecosystems can influence the entrepreneurial potential of firms (Specht, 1993). Drawing on resource dependence and population ecology theories, Specht, 1993 argued that the richness and carrying capacity of an environment are critical predictors of new ventures survival rates. According to Specht, richness is defined as the abundance of resources in an environment, while carrying capacity refers to the number of organizations competing for the same resource in a niche environment. She identified five dimensions of richness, namely economy, politics, market, infrastructure, and society. Carrying capacity, however, is only one dimension. Her predictions suggested that organizational formation rate would increase with higher levels of environmental richness and carrying capacity.

In addition to its impact on entrepreneurial potential, entrepreneurial

ecosystems can also influence the entrepreneurial interest of entrepreneurs. Building upon Specht's (1993) model, Birley and Westhead (1993) suggested that the richness and carrying capacity of an environment may relate to the entrepreneurial interest of potential entrepreneurs (Birley and Westhead, 1993; Tsai, MacMillan, and Low, 1991). However, it is the entrepreneurs' perception of politics, economy, and environment rather than the objective reality of the situation, that has greater impact on their interest in entrepreneurship. In fact, people are more likely to take action when they perceived favorable conditions, regardless of whether the conditions are objectively favorable or not (Davidsson, 1991). The critical perceived factors for environmental resources include perceived financing, supportive government regulations, market opportunities, support services, skilled labor, and relationships with resource holders. Reynolds et al. (2001) proposed that the greater the availability of perceived favorable conditions, the greater the perceived feasibility and desire for entrepreneurship. Moreover, potential entrepreneurs' views on environmental carrying capacity also affect their interest in starting a business. While negative factors such as high business failure rates and risks may reduce interest, favorable conditions such as high barriers to entry, high demand for the products or service and industry expansion can increase entrepreneurial interest. The government can enhance perceived favorable conditions to stimulate entrepreneurial interest (Davidsson, 1991; Porter, 1980). Thus, clarifying the environmental resources that entrepreneurs can access to improve feasibility and desire is necessary to increase interest in entrepreneurship.

2.4 Pointers from the literature

Based on the literature review conducted, the following conclusions have been drawn.

Firstly, it has been determined that the sustainable development of agriculture is reliant on collaborative efforts across all domains of the agricultural ecosystem. Sustainable agricultural development is a multifaceted field of research that integrates perspectives from ecology, economy, and food security, and involves various departments including land, economy, environment, and energy departments. The achievement of sustainable agricultural development is contingent upon the involvement and coordination of all domains within the agricultural ecosystem. As such, providing guidance on agricultural development from an agroecosystem perspective can serve to strengthen the healthy, systematic, and sustainable development of agriculture.

Secondly, agroecosystem research should adopt a specific perspective. While the multi-actor network perspective is beneficial for investigating entrepreneurial ecosystems, researchers may encounter significant difficulties when identifying the various items or components of each ecosystem. In research practice, scholars often focus on a specific component rather than examining all components comprehensively. For example, Bennett (2019) examined the relationship between infrastructure and entrepreneurial activities, focusing on hard infrastructure (private and public infrastructure investment) available in government statistics. The study proposes that building an enterprise ecosystem requires the cooperation of multiple stakeholders,

with enterprises playing the most significant role and the government's role being relatively limited. The government's primary responsibility is to create a competitive environment for entrepreneurship and assist stronger enterprises in accessing resources. In summary, this study aims to examine the entire agroecosystem from the perspective of agribusiness.

Thirdly, it is worth noting that Daniel Isenberg, a distinguished scholar of entrepreneurial ecosystem, has an extensive research background in this field. He is the founding executive director of the Babson Entrepreneurship Ecosystem Project and has authored over five papers exploring entrepreneurial ecosystems. Notably, his work "How to start an entrepreneurial revolution" has been cited more than 300 times. Therefore, for this study, Isenberg's enterprise ecosystem model proposed in 2011 will serve as the foundational model.

Chapter 3 Research Process and Methods

The study topic is “Exploring the Development of an agribusiness Ecosystem for Singapore: Lessons from Taiwan”. The objective of this research is to extract valuable insights from Taiwan’s agribusiness ecosystem and draw upon them to provide a reference to Singapore for developing its agribusiness ecosystem. This chapter aims to elucidate the research methodology that will be adopted to accomplish this objective.

3.1 Research Process

This study collected information on the agricultural practices and experiences of Taiwan by means of interviews. The study is conducted under the guidance of Professor Tan and employs the concept of “Agribusiness Ecosystem”, which is an adaptation of the “Entrepreneurial Ecosystem” concept, to facilitate the study of a specialized entrepreneurial ecosystem in the agriculture industry. For brevity, "AE" will be used to represent Agribusiness Ecosystem and "EE" will be used to represent Entrepreneurial Ecosystem in the following sections.

The research goal will be accomplished by following four sequential steps. Firstly, the author will conduct a comprehensive literature review on the entrepreneurial ecosystem using a range of academic, governmental, and industrial sources in both English and Chinese languages. Secondly, based on the findings of the literature review, the author will lay down the background of the entrepreneurial ecosystems in Taiwan. Thirdly, the author will engage in in-depth interviews with founders of SMEs in Taiwan to evaluate the efficacy of Isenberg’s model and identify any gaps that exist between theory and practice. This process will help the author comprehend the issues, challenges,

or barriers related to the initiation and operation of a business and uncover the essential challenges and critical components within Taiwan's agribusiness ecosystem. Finally, utilizing the insights from Taiwan, the author will synthesize all the information gathered and develop a set of success factors for Singapore.3.2 Research Methods

In this study, three research methods are predominantly employed. Firstly, literature reviews conducted using both online and offline sources, such as the Internet and libraries, to gather, read, collate and analyze existing research results in the areas of agricultural sustainable development and business ecosystems. This method is employed to identify gaps in research, clarify relevant ideas and methods, and establish a robust theoretical foundation for subsequent practical research. The literature review revealed a scarcity of academic research on agricultural ecosystems and highlighted the potential inadequacy of existing research theories and models when applied to such ecosystems. However, Isenberg's (2011) model of the entrepreneurial ecosystem is a well-established model that can be served as the foundational model for developing an agricultural ecosystem model. Building on Isenberg's model, this study will explore the agroecosystem, identify their unique features, and endeavor to conceptualize an agroecosystem model.

The second research method employed in this paper is the case study method. Given that enterprise ecosystems are influenced by a variety of factors such as industry and geography, it is important to define the geographical scope of the research in order to determine the applicability of the results. For this study, the author has selected Taiwan as a case study due to its similarities with Singapore and its well-developed

agricultural ecosystem. By examining Taiwan's experiences in the development of its agricultural ecosystem, this study aims to provide a reference to Singapore for developing its agribusiness ecosystem.

The third research method employed in this study involves conducting in-depth interviews. Given the complexity of the agricultural ecosystem concept, which encompasses numerous domains and elements, this study will draw upon research papers such as Tan et al. (2000) to gain a deeper understanding of the subject matter. The in-depth interviews will serve as an additional means of gathering rich, detailed data on the agricultural ecosystem.

3.2 Selection of Case Study

This study has selected Taiwan as a case sample for analyzing the agroecosystem. The choice of Taiwan is based on several underlying factors. Taiwan and Singapore are both islands located in Southeast Asia and have limited land resources for agriculture. In terms of demand for agricultural products, both share similar population age structures, dietary preferences, and GDP per capita rankings. Additionally, they have comparable requirements for the type and quality of agricultural products, and their populations are predominantly made up of ethnic Chinese descent. Both are also recognized as members of the Four Asian dragons, and have experienced rapid development in the past decades, with their GDP per capital ranking among the top 30 in the world, despite being considered developing countries. With respect to the supply chain of agricultural products, both share similar geographical locations and climates. Furthermore, both have relatively high population density, limited cultivated land and

a low proportion of agricultural employment.

However, Taiwan possesses a substantial and diverse agricultural history and expertise, which has proven to be more successful in achieving food security compared to Singapore. Singapore's agriculture industry accounts for less than 5% of its food self-sufficiency rate stands at approximately 10%. This leaves Singapore heavily dependent on food imports from other nations, resulting in a pressing concern for food security. Severe food insecurity among the populace exceeded 1% between 2015 and 2018, while moderate to severe food insecurity surpassed 2.5%. Despite its high GDP per capita, approximately 10% of households in Singapore experience food shortages at least once within a year. Conversely, Taiwan boasts a food self-sufficiency rate at about 31% as of 2020, with a thriving aquaculture industry and abundance of supplies exceeding domestic demand. As the "fruit kingdom" of Asia, Taiwan has made notable strides in the export of high-quality pork, vegetables, sugar, sugar cane, tea, rice, and tropical and sub-tropical fruits, with an upward trend in export volumes. In 2020, the export value of agricultural products was US$132 million based on the 2020 Statistical Yearbook. Singapore could gain valuable insights from Taiwan's agricultural production and technological expertise to establish a sustainable ecosystem for agricultural industry, thereby increasing its food self-sufficiency rate.

The agricultural sector in Taiwan is made up of many small-scale farms that prioritize high-value crops, making it an appropriate model for Singapore given its natural limitations.

In addition, the author is a Taiwanese and given his background, the author could

have facilitated data collection and interviews with relevant stakeholders, further justifying the selection of Taiwan as a case study for Singapore.

3.3 Selection of Interviewees

3.3.1 Criteria for the selection of enterprises for interviews

This study will concentrate on agricultural enterprises in Taiwan as the subject of targeted interviewing enterprises. The author posits that enterprises are the primary actors in the agroecosystem. prioritizing enterprises as the central actor in the agricultural ecosystem, it is possible to realize economic sustainability and create benefits, value and profits. When compared with other elements, such as government and educational institutions, enterprises are the primary beneficiaries of the agricultural ecosystem. Hence, they have a stronger incentive to engage in the ecosystem and form close connections and interactions with other elements in the ecosystem.

This study emphasizes agricultural SMEs in Taiwan. This focus is particularly relevant to Singapore, which could benefit from Taiwan's extensive experience in the development of agricultural SMEs. Singapore has historically relied on imported agricultural products due to the high costs of land and labor, resulting in a limited number of agricultural businesses and employees. To achieve the objective of attaining a of 30% self-reliance rate by 2030, Singapore requires a more significant number of small and medium-sized agricultural business owners and potential entrepreneurs to participate in the sector. The growth and expansion of such enterprises would fuel Singapore's agricultural production and industrial development in the future. Hence, Singapore would benefit most from the experiences of Taiwan in developing

agricultural SMEs.

SMEs require greater support from the agroecosystem as compared to larger enterprises. The significance of the ecosystem may vary for enterprises at different stages of the business cycle. Larger enterprises typically have stronger core competitiveness, brand awareness and business experience, resulting in lower demand for external resources. However, enterprises at the entrepreneurial stage, including birth stage and growth stage, are more likely to encounter a range of problems. These enterprises are typically not yet established and have limited resources. Due to the lack of time (Gibb, 1993), resources and experience (Smallbone et al., 1993; Tan et al., 2000), they would require more external help and support from other elements. For instance, they may require assistance with obtaining seed capital, building a leadership team, developing products and technology, and promoting new products (Choo and Wong, 2006). When entrepreneurs and SMEs perceive that they benefit from the services provided by these elements or organizations, they are more likely to form relationships with the organizations (Donckels, 1997; Ring et al., 1994) and contribute to the formation of the ecosystems. Therefore, this study emphasizes the importance of focusing on interviews. small and medium-sized agribusinesses to obtain more in-depth information about the agribusiness ecosystem.

This study takes into account the level of external resource dependency of agricultural SMEs. Although agricultural enterprises may be at the same stage of development, they may have different needs for external resources due to variations in industry segments, development stages, and founder personality. According to Tan et

al. (2000), entrepreneurs or companies' awareness of legitimate business assistance needs, resource availability, and resource accessibility affect their decisions to participate in infrastructure. Consequently, the degree of participation among enterprises in the enterprise ecosystem may differ. Hence, this study regards the dependence of small and medium-sized agricultural enterprises on external resources as an indicator to differentiate among agricultural enterprises with high, medium and low level of reliance and select three enterprises for each level of dependency and to understand their needs of the elements in the ecosystem and to rank the elements based on their involvement in the ecosystem.

In summary, the present study aims to conduct comprehensive interviews with the Taiwanese SME founders to explore the composition and operating mechanism of the agricultural enterprise ecosystem. By starting with critical factors. common challenge, and corresponding solutions in the agricultural industry, this research seeks to provide insights into the development of enterprises and the support they receive from ecosystem elements.

3.3.2 Profiles of interviewed enterprises

The author, who is the founder of the International Association for Agriculture Sustainability (IAAS), compiled a list of thirty companies that met the screening criteria The list was derived from the members' profiles of IAAS and the relevant agribusiness associations in Taiwan. Subsequently, fifteen companies were randomly selected for further analysis. The author then approached the SMEs founders to explain the purpose of the interviews and the necessary requirements. Based on the founders' willingness

to participate in the interview and their ability to communicate effectively, the following nine enterprises were ultimately selected for the study:

Table 3-1 Names and characteristics of 9 companies for in-depth interviews

Name	Industry	Type of enterprises	Degree of dependence on external resources
Means Good	Dietary agricultural products	SME	High
Yuan Jin Chuang	Automated chicken farm	SME	High
Lin Wang Tea	Five-star tea factory	SME	High
Balay	Antrodia cinnamomea	SME	Medium
Green Day Biotech	Enzyme-based decomposition of organic waste into fertilizer	SME	Medium
Rolling Green	Plant growth enzyme	SME	Medium
Hua Gung Tea	High mountain tea	SME	Low
Kindly Eggs	Additive-free duck eggs in natural processing	SME	Low
Rice Valley	High-quality rice	SME	Low

3.4 Interview outline

Prior to conducting the interviews, the author developed an interview outline. The outline aimed to investigate whether Isenberg's model was applicable to Taiwan agribusiness ecosystem and to identify any existing gaps. It aimed to comprehend the issues, hindrances, and difficulties faced by small business owners and entrepreneurs in the establishment and operation of their business, as well as the primary challenges and critical components of the agribusiness ecosystem in Taiwan. The final interview outline was shaped by the research topic and Isenberg's model:

1. Description of the enterprise

2. Whether the agribusiness participated in the AE

3. Description of experience with the AE

4. What difficulties and challenges has the business encountered, and how have they been overcome, and what breakthroughs have been achieved? Elaborate on these six areas (policy, finance, culture, support, human capital, markets).

5. Which of these six areas (policy, finance, culture, support, human capital, markets) are the most critical to the enterprise's development? Note that the elements that may play a key role differ at different stages of an enterprise's development.

6. Who are the people or organizations that have provided significant help to your enterprise?

6.1 In what ways have they provided clarification? What specific contributions have they made?

6.2 How did you come into contact with these people?

6.3 In your experience, to what extent have others helped your own enterprise in the right way?

7. Do you have the opportunity to advise the government?

7.1 What are the problems or shortcomings of government programs in areas where the government is already providing relevant assistance? If you were a government staff member, how would you improve it?

7.2 If you were a government employee, what other new assistance would you provide to a business like yours?

8. In addition to those mentioned above, are there any other domains or elements you think could help your business grow? They may include, but are not limited to

government, financial institutions, universities, related businesses, and cultural influencers.

The interview outline comprises of eight parts aimed at obtaining relevant information from the entrepreneurs and small business owners in Taiwan. The first question aims to gather information on the enterprise's business scope and its current stage of development. Questions 2 and 3 are intended to inquire about their experience with the agribusiness ecosystem. Isenberg's model is used as a framework to guide question 4, which aims to explore the difficulties and challenges encountered by the enterprises. Question 5 seeks to identify the most critical elements required at different stages of the company's development. The interactions among various elements within the agribusiness ecosystem are investigated through questions 6 to 8, which aim to determine the significance of specific elements in supporting the agribusiness ecosystem.

3.5 Taiwan's AE

In this section, the Taiwan AE is described employing Isenberg's model.

3.5.1 Agricultural Policy

Taiwan has implemented a range of policies aimed at promoting the growth and development of its agricultural sector. The Taiwan government has taken a leadership role in this regard, which has included the establishment of official organizations to promote agriculture, the issuance of supporting documents, advocacy for the adoption of sustainable agriculture, and active promotion of agricultural entrepreneurship. In terms of governance, the government has established various institutions such as the

Young Farmers' Counseling Platform and the Taiwan Agricultural Research Institute, alongside financial support mechanisms including the National Development Fund and Start Funds. Furthermore, the government introduces research and development plans such as the Agricultural Specialist Program and the Agricultural Development Act 2016, which offer tax benefits to support agricultural growth and development.

1. Leadership

The Council of Agriculture, Executive Yuan, has unveiled a set of objectives aimed to foster agricultural development. The twelve objectives are:

1) fostering new and innovative agricultural practices;
2) developing an agricultural knowledge economy and the cultivation of competitive niches within the sector;
3) ensuring food security and upgrading the agricultural and food industry;
4) creating an environment favorable for fishery management and developing high-value industries;
5) promoting integrated animal husbandry management and establishing a new industrial image;
6) establishing an efficient and service-oriented transportation and marketing system for agricultural products;
7) strengthening the agricultural epidemic prevention and quarantine network to ensure the safety and hygiene of agricultural products;
8) enhancing the functions of farmers and fisher's groups and improving their well-being;
9) creating a healthy and dynamic rural landscape;
10) strengthening soil and water conservation on hillsides and maintaining public safety;
11) conserving natural resources and preserving environmental ecology; and
12) stepping up foreign agricultural cooperation and promoting trade liberalization

The Taiwan government has established various institutions and associations to support agricultural development and facilitate research and technology, while providing financial support for its development.

The formation of official agricultural associations such as the Credit Department

of Farmers' & Fishermen's Association and the Council of Agriculture helps to ensure the social legitimacy of agricultural development. Based on caloric calculations, Taiwan's self-sufficiency rate in 2020 was around 31%. In addition to being self-sufficiency, Taiwan also exports high-quality pork, vegetables, and fruits for example. In 2020, Taiwan's agricultural product exports amounted to USD132 million. The development of Taiwan's agriculture is mainly due to the government's emphasis on agriculture. Since the late 1960s, the Taiwan government has vigorously advocated for the development of agriculture, changing land reform regulations and strategizing agriculture productions for example. In the 1980s, Taiwan's agriculture was in a secondary position in terms of GDP and experienced consecutive negative growth. In response, the Taiwan authorities adjusted the agricultural structure, promoted the agricultural products as high-quality products, and implemented measures to promote the industrialization, automation, and modernization of agricultural production, while adhering to the concept of "core farmers" and advocating for the transformation and upgrading of its agriculture industry from various angles.

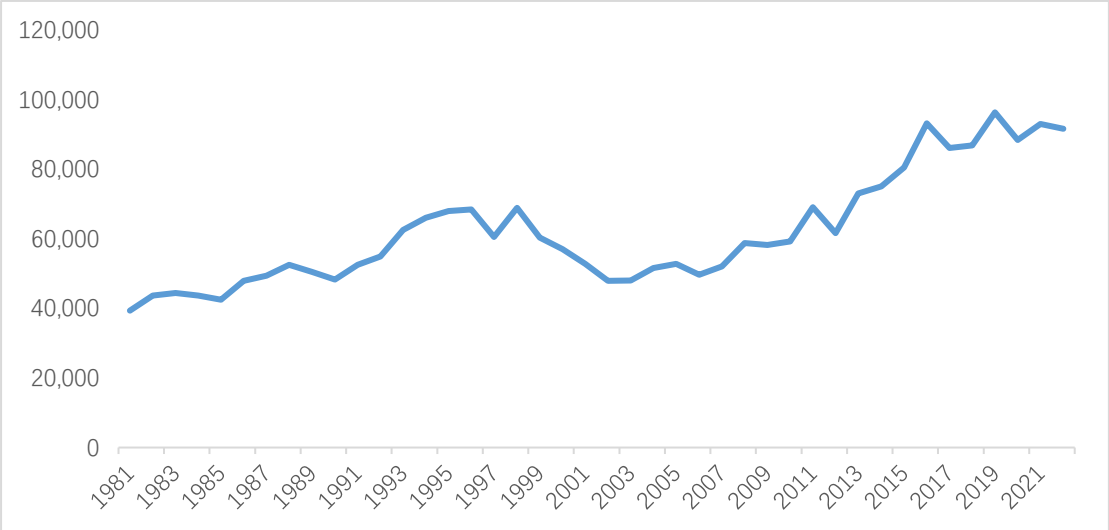

Table 3-1 Taiwan agricultural business total value (NT million)

Taiwan government has taken an active in promoting sustainability and advocating for the agricultural sector. In 2010, the government emphasized the sustainable use of land and natural resources. More recently, in 2022, Taiwan hosted a seminar on climate services in the agricultural sector, with the participation of relevant departments. During the seminar, the Bureau of Meteorology proposed a framework for climate services in the agricultural sector and discussed an action plan to promote agricultural climate services. These efforts have laid out a new blueprint for climate services and reinforced Taiwan's commitment to net-zero emissions in agriculture.

The Taiwan government also encourages entrepreneurship in the agricultural sector, particularly in the field of technological innovation. Taiwan established the Agricultural Technology Research Institute in 2014, with the aim to provide agricultural technology, commercialization, and industrialization services to farmers, farming organizations, and agricultural enterprises, accelerating the development of new agricultural businesses and internationalization. Furthermore, innovative agricultural management models have been developed, such as agricultural-commercial cooperation mechanisms that integrate agricultural and fishery special zones, and piloted agricultural insurance schemes. The government is also committed to cultivating agricultural talents, providing counselling for youth farmers and setting up agricultural exchange service platforms to guide young people becoming the backbone of the agricultural workforce. In terms of agricultural marketing, Taiwan has constructed an export-oriented agricultural value chain and expanding international business opportunities for agriculture.

2. Government

Initially, Taiwan has established institutions such as the Young Farmers' Counseling Platform to promote agricultural development. The Platform imparts practical training and internships to young farmers to develop their professional skills, as well as provides consulting services for agricultural management to guide them in addressing business challenges and improving their management abilities.

In addition, the Taiwan government ensures financial assistance for agricultural enterprises through various means, such as investment, loans, and subsidies. The National Development Fund by the National Development Council provides funding for enterprise operations and development through direct investment or as angel investment. The Council of Agriculture offers agricultural loans to young and middle-aged farmers (aged 18 to 45 years old) to alleviate financial difficulties. The Agricultural Specialist Program provides subsidies for innovations, research and development activities to encourage enterprises to commercialize their research results. The Bureau of Foreign Trade, MOEA, provides subsidies, such as venue rental and registration fees, for companies participating in overseas exhibitions.

Furthermore, the Taiwan government supports agricultural development through regulatory policies such as tax incentives. The Agricultural Development Act 2016 provides tax benefits to ensure the sustainable development of agriculture, address agricultural globalization and liberalization, promote the reasonable utilization of farmland, adjust the structures of agricultural enterprises, and stabilize the sale of agricultural production.

Moreover, the government has established and supported research institutes to promote scientific research and technological advancement in the agricultural sector. These institutions, such as The Taiwan Agricultural Research Institute, are categorized into agricultural experiment institutes, testing grounds, and improvement grounds, professional research institutes, and scientific research institutions with corporate nature. Each category is governed by specific regulations and systems, with financial support provided by the government.

3.5.2 Agricultural Finance

In Taiwan, agricultural enterprises reply primarily: on three sources of funding: (1) personal connections with friends and family; (2) angel investment funds and (3) micro-loans from institutions.

The majority of interviewees reported using personal savings or investment from acquaintances to meet their initial financial needs. Only Means Good was able to secure angel investment, and Kindly Eggs obtained commercial loans.

Micro-loans for agricultural development are offered by commercial banks through personal or corporate credit loans, as well as by the Agricultural Bank of Taiwan, which specializes in financing for agriculture, forestry, fishery, animal husbandry. The Agricultural Bank of Taiwan, established in 2005 by the Bureau of Agriculture Finance under the Council of Agriculture, Executive Yuan, aims to establish an agricultural financial system, support the development of credit departments for farmers' and fishermen's associations, and boost the development of the agricultural economy. However, most agricultural SEMs are not eligible for investment from

commercial banks, even those targeting agricultural enterprises, due to their lack of assets, revenues, or profitability.

Overall, Taiwan's agricultural enterprises face significant challenges in securing financing. They lack zero-stage venture capital, venture capital funds, private equity, public capital markets, and debts, while their angel investors and micro-loan providers need to be further strengthened. Therefore, there is a need for policies that address these issues to improve the financial support available to Taiwan's agricultural sector.

3.5.3 Agricultural Culture

Taiwan has a rich legacy in the realm of agricultural production. While many countries and regions tend to view agriculture as a "low-end industry", thereby dissuading people from pursuing careers in this domain. However, the belief that "engaging in agriculture is honorable" has permeated the Taiwanese psyche. Agriculture is viewed as the bedrock of human existence and national stability, and it transcends the dichotomy of high versus low, and noble versus humble professions. Through the dissemination of success stories and cultivation of social norms, Taiwan has been successful in transforming public perception regarding agriculture, making the Taiwanese people proud to be involved in this vital sector.

1. Success Stories

In Taiwan, promoting the success of agricultural entrepreneurs is highly emphasized both in academic institutions and daily life. For instance, the Agricultural Bank of Taiwan has compiled a book featuring 100 successful agricultural enterprises, and their experiences are shared to inspire young people to return to their hometowns

and engage in agricultural work. The Taiwanese government also places significant emphasis on the financial returns of agricultural producers. It is reported that the income of Taiwanese farmers is 25 times higher than that of their Chinese counterparts, owing to both the high level of agricultural modernization and the government's focus on increasing the added value of agriculture. The concept of "agricultural multiplier" effect is promoted, on the importance of product quality, food processing, and marketing to maximize the value of farmers' output. With a per capita agricultural value-added of USD13,300, which is ten times that of China, the urban-rural income gap in Taiwan is around 1.3:1, much lower than China's 3.3:1. For many Taiwanese people, this is a crucial factor when deciding to participate in agricultural production. In addition, the Taiwanese government, universities, and social organizations bestow awards and honors upon agricultural practitioners to recognize their contributions. While economic returns are critical, acknowledgment is also highly sought after. Hence, the Taiwanese government sponsors evaluations and competitions such as the Shen Nong Award, Golden Platter Award, Golden Chicken Award, and Elite Award.

2. Societal norms

By means of cultural guidance and educational training, Taiwan's resident regard agricultural workers as individuals with high social status. Taiwanese operators of homestays, leisure farms, and rural tourism exhibit a remarkable passion for agriculture, and the desire to own a farm is shared by many Taiwanese individuals. A significant number of individuals, including recent college graduates, are willing to engage in agricultural activities and pursue a farming lifestyle. Furthermore, there is a segment of

individuals who work part-time as farmers, experimenting with innovative and creative farming techniques.

3.5.4 Agricultural Support

1. Infrastructure

Taiwan has established various infrastructure and invested resources to foster their growth, notably, the “Startup Terrace”, which serves as an “all-in-one” entrepreneurship resource integration platform established by the Small and Medium Enterprise Administration of the Ministry of Economic Affairs. By integrating entrepreneurship resources from the central to local governments and the private sectors, the platform has become the largest one-stop platform for entrepreneurship resources in the country. In addition, it has launched physical bases and incubation institutions, playing an important role in assisting new entrepreneurs to start businesses and promote Taiwan’s entrepreneurial ecosystem. This platform provides diverse support for the development of agricultural enterprises and ecosystems.

2.Support Professions

Infrastructure encompasses both hard and soft aspects (Beerli & Martin, 2004). The “soft” aspects of infrastructure refer to support professions such as legal, accounting, investment bankers, technical experts, and advisors, as outlined in Isenberg’s model (2011). In this regard, Taiwan has made significant strides. For instance, in 2019, the Legislative Yuan enacted an amendment to the "Agricultural Product Production and Verification Management Act," which established the legal framework for eco-friendly agricultural operations. In addition, Taiwan’s accounting

and consulting services are also well-established and are willing to provide related services to agricultural enterprises to support their growth. The "Startup Terrace" website also integrates professional services crucial for agricultural development and facilitates the connection between agricultural enterprises and related service agencies.

3.Non-Government Institutions

According to the interviews conducted, it is revealed that several non-governmental organizations (NGOs) in Taiwan are actively supporting agricultural development. Firstly, there are numerous agricultural associations, including the Farmers' Association, which serves as a platform for farmers to convene and engage in discussion. In rural Taiwan, almost all farmers (99%) are members of such associations, which are established and managed democratically by the farmers. The association aims to improve the quality and skills of farmers, protect their rights, and enhance their political status. Secondly, several accelerators have been established, such as the HAOSHi Accelerator, which is the largest food and agrifood accelerator in Taiwan. It promotes the development of new food and agriculture industries with international perspectives and innovative thinking, stimulates local innovation in food and agriculture, and accelerates global integration. The HAOHSi Accelerator has incubated the Means Good team. In addition, there are numerous business competitions and conferences in which agricultural enterprises can participate. Interviewees from Yuan Jin Chuang, Lin Wang Tea, Green Day Biotech, Hua Gung Tea, and Rice Valley, stated that participating in these competitions and receiving awards and honors has aided in their business development.

3.5.5 Agricultural Human Capital

Isenberg's (2011) model divides Human Capital into two aspects: Labor and Educational Institutions. As education enhances the quality of the labor force, it is a critical factor in improving human capital.

1.Labor

To enhance the quality of human resources in agriculture, Taiwan has taken active measures to upgrade the skills of farmers. In 2011, the Farmers' Academy was established by the Council of Agriculture, which serves as a comprehensive agricultural training system that combines research, education, and resources. This academy uses various experimental improvement sites, professional skills, and knowledge to cultivate high-quality agricultural talents and enhance agricultural competitiveness. To achieve this, the academy formulated functional benchmarks for various categories of agriculture, fisheries, and animal husbandry, followed by the planning of systematic education and training courses for the general public, new farmers, and professional farmers. These courses range from introductory to basic, advanced, and high-level training in agriculture, with strengthened farmers' internships and providing lifelong learning channels for farmers and those interested in farming.

In Taiwan, farmers can be categorized into various groups, such as full-time farmers, serial entrepreneurs, and "later generation family farmers". Most of them operate family-based micro-enterprises, planting rice, vegetables, and fruits year after year, and passing down their agricultural activities from one generation to another. There are many "part-time farmers" who engage in agricultural activities in their spare

time, and their work extends to various related professional fields. To them, farming has become a rich and diverse industry, and they identify themselves with multiple identities as a "part-time farmer", who integrates physical labor and as an entrepreneur.

2.Educational Institutions

Taiwan places significant importance on agricultural degree and entrepreneurship training, in addition to providing skills training for farmers. This is evidenced by prestigious universities in Taiwan, including National Taiwan University, National Chung-Hsin University, National Pingtung University of Technology, National Ilan University and National Chiayi University, which offer bachelor's, master's, and doctoral degrees in agriculture, with relevant courses and experimental sites to cultivate the experts and scholars in the field. Furthermore, the Taiwan Ministry of Education has launched the New Agriculture Innovation and Entrepreneurship Talent Cultivation Program, aimed at bridging the gap between learning and application by establishing a connection between government, academic institutions, and the agricultural industry. This program aims to support agricultural research and development scholars in achieving commercialization. Thus, Taiwan's Agricultural Entrepreneurship (AE) has developed significantly in terms of Human Capital, with each element outlined in Isenberg's (2011) model being closely related to this development.

3.5.6 Agricultural Market

According to Isenberg's (2011) model, the market comprises of two elements, namely: Early Customers and Networks.

1.Early Customers

Taiwan has displayed considerable ingenuity in the processing and marketing of unique agricultural products. Firstly, the government has supported farmers in developing distinctive agricultural products and promoting their sales and distribution. In response to food safety concerns, consumers have increasingly favored small-scale, handmade, natural, and additive-free agricultural products, and the Council of Agriculture has launched various campaigns such as the "One Township, One Leisure Agriculture and Fishery Park", "Development of Local Specialties as Souvenirs", and "Rural Regeneration" to take advantage of this trend. By combining rural tourism with industrial guidance and integrating marketing channels, the Council has facilitated the marketing of local specialty products across Taiwan and overseas. Moreover, in 2019, the "Agricultural Product Production and Verification Management Act" was amended to establish a certification system for primary processing facilities for agricultural products, enabling small farmers to set up food processing rooms on legally designated land under their own brands. This has enhanced the value of agricultural products and enabled farmers to connect directly with consumers through farmer’s markets, social media, and online platforms, thereby establishing a mutually beneficial network between consumers and producers.

Secondly, the Council of Agriculture has established an agricultural product processing integration service center to enhance the food processing skills of farmers. The center provides one-stop consulting services for agricultural product processing, including integration consulting, sample production guidance, trial production, and

public packaging services. The "Agricultural Product Value-Adding Sample Center" has also been established in agricultural trial units throughout Taiwan and some agricultural colleges, providing consultation services such as processing equipment, technical guidance, processing mediation, marketing packaging, and other services for low-risk processing projects, such as drying, crushing, grinding, and roasting, to help farmers carry out agricultural product processing operations and extend the shelf life of agricultural products. The primary processing system highlights the government's recognition of the demand and value of small-scale farmer processing, which helps to stabilize the production and sales of agricultural products, increase the value of local crops, enhance agricultural competitiveness and farmers' income, and promote agricultural transformation. With the strong promotion of agricultural policy units and local organizations, Taiwanese farmers have gained a basic understanding of the benefits and effectiveness of the "six-level industrialization" approach through the training provided by the small-scale rural processing program. These improve the added value of agricultural products by integrating their production, processing, and sales.

2.Networks

The Taiwan government has established an International Marketing Advisory Center to assist businesses in exploring overseas markets. Similarly, the Taiwan External Trade Development Council has instituted the "International Marketing Advisory Center" to support innovative industries or small and medium-sized enterprises with international competitiveness in expanding into the global markets. The center comprises regional experts with extensive international market experience,

who serve as exclusive consultants for international marketing of small and medium-sized enterprises by providing customized, one-stop professional consulting services. In addition, they guide entrepreneurs in leveraging government funding, enhancing business operations, and strengthening international competitiveness. Through these concerted efforts, Taiwan's agricultural products gained traction overseas, rendering Taiwan a renowned "kingdom" of agricultural exports in Asia. Thus, it is evident that Taiwan's agricultural ecosystem actively aids farmers in developing specialty agricultural products and facilitates their sales and distributions. The establishment of the International Marketing Advisory Center enables businesses to explore global markets, while the Agricultural Product Processing Integration Service Center improves farmers' food processing skills.

To sum up, the domains and elements of Taiwan's AE can be as follow figure.

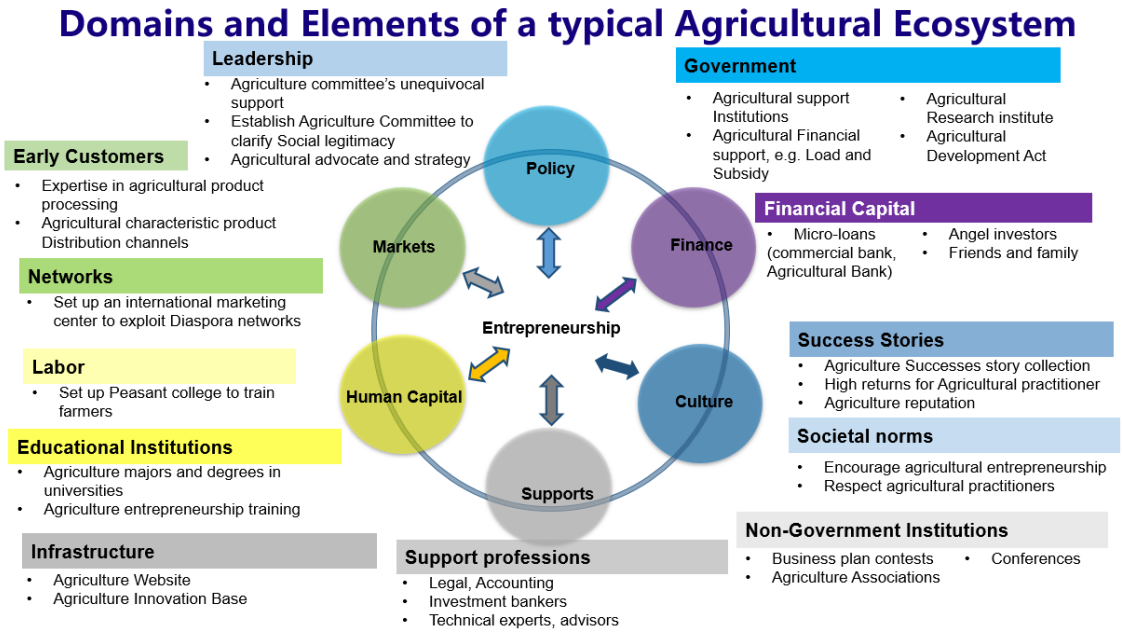

Figure 3-1 Domains and Elements of Taiwan's Agricultural Ecosystem

Chapter 4 Findings

Taiwan and Singapore share similarities in various aspects, including demographics age structure, dietary preferences, GDP per capita ranking, geographical location, climate, and land area per capita. However, a significant difference between the two nations is Taiwan's notably higher food self-sufficiency rate which can be attributed to a combination of government policies, scientific research institutions and school's contributions, as well as native agribusinesses' involvement. As Singapore aims to achieve its objective of domestically producing 30% of the food it consumes by 2030, Taiwan's agribusiness ecosystem can serve as a valuable reference for the Singapore government. This study intends to examine the domains within Taiwan's agribusiness ecosystem, the roles they assume, and the constituent elements of each domain.

Based on the selection process described in Chapter 3, the author will identify target enterprises for conducting interviews. Theses interviews will involve the founders of nine enterprises and will focus on six aspects. Firstly, the fundamentals of these enterprises will be ascertained. Secondly, the relationships between policies, financing, culture, support, human capital, and market - referred to as the "six domains" hereafter – will be explored. Thirdly, any other domains or elements that contributes to business development besides Isenberg's six domains or elements. Finally, the difficulties encountered and suggestions for Taiwan' entrepreneurial ecosystem will be identified.

4.1 Profiles of the enterprises

Prior to conducting the interviews, the author attempted to comprehend the fundamental information of the enterprises, including their business growth stage and other basic details. The aim was to ascertain whether the enterprises met the interview criteria for this study and to create a context for an open discussion with the founders during the interviews. Specifically, the author gathered information on the year of incorporation, primary business activities, and current business growth stage of each enterprise.

The table presented below display the data gathered from the interviewees regarding their enterprises' year of establishment, primary business activities and business growth stage. To categorize the growth stages of these enterprises, the author adopted the categories proposed by Miller and Friesen in 1984, which classifies the corporate life cycle into five stages: Birth phase (B), Growth phase (G), Maturity phase (M), Revivl phase and Decline phase. In this context, we will focus solely on the first three stages of the corporate life cycle, namely the birth phase, growth phase, and maturity phase, and we will not address the revival phase or the decline phase. For enterprises in the revival phase, the emphasis is on diversifying and expanding their products and markets, and the focus is on corporate strategy rather than on AE. Conversely, in the decline phase, enterprises experience a contraction in their operations due to market exhaustion, and the emphasis is on scaling back their operations, which is beyond the scope of AE support.

Table 4-1 The enterprises' year of incorporation, main business activities and business growth stage

Enterprise[1]	Year of Incorporation	Main Business Activities	Growth Stage
Means Good (G)	2015	Cultivation of crops like cordyceps and fungi	Growth
Yuan Jin Chuang (M)	2005	Wholesale and breeding of poultry and manufacturing of poultry feed	Maturity
Lin Wang Tea (M)	2005	Sales and production of tea, coffee and related products	Maturity
Balay (G)	2011	Cultivation of Antrodia Cinnamomea, sales and production of related products	Growth
Green Day Biotech (B)	2020	Dead livestock and poultry biological treatment system, and the decomposition of biological wastes into fertilizer with enzymes	Birth
Rolling Green (G)	2012	Fertilizer manufacturing and crop cultivation	Growth
Hua Gung Tea (M)	2006	Tea planting, wholesale and processing of products	Maturity
Kindly Eggs (M)	1993	Duck egg production, sales and processing of products	Maturity
Rice Valley (G)	2017	Rice cultivation and retail	Growth

Drawing upon the fundamentals of the enterprises, it is apparent that SMEs reach the maturity stage, when their product sales revenue has stabilized, operations are relatively stable, and market prospects are positive, and funding constraints are relatively small (Churchill and Lewis, 1984；Miller and Friesen, 1984), SMEs still desire to engage with relevant authorities, associations, institutions and other enterprises within the ecosystem to foster their business development.

[1] The letter in parentheses after the name of the SME refers to the growth stage of the SME.

Many SMEs are reliant on external research centres for their research and development needs. Thus, they need close collaboration with universities and research institutions in the AE. SMEs also engage with AE for market information and expansions. SME owners recognize the significance of market information in the sales market and leverage on their industry network and relationship with their peers to obtain valuable information to adjust their enterprise strategies and even create new businesses. Consequently, many owners of mature SMEs proactively cultivate ties with their peers in their industry by joining associations, serving as board of directors or committee members of SME associations or agricultural associations, or offering part-time lectures in universities to acquire useful information for business development. As an illustration, the Chairman of Hua Gung Tea (M), Mr. Du, also serves as an adjunct teacher at National Chung Hsing University and often invites industry players to deliver lectures on campus. Through this activity, Hua Gung Tea obtains consumer feedback on product research and development while promoting their products. It is a formidable challenge for SMEs to grow and transform into larger enterprises. Despite being operational for 20 to 30 years and achieving stable turnover and maturity, many enterprises are still classified as SMEs. Hence, SMEs at matured stage are an important research party for this study.

In contrast, SMEs in the Birth[2] or Growth stages[3], while showing a strong desire

[2] At Birth stage, SMEs have not yet established a comprehensive organizational structure and management system. The level of management is relatively low, and it is generally done in an informal way, with the owner taking responsibility. The primary strategic objective of these enterprises is to strive for survival (Miller and Friesen, 1984).

[3] At Growth stage, SMEs' product market has generally achieved initial success, and its operation scale is rapidly expanding. A functional organizational structure is formed, and some decision power is delegated to middle-level managers. Decision-making procedures begin to become more

to participate in the ecosystems, often lack clarity on how to do so effectively. Some entrepreneurs who have just started their businesses may not fully understand the roles of the government and universities and as a result, may provide limited information on these areas during the interview process. For example, some start-up small businesses have too high expectations of government support and hope that the government will provide the necessary assistance. However, some mature SME owners realize that government support is merely a supplementary resource. As Mr. Wei, the chairman of Means Good, emphasized, enterprises in their infancy should focus on product development, as seeking government aid could be a waste of time, especially when the enterprise's future is uncertain. Government personnel who oversee SME support have key performance indicators to meet, and if they provide assistance to an enterprise that fails to develop further, their performance will be affected. Therefore, start-up enterprises should not spend too much time seeking resources from the government. This is also why the interviews conducted in this study focused on entrepreneurs with 20 to 30 years of entrepreneurial experience, as they possess a better understanding of the ecosystem's history, domains, and elements, and can provide more relevant information for this study.

Through the initial interviews conducted, this study has discovered that SMEs in the Birth, Growth, and Maturity stages were keen to engage with the Agricultural Ecosystem (AE) and facilitate the growth and development of their businesses. As

standardized and institutionalized. The strategic objective of the enterprise is to achieve rapid sales growth and invest in expanding production scale, in order to defeat other competitors (Miller and Friesen, 1984).

enterprises in the Birth stage are still in the early exploration stage, they do not possess a comprehensive understanding of the AE. However, those in the Growth stage and Maturity stage have developed a clearer understanding of the composition and functional positioning of the AE through years of exploration. Moreover, as the interviewees were primarily founders of their respective companies, they possess a deep understanding of their companies' history and situations. Therefore, it is suggested that interviewing founders of companies in the Growth stage and Maturity stage would offer a more useful and comprehensive understanding of AE than those in the Birth period. Hence, the author opted to conduct in-depth interviews with one enterprise in the Birth period, four in the Growth period, and four in the Maturity period of small and medium-sized agricultural enterprises to construct an AE model.

4.2 The impact of the six domains on the business development of the enterprises

The second phase of the interviews focused on exploring the relationship between the interviewees and various stakeholders, the challenges encountered during business development, and the strategies adopted to overcome obstacles. Isenberg's (2011) six domains-namely, policy, finance, culture, support, human capital, and markets - were used as the framework to guide the interviews, with a specific focus on how each domain impacted the interviewees' business development. This approach was intended to assess the applicability of Isenberg's entrepreneurial ecosystem model to the context of Taiwan's agribusinesses, while also uncovering any additional insights.

4.2.1 Agribusinesses in Taiwan are involved with the agricultural ecosystem (AE)

To foster growth and expansion, Taiwan agribusiness maintain active and positive connections with various elements in the agriculture ecosystem in order to seek the means to strengthen their relationship with the government, industry associations, universities, and other relevant entities to obtain help and assistance.

Through the interviews, it was revealed that the AE could assist agricultural enterprises in overcoming challenges. The interviewees highlighted two of the most difficult stages in the business development of such enterprises. The first stage is the start-up phase when entrepreneurs must determine their future business directions. Many agribusinesses, prior to their incorporation or during the early stages of incorporation, must continuously explore the markets and adjust their business directions for survival. This process often takes two to three years or more. The second stage occurs when enterprises are established, but entrepreneurs have to make adjustments to their products and strategies to achieve further growth. Mr. Wei, chairman of Means Good, expressed that the exhaustion he experienced before and after determination his business directions were different. After setting business directions, the focus is on expanding and growing the business. However, before the business directions are determined, the entrepreneur is hesitating at every step, as investing funds and resources in the wrong approach would result in significant losses. At this stage, agricultural enterprises can seek guidance from entrepreneurial predecessors, industry development, market information provided by associations, and

policy interpretation provided by the government. Through the AE, these forms of assistance can help enterprises clarify their business development direction.

Innovation and product development can pose another challenging stage for agribusinesses, particularly in terms of introducing innovative products to the market and generating revenue from them. Due to their newness, consumers may be hesitant to accept such products, and there may be a shortage of capital funds available to address this issue. Therefore, enterprises must quickly overcome these challenges by obtaining customer acceptance and generating sales to secure the necessary working capital for normal operations. To achieve this, agribusinesses engage actively with various elements in the AE, seeking assistance in opening up new markets, acquiring customer referrals, and obtaining valuable market information to help them to quickly penetrate the market.

It can be inferred that agribusinesses exhibit a pronounced inclination to engage with the AE, as such a move allows them to address the operational obstacles they encounter. The degree of an enterprise's willingness to participate in the agricultural ecosystem corresponds directly to the magnitude of the challenges it confronts.

4.2.2 Presence of Isenberg's Domains in Taiwan's AE

The nine interviews report that the six domains of Isenberg's model are present in Taiwan's AE.

(1) Policy in Taiwan AE

Isenberg's model (2011) highlights the importance of leadership and government institutions in promoting entrepreneurship.

a) Leadership, such as clear support, social legitimacy, advocates of openness, and entrepreneurship policies

b) Government, such as institutions (investment and support), financial support (R&D funding, start-up capital), regulatory incentives (tax benefits), research institution establishment, entrepreneurial legislation (bankruptcy, contract enforcement, property rights and labour).

Through the interviews conducted, it was revealed that the Taiwan government plays a role in AE by providing subsidies for exhibition booth, investment funds, bonuses, and other monetary support. The most frequently mentioned type of support was overseas exhibition booth subsidies, which is aimed at promoting market expansion and encouraging agricultural enterprises to venture into the international market. With regards to government grants for research and development, the application process was noted to be lengthy, thus enterprises are advised to carefully consider whether to proceed with the application and seek assistance from experienced experts or scholars if they intend to. The government's support in AE, as mentioned by the interviewees, includes the following table 4-4:

However, the author suggests that Taiwan government should focus more on policies related to "urgency, crisis, and challenge" and "venture-friendly legislation", with reference to Isenberg's model (2011), to further enhance its support for agricultural development.

Table 4-4 Interview Contents Related to Policy

Enterprise	Example of Policy
Means Good (G)	1.Fund: The establishment of the National Development Fund by the government serves to support nascent enterprises. Unlike other funds, this initiative does not necessitate enterprises to generate a profit immediately, and is not compelled to divest expeditiously, providing more leeway for the enterprises to develop their products and gauge the market. This policy is especially commendable and has the potential to prompt other commercial funds to furnish long-term funding to support SMEs. 2. Incentive Program Subsidies: Means Good was bestowed with an award by the Economic Daily News and succeeded acquiring subsidies for the CITD and SBIR programs. However, processing the plans and applications was a protracted procedure. Start-ups should access the feasible of the application process.
Lin Wang Tea (M)	1. Subsidies for exhibition booth: The government extends certain subsidies to enterprises to participate in trade exhibitions in Hong Kong and Japan, with the aim of facilitating their entry into the international market and resolving issues stemming from the small domestic market. 2. Product subsidies: The Council of Agriculture extends grants for product and packaging design to support the marketing of agricultural products.
Balay (G)	Due to the lack of significant support from the government support for start-ups, it is advisable not to allocate excessive resources towards applying for government subsidies. However, should the enterprise decide to pursue such subsidies, seeking expert advice may be a wise approach to minimizing the investment of time and avoiding any unnecessary detours.
Green Day Biotech (B)	1. The Council of Agriculture offers subsidises to cover booth and promotion fees for agricultural enterprises. 2. Agricultural machines subsidies: The government provides grants subsidies to farmers who purchase domestically produced agricultural machinery products, as a means to encourage domestic sales.
Kindly Eggs (M)	The government assist in the development of markets by providing subsidies to support participation in international exhibitions.

(2) Finance in Taiwan AE

According to Isenberg's model (2011), the financial factor plays a crucial role in providing necessary funds to facilitate entrepreneurial activities. These funds may take

various forms such as small credit loans, capital funding, angel investment funding, intellectual property (IP) funding, and public capital funding, among others.

The author conducted interviews with the founders of the enterprises to examine the level of financial support provided by financial institutions. The extent of financial support that SMEs can obtain is contingent upon their operational status and existing assets. The findings indicate that such support remains weak and insufficient, particularly for SMEs. SMEs have high operating risks which may render them unattractive to many financial institutions. Moreover, agricultural enterprises face dual risks emanating from nature and business operations, making it an industry with higher risks than others. Consequently, it is more challenging for these enterprises to secure financial support from financial institutions. Most interviewees revealed that they primarily rely on internal fundraising to obtain capital, with only one enterprise, Means Good, receiving angel investment through a start-up accelerator. Despite some enterprises having a history of over 20 years, obtaining external funding is still difficult for them. Banks typically require financial statements and assets before issuing credit, which is an obstacle for start-up enterprises that are yet to turn a profit. However, given that most agricultural enterprises have low initial investment requirements, they may not have significant funding needs.

Table 4-5 Interview Contents Related to Finance

Enterprise	Example of Finance
Means Good (G)	1. Capital from family members, relatives, and friends. 2. Accelerator-based angel investment: As a newcomer to the angel investment market, Means Goods received support from the mentor who recommended the project for evaluation. After successfully passing the feasibility assessment, Means Good was fortunate to secure angel investment.
Balay (G)	Due to the significant financial resources required for researching and developing the product's efficacy, Balay relied on self-funding to increase capital since securing external funding sources proved challenging.
Lin Wang Tea (M)	The Famer & Fishing Association offers loans at low interest rates for eligible businesses.
Rolling Green (G)	External sources of funding were not available; hence the entire funding was generated through internal capital investment.
Kindly Eggs (M)	Bank loans: Our company was able to obtain bank loans due to our strict control of return on investment and consistently profitable financial performance.

(3) Culture in Taiwan AE

Isenberg (2011) identifies the following elements of culture in his model, are:

a) Successful case studies, such as successful models, the wealth and honour of founders.

b) Social norms, such as tolerance for risk and failure, entrepreneurs' social status, ambition, drive and motivation.

According to Chen and Li (2010), culture is a gradual development of concepts, ideas, or habits over time. Taiwan exhibits a strong culture of entrepreneurship and agricultural enterprises, which can be attributed to various factors.

Firstly, the government provides a favourable environment for entrepreneurship by offering support to individuals interested in starting their own businesses. Secondly,

the Taiwanese society regards entrepreneurs in high esteem, which serves as a motivation for aspiring entrepreneurs. Thirdly, entrepreneurs in Taiwan often engage in knowledge-sharing, mentorship, and networking, which helps in building a supportive community. In addition, Taiwan's agricultural sector is not considered as a low-level industry, which makes it an attractive option for individuals seeking career opportunities in this field and even small and medium-sized agribusinesses can easily attract university graduates (Hwang et al., 2008). The government has also been supportive of the agricultural sector, with the Council of Agriculture providing assistance to farmers and agribusinesses. Almost all interviewees acknowledged receiving some form of support from the Council.

The extracts from the interviews in Table 4-6 show the influence of role-models on the SMEs; see e.g., Means Good. The supportive networks and assistance from the Council of Agriculture are also highlighted by Lin Wang Tea.

Table 4-6 Interview Contents Related to Culture

Enterprise	Example of Culture
Means Good (G)	"I was greatly influenced by one of the prominent entrepreneurs in Taiwan who is an alumnus of National Taiwan University, specializing in the field of agriculture Initially, he worked for a company and subsequently embarked on his own entrepreneurial venture. He has achieved considerable success and has an extensive network of contacts and resources. I hold him in high esteem and have great trust in him."
Yuan Jin Chuang (M)	"There are various competitions in Taiwan, such as the National Quality Award, the Innovation Research Award, the Women's Entrepreneurship Award. The Council of Agriculture often recommends us to participate to get recognition. There is a robust entrepreneurial culture in Taiwan, which provides spiritual motivation for entrepreneurs."
Lin Wang Tea (M)	"The government provides entrepreneurs with spiritual support, especially the Council of Agriculture, which provides a broad range of assistance. The Council encourages me to participates in international exhibitions, provides us with subsidies and conducted various courses to enhance technical skills and sharpen our competitive edges." "The top Ten Outstanding Agricultural Experts award is held once every two years. It is to honour the top 10 farmers in Taiwan. I was honoured to receive the award as one of the first enterprises to promote the sanitary production and sales. Winning this award has boost our brand image. I have been actively participating in government initiatives to enhance my entrepreneur competitiveness."

(4) Supports in Taiwan AE

As stated in the research by Isenberg (2011), the key elements of support that benefited the EE are:

a) Infrastructure, such as telecommunications, transport and logistics, energy.

b) Professional support like lawyers, accountants, technical experts, and consultants.

c) Non-governmental organizations, including business plan competitions, seminars, enterprise incubator, accelerators, and entrepreneur associations.

As per the responses of the interviewees, they reported that they establish connections with experienced business mentors and fellow entrepreneurs through accelerator programs and professional associations. The support is accessed through the connections and the events organized by non-governmental organizations. Such relationships have proven to be advantageous for their business development, allowing them to minimize detours in their journey. In addition, participating in various competitions has enabled the enterprises to not only gain recognition, awards and bonuses but also to evaluate their strengths and weaknesses relative to their competitors in the industry. This self-assessment has facilitated the identification of areas that require improvement and has guided the enterprises in determining their strategic direction for growth.

Table 4-7 Interview Contents Related to Supports

Enterprise	Example of Supports
Means Good (G)	"The accelerator program provides entrepreneurship courses at the outset of our business, and we were paired with industry mentors who helped guide us in the right direction. Acquaintances inside the accelerator also provide valuable advice on business strategy.". "The feed industry is a closed circle. Thankfully, with the help from related association members, I gain access to the market and found new customers through their networks."
Balay (G)	"Participations in seminars help me to expand my network and market reach." "I met a successful entrepreneur in the industry association, and he has been mentoring me in my business operations. With his experience and knowledge, not only did he guide me on our product development but also on market strategy, and corporate finance, so that we avoid many unnecessary setbacks."

(5) Human capital in Taiwan AE

Isenberg's (2011) educators and human capital elements include:

a) Labor (skilled and unskilled labor), serial entrepreneurs, and intergenerational inheritors.
b) Educational institutions (providing professional /& academic qualifications), and specific entrepreneurial training.

Taiwan places great emphasis on the cultivation of agricultural talent. Firstly, both the government and non-governmental organizations provide numerous training courses on agricultural entrepreneurship and food processing. The most prominent of these is the "Six-level Industrialization," which guides Taiwanese citizens on how to increase the added value of agricultural products through processing and balancing between production and sales. Many Taiwanese universities value the training of agricultural talent, with renowned institutions such as National Taiwan University, National Chung Hsing University, National Pingtung University of Science and Technology, National Ilan University, and National Chiayi University, setting up agricultural colleges. Many other institutions also establish agricultural-related majors such as food science and actively engage in research and development cooperation with enterprises while simultaneously cultivating professional talent for these industries.

In terms of human capital and education providers, the interviewees express the opinion that colleges and universities could play a significant role in enhancing the performance of agricultural enterprises by offering courses on product innovation, business modelling innovation and to improve and increase the efficiency of business management. Agricultural enterprises would like to recruit graduates from the relevant fields of academia. For instance, Rice Valley mentioned that during the early stages of

his startup, he enrolled in a doctoral course in a business school, which greatly assisted in the operations and expansion of his business. Similarly, an interviewee from Yuan Jin Chuang stated that they recruited students who collaborated with their enterprise and to hire the teachers who work with them as consultants.

Table 4-8 Interview Contents Related to Human Capital

Enterprise	Example of Human Capital
Means Good (G)	"The professors that I knew recommended students in the fields of agriculture and biology to join my enterprise."
Yuan Jin Chuang (M)	"The industry-university collaboration arrangement allows us to recruit the students who collaborate with us as employees and recruit the teachers who work with us as consultants." "We are also recruiting other employees from recruitment agencies."
Balay (G)	"Through my classmates' network, we recruited a highly connected executive. Through his referrals and subsequent referrals from his network, our talent pool expanded significantly."
Rice Valley (G)	"During the early stages of my start-up, I took a doctoral course at a business school. The marketing and business model's syllabus were of great help when I applied to my business operations and expansion strategies."

(6) Markets in Taiwan AE

The key elements in market access are listed below based on the model of Isenberg (2016):

a) Initial customers (e.g., early adopters who had certified the concept), productization expertise, experimental customers, and distribution channels;

b) Networks, for example entrepreneurial networks, discrete networks, and multinational corporations.

With regard to attracting the first batch of customers at the beginning of their businesses, the majority of the interviewees expressed that leveraging the internet to

promote their brand and identify potential customers was a highly effective strategy to adopt. As these enterprises are at the start-up phase, they lack an established reputation, which makes market entry a more challenging task. Therefore, it is crucial for these businesses to leverage the distinctive qualities of their high-quality products to create awareness and expand their network. One feasible approach is to offer free trials and samples to potential customers, which will enable them to experience the benefits of the products and potentially lead to purchases. In addition, exhibiting the unique features of the products at relevant trade shows and exhibitions can also serve as an effective way to attract customers.

In terms of networking, the interviewees recognized its significance for agriculture enterprises. For instance, the interviewee from Means Good emphasized that "given the characteristics of the agricultural industry, it takes a longer time, as compared to other industries, to establish networks, and the industry circle is relatively closed. Even with the provision of product information and instructions, potential customers may not be willing to invest their time to understand, build trust and collaborate without the recommendation of acquaintances. Recommendations, provide a suitable platform to discuss cooperation opportunities and significantly reduce the time spent searching for potential customers."

Table 4-9 Interview Contents related to Markets

Enterprise	Example of Markets
Means Good (G)	"Using the experimental data from the Agricultural Technology Research Institute (ATRI) as a foundation, we proceeded to visit each of the farmers registered with the Council of Agriculture. We distributed free samples to the farmers to let them test and understand the benefits of the products and sold the products at a special rate to farmers who purchased in huge quantities."
Yuan Jin Chuang (M)	"Over the past few years, we have developed our own brand. We leverage on the official website and social media platforms to share our products' innovations, the honours we have achieved and other details with our consumers. Through the promotion of our brand over the internet, we attract potential distributors who help us to promote our products in the domestic and foreign markets they are familiar with." "We attend domestic and international exhibitions to promote our product innovations and specialised technologies. This strategy enables us to engage with corporate customers and explore opportunities for collaborative partnerships."
Lin Wang Tea (M)	"We post pictures of the production process on Facebook to increase the visibility of our brand." "We participate in domestic and foreign exhibitions held by the Council of Agriculture or the Taiwan External Trade Development Council (TAITRA) to build customer base."
Rice Valley (G)	"We apply block chain technology in our production process and effectively store all the data. It is a feature in promoting our brand through Facebook, thereby successfully attract both local and international customers. Furthermore, we use Amazon as our sales channel to enter the US market."

In summary, all six domains in Isenberg's (2011) entrepreneurial ecosystem model were found in Taiwan's AE, and the interviewees expounded on their respective functions.

4.3 Additional new roles for AE

According to the interviewees, certain novel roles were observed in the AE ecosystem, which were not identified in Isenberg's model. It appears that due to the increasing interactions and richer functions of the elements within each domain, some

additional roles have emerged. However, these new roles could not be fully integrated into the existing model. The new roles can be broadly classified into four categories:

(1) The accelerator, which is supposed to be used for financing, becomes a place to develop a new customer base.

The primary aim of the accelerator program is to aid entrepreneurial teams in defining their core competencies and securing funding during the developmental stages (Gourlay et al., 2008). In the accelerator program, entrepreneurs have the opportunity to meet highly experienced mentors who can provide guidance on the development of business directions and connection to potential customers, often resulting in a high likelihood of collaboration through the mentor's network. In the context of accelerators, entrepreneurs may exhibit similarities in terms of their values and business life cycles. Accelerators that focus on specific sub-industries may serve as a hub for entrepreneurs within the same industry. The training programs offered by the accelerators may create a sense of camaraderie among entrepreneurs, fostering an environment that encourages sharing, mutual support, and networking, including the exchange of customer referrals.

(2) In addition to their traditional role of providing talent and education, universities also serve an important function in product research and development for enterprises.

Isenberg's (2011) model positions colleges and universities as providers of talent and training, however, interviews with the founder and co-founders revealed an additional function - co-operation in research and development. Given that many

agricultural start-ups have limited resources and expertise for research and development, they often actively collaborate with universities and research institutes. For instance, Means Good mentioned that “we participated in the experimental program of the Agricultural Technology Research Institute (ATRI), providing raw materials for the experiments while the ATRI’s researchers conducted the experiments and shared the research data and results with us. The research findings of ATRI have opened up a new market for us, and the data obtained from the research has become the most effective evidence for our marketing efforts. Without the ATRI, we cannot do the research due to high personnel requirements and high expenditures”. This highlights the crucial role that universities and research institutes play in facilitating product development and ultimately, business success.

(3) Government agencies, in Isenberg’s model, are primarily viewed as policymakers and public leaders.

However, the interviews revealed that these agencies are involved in activities beyond these traditional roles. The agricultural experts at the Agricultural Research and Extension Station and the Agricultural Research institute under the Council of Agriculture cover various fields such as agriculture, forestry, and animal husbandry. Their research results can be transferred to private enterprises as technology for their use. These experts’ grasp of international industry trends can provide enterprise education and training to enhance our industry vision and research and development standard. In addition, the government’s selection activities for outstanding enterprises and excellent products, due to the strict participation requirements and rigorous

evaluation process, serve as the best guarantee for enterprises to enhance their brand image. Yuan Jin Chuang, Lin Wang Tea and Rice Valley all highlighted the significance of government-issued awards and endorsements for their businesses. These awards were considered equivalent to receiving endorsement from the government, which resulted in positive publicity effects when included in the enterprises' marketing and promotion materials. Yuan Jin Chuang explained, "Every year, we apply for awards to gain media exposure, such as the National Quality Award. It will be easier for our marketing team because getting an award would indicate that our enterprise and products have gained the government's approval".

(4) Other additional roles in the AE domains. Additional roles for actors in the AE domains include staff employment at trade fairs, and exploring customers through EMBA classes, among others. This indicates that as interactions between elements in the ecosystem's various domains increase, the functions and roles of these elements become richer and more diverse.

Table 4-10 Additional new roles for AE

Enterprise	Additional new roles for AE
Means Good (G)	1. Through leveraging the accelerator program, associates introduced prospective clientele and facilitated the cultivation of mutual trust between the parties involved. 2. Active participation in Agricultural Technology Research Institute's (ATRI) experimental program enabled the acquisition of research data to be utilized as marketing intelligence.
Yuan Jin Chuang (M)	1. Engaging in proactive participation in government-organized events and competitions has enabled the enterprise to leverage opportunities for increased brand exposure. Upon receiving the accolade, media channels are employed to effectively heighten awareness and achieve sales targets.

	2. Collaborating with educational institutions to develop targeted curricula enables the enterprise to better align students with the requisite skills and knowledge to meet industry demands.
Lin Wang Tea (M)	1. Active participation in diverse agricultural business support programs initiated by the Council of Agriculture and affiliated government entities has enabled the enterprise to garner positive brand image enhancement through relevant promotional activities or media exposure. 2. Attainment of the prestigious designation of Top Ten Outstanding Agricultural Experts has yielded a notable upswing in sales for the enterprise.
Balay (G)	Undertaking academic research with universities to explore the diverse functions of the products and subsequently published the research results and articles in renowned domestic and international journals serves to substantiate the scientific efficacy of the offerings. Moreover, the academic articles serve as a valuable testimony when pursuing collaborative efforts with corporate partners and industry experts.
Green Day Biotech (B)	1. Active participation in industry exhibitions not only enables enterprises to network with fellow practitioners, but also serves as a potential avenue for recruitment opportunities. 2. The marketing team's attendance at training courses offered by educational institutions or associations facilitates the exploration of prospective clientele while concurrently advancing professional development. 3. Regular communication with directors and officers of the Council of Agriculture enables enterprises to remain attuned to prevailing global agricultural industry trends and government initiatives, while also receiving advice to foster business development.
Rolling Green (G)	1. Invitations to deliver speeches at educational institutions or professional associations, offer enterprises an opportunity to identify potential customers. 2. Collaborative efforts with university lecturers not only facilitate product development, but also serve as a recruitment platform for attracting talents to the enterprise's research team.
Hua Gung Tea (M)	1. Through serving as a business mentor at Chung Hsing University and engaging with its students, enterprises have the opportunity to identify potential clientele and cultivate prospective recruitment leads. 2. Participation in prestigious international competitions enhances brand value and facilitates the establishment of relationships with international counterparts from within the industry.
Kindly Eggs (M)	By participating in government departments-sponsored courses on corporate innovation, enterprises can acquire valuable knowledge relevant to business operations.

Rice Valley (G)	The donation of Rice Valley high-quality rice to Vatican, a religious significant site, received extensive media coverage and subsequently contributed to heightening brand recognition and a marked upswing in sales volumes.

4.4 Unique features in Taiwan AE under Supports

The author endeavored to construct a comprehensive AE model by exploring domains or elements that potentially affect AE beyond the scope of the Isenberg's model. In this vein, the author asked the interviewees that "in addition to those mentioned above, are there any other domains or elements you think could help your business grow? These include, but are not limited to government, financial institutions, universities, related businesses, and cultural influencers". This inquiry aimed to identify additional domains or elements that significantly affect AE and integrate them into Isenberg's (2011) model to improve its comprehensiveness. The author incorporated these domains or elements to enhance the model based on insights gathered from the interviews.

The actors that are most frequently cited include successful entrepreneurs, technical experts, and individuals with extensive connections.

Successful entrepreneurs: One of the frequently cited elements is successful entrepreneurs who often act as mentors to most entrepreneurs. These mentors play a crucial role in guiding the business direction and company management while also sharing their network resources with the mentees. In the case of agricultural entrepreneurs, access to networking resources is particularly crucial given that the industry circle is relatively closed. Therefore, entrepreneurs often rely on connectors to

facilitate their entry into the circle. For example, Means Good participated in the HAOSHi accelerator program, and through mentor's networking referrals, they were able to meet the research and development director of a well-known animal feed factory, which led to an opportunity to test their products and ultimately secure an order. Technical experts: According to Green Day Biotech's interviewee, technical experts such as university professors or government research unit researchers are not only familiar with the latest technologies and industry trends, but also have connections with international research organizations and industry experts. They have the potential to introduce contacts to assist with research and development of new products, market promotion, and internationalization development for enterprises.

Network: Means Good and Kindly Eggs' interviewees stated that individuals who possess an extensive network of contacts, particularly those experienced in marketing or holding leadership positions in associations, can significantly aid in the promotion of new products.

People with rich industrial contacts are crucial for SMEs as they can help connect enterprises to the right people, reducing the time and cost required for developing relationships from scratch. Moreover, their introduction of products also serves as an endorsement, while reducing the risk of a new party in choosing products and suppliers. The present study posits that to establish a complete AE model, "connectors" are required to facilitate the linkage between different domains and actors within the ecosystem. However, the "connectors" should not be regarded as a distinct domain or element beyond Isenberg's model, rather they should be seen as an element that plays

a vital supporting role. This support can be in the form of professional assistance provided by lawyers, accountants, technical experts, or consultants.

Furthermore, this study observes that among the six domains, entrepreneurs in Taiwan exhibit a particular emphasis on human resources related elements, recognizing that the ecosystem operates as a network of connections, highlighting the significance of human resources in this regard. In addition to “connectors”, this study identifies a strong sense of “comradeship” among Taiwanese entrepreneurs, fostered by a supportive culture in the government and among the general public. Mentors and advisors are often found providing their support to entrepreneurs beyond their call, even at their own expense. They are willing and eager to share their network resources with them to create more opportunities for collaboration. This culture of support extends beyond Taiwan, as some interviewees attest that their business expanded overseas due to the help provided by friends who had already established a presence in foreign markets.

4.5 Difficulties encountered by agribusiness that need Taiwan’s AE to improve

4.5.1 Difficulties encountered by agribusiness in Taiwan

During the interviews, it was revealed that the Taiwan AE was beneficial for agribusinesses, however, there were certain areas in which its usefulness may be lacking. In order to identify these areas of improvement, questions were asked to ascertain the difficulties faced by the interviewees regarding the AE, even though the current AE provided for the needs of agribusinesses. Addressing these difficulties

would lead to a better functioning AE in the future.

Interestingly, the difficulties encountered by the entrepreneurs were mainly attributed to the government. There appeared to be a gap between what the government does and what entrepreneurs expect from the government. For instance, interviewees faced challenges with the high threshold for qualification certification, low efficiency lack of publicly available agricultural data for market opportunity analysis, and the government's limited support on international market regulations and requirements which are critical for the enterprises to enter the international market. The following are some examples from the interviews:

Means Good's interviewee noted that: "It is time consuming to apply to the government for certification of qualification. At the beginning, we made human health products and wanted to supply to big brand companies, however they needed the enterprise's qualifications, and the certification process took more than a year. I hope the government will speed up the efficiency of certifying the qualification.". In addition, he mentioned that: "Most of our customers are enterprises. One of the approaches to develop the market is to obtain the information of potential customers through the data published by the government, and then promote to them individually. However, the current information is not comprehensive enough."

Balay's interviewee mentioned that: "I hope that the government will strengthen their services pertaining to international market regulations. To enter the international market, we must first clearly understand the regulations of the international market." Nevertheless, it remains a significant challenge for enterprises to acquire the necessary

information and comprehend the regulations of the international market, as well as to link them with the domestic regulations regarding product manufacturing and exporting. Meanwhile, the government possesses the capacity to reach out to the pertinent departments and obtain such information. We expect that the government can take the initiative to understand the regulations of other countries and facilitate introductions with foreign regulators to enable the exportation of enterprises' products to these countries.

Moreover, the respondents have cited with regards to the domains of market and finance. Specifically, impediments in marketing operations stem from policy modifications which precipitate market fluctuations. Additionally, certain offline sales channels entail exorbitant commission rates, further compounded by customers' limited knowledge of newly introduced products. As for financial difficulties, the interviewees noted the arduousness of procuring loans from conventional banking institutions, both for start-up and enterprises at growth stage, thereby necessitating exploration of alternative funding options.

Table 4-11 Difficulties encountered by agricultural enterprises and the suggested solutions

Enterprise	Difficulties and Suggested Solutions
Means Good	1. The provision of government statistics and business registration information, specifically more comprehensive data related to agricultural production, consumption, import and export, and detailed industrial and commercial registration data. It can facilitate enterprises in forecasting market demands and identifying potential customers, thereby reducing the time spent in expanding the market. by conducting in-depth analysis of these aspects, enterprises may discover new industry development and innovated business models. 2. The simplification of the certification application process and the expediting of review procedures by government bodies can streamline the launch of new products and support enterprises in obtaining sales licenses earlier, thus

	providing more time for marketing efforts. 3. The recognition of high-tech agriculture as an agricultural enterprise is critical. High-tech agriculture has the potential to produce high-quality crops in large quantities with lower unit costs and higher profits. However, the current regulations do not recognize such enterprises as agricultural entities, resulting in their inability to obtain the relevant subsidies. Amendments to the regulations to include high-tech agriculture are therefore necessary. 4. Newly established enterprises often face difficulty in obtaining bank loans due to the banks' requirement for information on revenues and profits, and collateral of equivalent value as mortgage. During the start-up stage, most funds are invested in research and business expansion, resulting in low revenues and profits, making it almost impossible to apply for low-interest loans from banks. As a result, equity financing becomes the only feasible option, which may be at the cost of the entrepreneurs' interest.
Yuan Jin Chuang	1. In view of the limited resources of SMEs, simplifying the application and certification processes and relaxing the corresponding restrictions could accelerate their development. 2. Given the wide range of development directions in agriculture and the shortage of personnel with diverse skills, the government could attract foreign talents to fill the gap in demand. 3. A clear understanding of regulations and policies in the targeted markets is crucial for enterprises seeking to enter the international market. Every country has its own unique set of laws and regulations. If the government agencies can analyse the laws and regulations of key markets, interpret them for enterprises seeking to enter these markets, and revise domestic laws and regulations to align with international standards, it will expedite their entry into international markets and allow them to focus more on their products.
Green Day Biotech	It is recommended that the government improve its data collections and industrial databases to enable enterprises to locate potential customers with greater accuracy and efficacy, thus minimizing the need for cold calls and optimizing marketing efforts.
Rolling Green	1. Taiwan should harmonize industry regulations with international standards. for the stringent microbiological certifications exceed those of United States. To attract American companies to Taiwan, the government could align its regulations with those of its American counterparts, thereby facilitating the entry of such companies into Taiwan's market. 2. Taiwan should strengthen international collaboration to adapt to changes in the global market. The COVID-19 epidemic, cross-strait relations, and US-China trade war have caused significant changes in consumer purchasing patterns, material costs, and other related aspects. To mitigate the impact of such changes on businesses engaged in imports and exports, the Taiwan government should strengthen its communication and collaboration with international counterparts.

	This would enable the government to adjust its policies promptly in response to any unforeseen circumstances.
Balay	1. For companies seeking to enter the international market, a thorough understanding of the laws and regulations of the target country is crucial. The government can facilitate this process by conducting more intensive research in this area, thereby enabling companies to comply with international standards and align domestic regulations, accordingly, thus saved time and resources. 2. Enterprises should diversify their market channels to mitigate the impact of shift in a single market. Formerly, China was the primary market; however, the introduction of stricter regulations prevented products from entering. Currently, the enterprise is exploring new markets, and developing new products to address the evolving needs of various markets. 3. In 2014, Taiwan abruptly replaced the long-standing Good Manufacturing Practices global regulations with its own regulations. While well-intentioned, this deviation from established international standards has impeded legal exports of their products.
Rice Valley	In order to enhance product visibility, innovative marketing campaigns and branding initiatives can prove to be effective. Conventional distribution channels tend to have high costs and may be less inclined to collaborate with startups offering new products. To address this challenge, enterprises may opt to establish their own brands, actively participate in various exhibitions and promotional events, and leverage on media marketing to promote their offerings. By adopting, these strategies, enterprises can improve their visibility in the marketplace and potentially drive growth.

4.5.2 Suggestions for improvement

In the course of the interviews conducted for this study, the interviewees were asked to undertake the role as consultants, to identify areas for potential improvement within the Taiwan agricultural ecosystem.

The overarching objective of this approach is to facilitate greater governmental comprehension of the demands of agricultural enterprises, thereby enabling it to play a more integral role in this domain. Notably, a significant proportion of the interviewees articulated a desire for greater policy harmonization between Taiwan and

other countries, particularly with respect to regulations. Given Taiwan's relatively diminutive size and dependence on foreign trade, its enterprises exhibit a strong demand for exporting products to other nations.

The results of these interviews were subsequently compiled and presented in a table, along with recommendations for the development of Taiwan's agricultural ecosystem as below:

Table 4-12 Recommendations from the interviewees to the government

Recommendations to the Government	
Assist enterprises in organizing the import and export policies of foreign nations and facilitate the completion of pertinent certifications.	Aggregate additional data pertaining to the agricultural industry and disseminate it, given that numerous agribusinesses necessitate such information to analyze the geographic distribution of their customer base.
Reduce the threshold for product certification and align national standards with international standards to facilitate a more streamlined export process for enterprises.	Furnish price subsidies, offer tax incentives, and institute supporting policies for agricultural products to procure them in suitable quantities, thereby mitigating losses for agribusinesses attributable to production and marketing imbalances.
Emphasize the cultivation of a favourable agricultural production culture, rather than rather than relying primarily on financial support to bolster start-ups.	Aid agricultural enterprises in enhancing their product offerings and support them in educating consumers and expanding their market reach.
Agricultural policies ought to be formulated with the comprehensive participation of farmers, rather than being cantered solely around municipality.	Stimulate innovation in agricultural products to circumvent the agricultural industry from becoming overly saturated.

Chapter 5 Discussion

This chapter will examine the implications arising from the findings in chapter 4 and put forth recommendations, within the context of two primary development goals, namely urban agriculture and agricultural food, as a reference for Singapore in its development of agribusiness ecosystems. This study also aims to serve as a reference for future research endeavours in this field.

5.1 Implications from findings

This study identifies three implications which can be drawn from the findings. The first implication suggests that Singapore could potentially adopt Isenberg's (2011) model in the development of its AE. This model was found to be effective in Taiwan's AE, where its various domains facilitate the growth of the industry and allowed for a systematic evaluation of the necessary components in an agribusiness ecosystem.

The second implication of this study highlights the significance of individuals who established connections between different domains within the AE. While Isenberg's (2011) model identified six domains as critical components, his 2016 model added the concept of six actors corresponding to the six domains. However, this study's interviews revealed the importance of individuals who act as "connectors" between the elements in different domain, which constitutes a novel addition to Isenberg's model (2011, 2016). When we prompted to identify other elements with a substantial impact on AE, the interviewees consistently emphasized the importance of these connectors", who play a crucial role in bridging the various domains and elements within such

system.

The third implication Drawn from this study highlights the necessity of contextualizing. Isenberg's model (2011, 2016) before its application to any particular AE. While Isenberg's model (2011, 2016) may present a generic approach, the case of Taiwan's AE illustrates that the development of any ecosystem must be contextualized according to regional and local environments. Scholars have long recognized that local economic conditions play a significant role in promoting new business creation and the growth and development of SMEs (Tan et al., 2000). Researchers have sought to explain why some discrete geographic areas produce greater degrees of economic activity than others (Arrow,1971). Local economic development typically refers to the promotion of economic growth and activity within a specific geographic region. Furthermore, culture elements and entrepreneurship have been identified as critical factors with a direct and substantial impact on the economic quality of life within distinct geographic areas (Morris and Lewis ,1991). Thus, Isenberg's model must be contextualized before its application to any specific agribusiness ecosystem.

5.1.1 Contextualization of Isenberg's domains for AE in Singapore

Given that regional and local environments are recognized as significant factors in stimulating new business creation and the growth and development of SMEs, the contextualization of Isenberg's model (2011) could be undertaken from two perspectives. First, geographic location should be taken into account. Second, industry-specific factors should be considered. The author suggests that prior to applying Isenberg's model in Singapore, the model should undergo both industrial and

geographical contextualization.

(1) Industrial contextualization

Based on the interview, the research has identified distinct characteristics of agriculture. Agriculture is a primary industry that ensures the country's economic and livelihood security, thus prompting governments to implement various policies to support it. As an industry with dual risks of business and natural hazards, agriculture faces more challenges in obtaining financial support from institutions compared to other industries (Ramaswami, 2003). Agriculture operates within a relatively closed market, which relies heavily on networks to expand its market reach. Beerli and Martin (2004) also highlight that infrastructure can be categorized as general or industry-specific, with unique infrastructure needs for each industry. Consequently, the concept of an ecological system varies across industries, and geographic location is also a crucial factor to consider the research has developed an agricultural ecosystem model based on Isenberg's model. The Taiwanese government places particular emphasis on improving agricultural technology, cultivating talent, and supporting farmers financially in promoting agricultural development. These are further elaborate as follows:

First, improving agricultural technology: The Council of Agriculture has established an agricultural research and extension stations and agricultural research institutes (under the government's research institutes element in the policy domain). The agricultural research institutes focus on regional crop and silkworm breeding, biotechnology application, and research on improving agricultural product quality

testing and processing. The agricultural research institutes are tasked with improving crop cultivation methods, crop varieties, and agricultural machinery and facility design.

Second, developing human capital: The establishment of agricultural colleges at National Taiwan University, National Chung Hsing University, National Pingtung University of Science and Technology, National Ilan University, and National Chiayi University provides comprehensive training for industry talent in agriculture, forestry, fishery, and animal husbandry (under educational institutions in the human capital domain).

Third, supporting farmers financially: The Council of Agriculture has set up agricultural and fishery associations to provide assistance to farmers and fishers. This includes credit loans (under finance in the finance domain), agricultural subsidies (under government in the policy domain), and agricultural product promotion (under markets in the markets domain).

This study was contextualized to Taiwan's circumstances. However, Singapore's agricultural ecosystem is still in the developmental stage and is not as comprehensive as Taiwan's. It is essential to contextualize the model as replicating the practices implemented in Taiwan may not be applicable to Singapore due to the differing local conditions and necessary institutions.

Due to the scarcity of land in Singapore, the country is not able to pursue agriculture to the same extent as Taiwan but has instead chosen to focus on the development of urban farming. In response to issues such as extreme weather

conditions and food shortages, alternative protein and related products are a major focus of Singapore's agrifood industry. Therefore, when implementing the AE model in Singapore, it is necessary to further contextualize and tailor it to the specific conditions and needs of the country.

(2) Geographical contextualization

As discussed earlier, regional, and local environments are important factors in stimulating new business creation and the growth and development of SMEs (Tan et al., 2000). Entrepreneurship and cultural elements have been identified as having a direct and significant impact on the economy within specific geographic areas (Morris and Lewis ,1991).

Due to scarcity of land, Singapore is only suitable for urban agriculture development, and has launched the 30x30 initiative to increase its food self-sufficiency rate. These conditions differ from those in Taiwan, highlighting the need for geographical contextualization.

Although Taiwan and Singapore are both Southeast Asian islands, they have some cultural differences. Cultural difference can include differences in lifestyles, thoughts, attitudes, language, behaviour, institutions, and power structures (Jones and Richard,2006). For example, Taiwan embraces Confucian culture, which emphasizes compassion, respect, and mutual support among individuals. In contrast, Singapore is heavily influenced by British capitalism, which may limit the spirit of mutual support among individuals compared to Taiwan due to a more westernized culture. It is important to note that the culture of sharing and proclivity towards mutual help is

crucial for agricultural businesses, especially SMEs and start-ups, which relies heavily on information and referrals from acquaintances to enter the relatively closed circle of agriculture. This Taiwan's culture may have contributed significantly to its AE's success. Singapore may consider building up similar culture.

5.1.2 The human element in the ecosystem

In the ecosystem of entrepreneurship, the role of human interaction is crucial. Isenberg has identified six domains in an ecosystem: policy, finance, culture, supports, human capital and markets. However, simply creating departments and organizations based on this model may not be workable. The AE model is not just a structure, but a living ecology, that requires interaction between the different domains to be effective. During interviews conducted for this study, interviewees emphasized the importance of certain individuals who are instrumental in their success. Interestingly, these individuals often played non-traditional roles within the ecosystem. The interviews revealed two key aspects: 1) the importance of individuals who go beyond their immediate roles in connecting with the different elements in the ecosystem (AE connectors); 2) the importance of individuals who have the ability to understand the specific needs of enterprises (AE need attentiveness)

(1) AE connectors

This study introduces "AE connectors" to refer to individuals who bridge the elements of the different domains. The concept of entrepreneurial ecosystem draws upon the natural ecosystem, in which the existence of organisms depends on the mutual influence and restriction between them and their environment, leading to an interactive

relationship (Feld and Brad,2012). Isenberg's model (2016) only considers the actors of domains within the entrepreneurial ecosystem and may have understated the importance of individuals who can connect or link with the different elements. The domains in AE are separated by space and time, creating gaps that need to be bridged by connectors. The theory of structural holes (Burt, 2003) was developed to explain this phenomenon and later evolved into a social network theory. In order to reduce gaps between individuals or groups, bridges, brokers or boundary spanners have emerged, who facilitate transactions and the information flow between the individuals or group.

The individuals who act as bridges between domains within the AE can be referred to as connectors. Thus, the AE requires connectors to operate as a living ecology. For instance, if the different elements of domains, such as Trade Association, University, government agency and financial institutions, do not interact with each other or work independently, entrepreneurs must approach each element individually and start cultivating relationships from scratch if they lack prior contacts within each domain. However, if connectors exist who can link the entrepreneurs with the different elements, the process will be more efficient and effective.

The importance of relationships in AE can be attributed to three reasons. Firstly, SMEs are associated with high risk, and partners need to be endorsed through relationships. Secondly, the agricultural practitioners' circle is relatively closed, and enterprises rely on relationships for entry. Lastly, relationships constitute the essence of the ecosystem, and are therefore regarded as the logical starting point for ecosystem formation, according to Brown et al. (2020), who argues that relationships should be

the meta-theory of ecosystems.

The role of connectors is usually performed by members of support institutes, such as associations, industry organizations, and intermediaries. For instance, governments provide agricultural enterprises with awards that they can apply for. However, since awarding is not a frequent occurrence, government staff often lack the knowledge on how to set up and publicize the awards, and a lot of workforces is required during the application and selection processes. Hence, professional support organizations could help the government formulate plans for the publicity and selection of awards, collect application materials, and hire experts for evaluation and selection, thereby saving time for government staff and enhancing project effects.

For enterprises, award application is an infrequent event, and enterprises often do not know how to handle the application process to increase the probability of winning. Furthermore, it takes a lot of time to understand and follow the application process, which discourages some enterprises from applying for government awards. Similarly, applying for bank loans or angel investments is also challenging for SMEs, as rules are complex and document preparation is time-consuming. Thus, expert intermediaries and supporting organizations are critical in assisting SMEs with navigating these complex procedures.

Connectors may also play an important role in facilitating information exchange, resource complementation, and synergy development between different elements of the ecosystem. By linking the elements of the ecosystem, connectors reduce detours or wasted resources, and hence are strongly needed to ensure the optimal functioning of

AE.

Likewise, Singapore can develop its AE by setting up relevant departments and encouraging them to interact and influence one another for an interactive relationship. The role of connectors is crucial in facilitating these ties between departments, and building a digital social platform could be a potential strategy for connecting individuals and organizations in the AE.

(2) AE need Attentiveness

The AE is not simply a structure of various domains and elements, but a living ecology that requires attentiveness in addition to connectors to thrive. Attentiveness refers to individuals who are sensitive to the needs of agribusinesses.

Throughout the phases of growth, ranging from start-up to maturity, agribusinesses face a series of unique challenges, each requiring targeted solutions and innovative breakthroughs. To effectively address these challenges, attentiveness is essential in identifying potential partners within the AE who can provide necessary resources to achieve the desired outcomes. The subsequent discussion outlines the specific obstacles that agribusinesses encounter during each growth stage.

In most cases, agribusinesses initiate operations with a distinctive technology or innovative service that requires validation for its commercial viability. During the growth phase, agribusinesses must address a range of challenges, including expanding products range, upgrading technology to compete in the market, generating revenue through marketing, and ensuring long-term sustainability. For enterprises that continue to progress, further development stages, such as international marketing, globalization,

and internationalization, present unique and diverse obstacles. To navigate these challenges, attentiveness is essential at each stage of growth, facilitating the identification of key partners and innovative solutions to address specific issues.

5.2 Recommendations for AE development in Singapore

Based on the strengths and weaknesses in Taiwan's agroecosystem, this paper proposes two recommendations with reference to Singapore's agricultural policies and competitive advantage.

(1) Create a good agricultural culture

Taiwan has a rich history of agricultural production, which is considered the most critical industry for sustaining human existence and national stability. The deeply ingrained belief that "farming is honourable" has become a fundamental part of Taiwanese culture. In 2021, the Taiwanese agricultural sector published a book titled *Transforming 100 Farmers into Outstanding Agricultural Entrepreneurs* which presented 100 successful cases of agricultural businesses and their inspiring stories of success. The book aims to inspire and encourage more young people to return to rural areas and engage in agricultural work by sharing these entrepreneurial experiences. Singapore may use this as a reference to build its culture.

In recent years, Singapore has shifted its focus from commercial development to promoting urban agriculture. However, building a culture that values agriculture will be a long-term process that should start with education. It should also involve promoting food and agriculture education, food safety awareness, and arranging opportunities for students to explore agricultural careers and visit successful

agricultural enterprises from various perspectives.

With regard to food and agriculture education, the term "food" refers to the understanding of agricultural food and the increasing awareness of agricultural environments. For Singapore to revitalize agriculture, food and agriculture education should be integrated into everyday life as a life skill. This involves learning nutrition knowledge and developing dietary culture, which are essential components. Food and agriculture education should not only start from school education but also include family education. If everyone has the opportunity to receive food and agriculture education from a young age and experience it in an educational environment, it will become a lifelong learning experience.

Another area of focus should be food safety. Food safety is a fundamental requirement for human survival. When food becomes a commodity, it is crucial to uphold its original value. Choosing nutritious food also supports environmental sustainability. Therefore, it is imperative to implement food safety education in daily life.

Singapore would also need to build up talent pool. Agricultural career exploration could encourage students to visit farms and fisheries and explore potential career opportunities in the agricultural industry. By understanding the capabilities required in the future workplace, Singapore needs to cultivate a new generation of agricultural operators.

（2）Build Strong Agricultural support

Taiwan has provided a variety of infrastructure to support agricultural

development and invested resources to encourage innovation and entrepreneurship. The "Entrepreneurship Platform," established by the Ministry of Economic Affairs for SMEs, serves as an integrated platform for consolidating entrepreneurial resources from central to local governments and private sectors. Moreover, there are many non-governmental organizations (NGOs) in Taiwan that support agricultural development. Vertical and horizontal accelerators both support the development of new type of agribusiness that has an international perspective and innovative thinking, hence stimulating local food and agricultural innovation, and accelerating the development of start-ups. Singapore may consider setting up such platforms to support its AE.

Singapore, as a business hub of Asia, boasts ample support professions, a well-established entrepreneurship infrastructure, and non-governmental institutions. With the existing framework, and by intensifying its efforts on the two critical domains of "urban agriculture" and "high-value Agrifood" in its agricultural development, Singapore can expect to attain significant outcomes over an extended period.

5.3 Limitations and future research directions

This study employs an ecosystem logic to explore the diverse domains and characteristics of relationships that exist within the agricultural ecosystem and reconstructs an agricultural ecosystem model by drawing on social capital theory and other relevant theories. Through in-depth interviews with the founders of nine SMEs in Taiwan, this study finds that the enterprise-centric agricultural ecosystem comprises hierarchies of interactions among individual, group factors, and community factors, and their relationships with the domains and elements in the ecosystem.

By analysing the functional and structural dimensions of the ecosystem, this study aims to provide theoretical reference for the construction of agribusiness ecosystems in Singapore, and to offer a more powerful theoretical explanation for the functioning laws and functional emergence of the ecosystem. However, this study has certain limitations, and future research may consider conducting interviews with other elements in the ecosystem, both in Taiwan and Singapore to verify and supplement the findings of this research.

This study posits that in order to ensure sustainable, attention should be directed towards the core of the agricultural ecosystem, and agribusiness are best positioned to benefit from the ecosystem. They process the motivation and financial resources to establish and sustain the ecosystem despite inadequate funding.

Consequently, this study focuses on conducting in-depth interviews with only nine founders of agricultural enterprises to gain insights into the roles of the different elements in the ecosystem. This study specifically approaches enterprises with more than twenty years of experience as they have a nuanced understanding of the ecosystem's elements' function. However, the inherent biases and perspectives of each actor make it challenging to provide a comprehensive and objective account. Hence, future research should conduct interviews with more enterprises and other elements in the ecosystem to validate and complement this study's findings.

Secondly, interviews with the various elements in Singapore's agroecosystem should be conducted to determine whether Taiwan's successful agricultural development experience can be replicated in Singapore. It is important to recognize that

different countries possess diverse systems, economies and cultures for example, which may affect the applicability of the Taiwanese model in Singapore. Future research could c investigate the applicability and suitability of the Taiwanese agricultural structure in the Singaporean agroecosystem by conducting interviews with the ecosystem's elements.

Thirdly, this study mainly relied on in-depth interviews to derive empirical conclusions. Although these interviews provided valuable insights, further research could use large-scale surveys and other methods to ensure the study's generalizability. Further research could also investigate the co-relationship between the ecosystem's elements.

5.4 Conclusion

Singapore has set a goal to enhance its food self-sufficiency rate through the "30/30 vision" initiative, which aims to fulfil 30% of its residents' nutritional needs with locally produced food by 2030.

This study provides evidence that Isenberg's Entrepreneurial Ecosystem (EE) model is applicable to Taiwan's agricultural ecosystem (AE) and reveals that connectors, which facilitate interactions and close relationships between enterprises and various domains, are a crucial component of the ecosystem.

This study presents an analysis of the positive and negative aspects of the Taiwan's agricultural ecosystem and provide as a reference for Singapore to enhance its agribusiness ecosystem.

Singapore is the hub of the ASEAN market and the financial and trading centre of Asia. It also serves as a Launchpad for Asian enterprises to expand into Europe and America, and as the headquarters for European and American companies to enter Asia. Apart from developing an agricultural ecosystem within Singapore, this study suggests that the key findings “AE connectors” and “AE need attentiveness” can be applied by engaging Singapore experts to serve as Asian AE connectors and attentiveness. These experts can facilitate the expansion of agricultural enterprises in other Asian countries, enable Asian agricultural enterprises to access Europe and America, and accelerate the entry of European and American agricultural enterprises into Asia. In this way, Singapore will play a crucial role in the global AE ecosystem.

References

[1]. Arrow, K. J. . (1971). The economic implications of learning by doing. Review of Economic Studies, 29(3), 155-173.

[2]. Bao S. G. & Feng X. Y. (2021). The current situations, problems and improvements of agricultural infrastructure investment. *Rural Finance Research* (8), 8.

[3]. Beerli, A., & Martín, J.D. (2004). Factors influencing destination image - sciencedirect. *Annals of Tourism Research*, 31(3), 657-681.

[4]. Bennett, D. L. (2019). Infrastructure investments and entrepreneurial dynamism in the U.S. *Journal of Business Venturing*, 34.

[5]. Bingham, & Richard, D. . Theories of Local Economic Development. Sage Publications.

[6]. Birley, S., & Westhead, P. (1993). The owner-managers exit route.

[7]. Burt, R. . (2003). The Social Structure of Competition.

[8]. Braithwaite, J. . (2006). An empirical assessment of social structural and cultural change in clinical directorates. Health Care Analysis, 14(4), 185-193.

[9]. Cai Y. L. & Smit. B. (1995). Sustainable agriculture and its situations in China. *Acta Geographica Sinica*.

[10]. Cai Y. L. (1994). Current situations and future adjustment of land resources utilization in Hainan Island. *Remote Sensing for Land Resources* (4), 8.

[11]. Chen W. K., & Lin H. C. (2000). Agricultural infrastructure and sustainable development. *China Rural Survey* (1), 13.

[12]. Chen Y. J, Hai X. Q., & Shi Y. (2022). Comprehensive evaluation of agricultural sustainable development in Gansu Province—A case study of high-

quality agricultural development. *Territory & Natural Resources Study* (6), 5.

[13]. Choo, S., & Wong, M. (2006). Entrepreneurial intention: triggers and barriers to new venture creations in Singapore. *Singapore Management Review*, 28(2), 47-64.

Churchill, N. C. , & Lewis, V. L. . (1984). Lessons for small business from the recession.

[14]. Drucker. P. F. (1985). The discipline of innovation. Excellence Cultural Enterprise Co., Ltd.

[15]. éamonn, D'Arcy, &, Bruno, & Guissani. (1996). Local economic development: changing the parameters?. Entrepreneurship & Regional Development.

[16]. Feld, & Brad. (2012). Startup communities: building an entrepreneurial ecosystem in your city, custom edition. , 10.1002/9781119204459, i-xviii.

[17]. Feng C. H. (2021). Research on the evaluation of agricultural sustainable development in Northwest China based on water resources carrying capacity. Xi'an University of Technology.

[18]. Gnyawali, D. R., & Fogel, D. S. (1994). Environments for entrepreneurship development: key dimensions and research implications. *Entrepreneurship Theory and Practice*, 18(4), 43-62.

[19]. Gomiero, T., Paoletti, M. G., & Pimentel, D. (2010). Biofuels: efficiency, ethics, and limits to human appropriation of ecosystem services. *Journal of Agricultural and Environmental Ethics.*

[20]. Gourlay, S. A. , Ambrosio, G. , Andreev, N. , Anerella, M. , Barzi, E. , & Bossert, R. , et al. (2008). Magnet r&d for the us lhc accelerator research

program (larp). IEEE Transactions on Applied Superconductivity, 16(2), 324-327.

[21]. Gro, Harlem, & Brundtland. (1987). Our common future—call for action. *Environmental Conservation*, 14(4), 291-294.

[22]. Gupta, D. (1994). Gibb, AA, 'Key Factors in the Design of Policy Support for the Small and Medium Enterprise (SME) Development Process: An Overview', *Entrepreneurship and Regional Development*, vol. 5, no. 1 (January-March 1993), pp. 1-24.

[23]. H., Van, De, & Ven. (1993). The development of an infrastructure for entrepreneurship. *Journal of Business Venturing*.

[24]. Hu S. W., Mi C. H., Shi R. G., & Yang Y. Y. (2022). Research hotspots and trends of agricultural sustainable development—a bibliometrics-based visual analysis. *Agro-Environment and Development* (001), 000.

[25]. Hwang, Y. C. , Hwang, Y. C. , & Su, C. H. . (2008). Experience Co-Creation on Ubiquitous Cultural e-Service Provision: A Case of Taiwan's Hakka Culture. Fourth International Conference on Networked Computing & Advanced Information Management. IEEE Computer Society.

[26]. Jeffrey, B. . (2010). Between-group behaviour in health care: gaps, edges, boundaries, disconnections, weak ties, spaces and holes. a systematic review. BMC Health Services Research, 10(1), 330.

[27]. Jiao J. P. (2019). Analysis of factors influencing agricultural sustainable development based on structural equation modeling. *Statistics and Decision* (6), 3.

[28]. Jones, & Richard, C. . (2006). Cultural diversity in a "bi-cultural" city: factors in the location of ancestry groups in san antonio. Journal of Cultural Geography, 23(2), 33-69.

[29]. Isenberg, D., & Onyema, V. (2016). Fostering scaleup ecosystems for regional economic growth (innovations case narrative: manizales-mas and scale up milwaukee)

[30]. Isenberg, D. (2011). The entrepreneurship ecosystem strategy as a new paradigm for economic policy.

[31]. Isenberg, D. J. (2010). How to start an entrepreneurial revolution. *Harvard Business Review* (6), 88.

[32]. Li Z. Q., Ye W. J., Mei D., & Zheng C. W. (2022). The impact of agricultural infrastructure on total factor productivity of food ecology from the perspective of environmental regulation. *Chinese Journal of Eco-Agriculture*, 30 (11), 15.

[33]. Liu H. L. (2019). Agricultural irrigation patterns and water-saving technical measures.

[34]. Liu H. L. (2021). Research on the evaluation of regional agricultural sustainable development integrating geographical indications. Gannan Normal University.

[35]. Liu X. H., & Ren T. Z. (1995). Research on the index system of China's agricultural modernization and sustainability. *Research on Agricultural Modernization*, 016(005), 287-291.

[36]. Liu Y. Z. (1998). Constructing an evaluation index system for China's sustainable agricultural development. *Beijing Statistics* (06), 9-10.

[37]. Love, G., & Clark, J. (1990). 1990 US Farm Bill: directions for grains. *Agriculture & Resources Quarterly*, 157-165.

[38]. Lucas, R. E. , Lupton, B. , & Mathieson, H. . (2007). Human resource management in an international context. Journal of the Less Common Metals.

[39]. Lux, A. A., Flávio Romero Macau, & Brown, K. A. (2020). Putting the entrepreneur back into entrepreneurial ecosystems. *International Journal of Entrepreneurial Behavior & Research.*

[40]. Mason, P. C., & Brown, D. R. (2014). 'Entrepreneurial ecosystems and growth-oriented entrepreneurship', background paper for workshop.

[41]. Miao J. Q., Yang W. T., & Huang G. Q. (2016). Research on the development of agricultural mechanization in southern hilly areas—A case study of Yugan County, Jiangxi Province. *Journal of Agricultural Mechanization Research* (4), 5.

[42]. Miao J. Q., Zhao M., & Huang G. Q. (2021). Comprehensive evaluation and empirical analysis of agricultural sustainable development in southern hilly and mountainous areas. *Chinese Journal of Agricultural Resources and Regional Planning*, 042 (008), 163-172.

[43]. Miller, D. , & Friesen, P. H. . (1984). A longitudinal study of the corporate life cycle. Management Science, 30(10), 1161-1183.

[44]. Morris, M. H. , & Lewis, P. S. . (1991). Entrepreneurship as a significant factor in societal quality of life. Journal of Business Research, 23(1), 21-36.

[45]. Per, & Davidsson. (1991). Continued entrepreneurship: ability, need, and opportunity as determinants of small firm growth. *Journal of Business Venturing.*

[46]. Porter, M. E. (1980). Competitive strategy: techniques for analyzing industries and competitors (republished with a new introduction). Free Press.

[47]. Ramaswami, B. , Ravi, S. , & Chopra, S. D. . (2003). Risk management in agriculture. Indian Statistical Institute, Planning Unit, New Delhi Discussion Papers(10), 1577.

[48]. Reynolds, P., Storey, D. J., & Westhead, P. (1994). Regional variations in new firm formation. *Regional Studies*, 28(4), 343-456.

[49]. Ring, P. S., & Ven, A. (1994). Development processes of inter-organizational relationships.

[50]. Rm, C., & Despain, A. Reviews of Free Ebooks Download 860: Searches.

[51]. Ryszkowski, L. (2002). Landscape ecology in agriecosystems management lech ryszkowski. CRC Press.

[52]. Say. (2009). Introduction to Political Economy. Commercial Press.

[53]. Schultz, E. B. . (1997). Modeling HRM in context: Examining the role of human resource manager discretion. (Doctoral dissertation, Louisiana State University and Agricultural & Mechanical College.).

[54]. Simpson, P. G., McLaughlin, M. J., Weatherley, A. J., Sale, P. W. G., Hoy, V., & Lancaster, P. (1997). Assessment of soil phosphorus tests for situations in Australia where reactive phosphate rock and water-soluble phosphorus fertilizers are used. *Australian Journal of Experimental Agriculture*, 37(8), 1027-1035.

[55]. Smallbone, D., North, D., & Leigh, R. (2006). The use of external assistance by mature SMEs in the UK: some policy implications. *Entrepreneurship and Regional Development*.

[56]. Smith, C. S., & Mcdonald, G. T. (1998). Assessing the sustainability of agriculture at the planning stage. *Journal of Environmental Management*, 52(1).

[57]. Smith, C. S., & McDonald, G. T. (1998). Assessing the sustainability of

agriculture at the planning stage. *Journal of Environmental Management*, 52(1), 15-37.

[58]. Soc, B. P. T. R., & Pretty, J. (2008). Agricultural sustainability: concepts, principles and evidence. *Philosophical Transactions of the Royal Society of London*.

[59]. Specht, P. H. (1993). Munificence and carrying capacity of the environment and organization formation. *Entrepreneurship: Theory and Practice*, 17(2), 77

[60]. Specht, J. J. (1993). Compound archery bow having a carrying adaptor mounted thereon.

[61]. Stam, E. (2015). Entrepreneurial ecosystems and regional policy: a sympathetic critique. *European Planning Studies*.

[62]. Tan, T. M., Tan, W. L., & Young, J. E. (2000). Entrepreneurial infrastructure in Singapore: Developing a model and mapping participation. *The Journal of Entrepreneurship*, 9(1), 1-33.

[63]. Tsai, M. H., Macmillan, I. C., & Low, M. B. (1991). Effects of strategy and environment on corporate venture success in industrial markets. *Journal of Business Venturing*, Elsevier, vol. 6(1).

[64]. Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2017). A review of the ecosystem concept—towards coherent ecosystem design. *Technological Forecasting and Social Change* 136(1)

[65]. Varela, C., Daniel, A., Strauss, C., & Riquelme, P. S. (2001). Global entrepreneurship monitor. Social Science Electronic Publishing.

[66]. Wang H. G. (1993). On the obstacles, laws and countermeasures of China's sustainable agricultural development. *Eco-Agriculture Research*, 1(2), 31-39.

[67]. Wang Y., Zhao Y. N., & Huang Y. (2022). Evaluation of Guizhou's sustainable agricultural development based on entropy value method. *Territory & Natural Resources Study* (1), 3.

[68]. Westbrook, B. M. . (2005). Rethinking clinical organisational structures: an attitude survey of doctors, nurses and allied health staff in clinical directorates. Journal of Health Services Research & Policy, 10(1), 10-7.

[69]. Wood, M. (1998). Donckels R., & Lambrecht J. (1997), The network position of small businesses: an explanatory model, *Journal of Small Business Management*.

[70]. Wu G. Q. (2001). Ecological security and evaluation analysis of regional sustainable agricultural development. *Ecological Economy* (8), 4.

[71]. Wu G. Q. (2001). Ecological security and evaluation analysis of regional sustainable agricultural development. *Journal of Natural Resources*, 16(3), 7.

[72]. Yin C. B., Cheng L. L., Yang X. M., & Zhao J. W. (2015). Path selection of agricultural sustainable development based on ecological civilization. *Chinese Journal of Agricultural Resources and Regional Planning*, 36(1), 7.

[73]. Yu B. H., & Lv C. H. (2004). Macroscopic analysis of agricultural sustainable development under the DPSIR framework. *Chinese Journal of Population, Resources and Environment*, 14(5), 5.

[74]. Zhou B. (2015). Research on factors affecting food security in China from the perspective of agricultural sustainable development. Shenyang: Shenyang

Agricultural University.

[75]. Zeng F. S, & Li F. (2015). Estimation of the cost-saving effect of agricultural infrastructure on grain production—a case study of seemingly unrelated regressions (SUR). *Chinese Rural Economy* (6), 10.