Intelligent Exchange Mechanism of Agriculture Sector for Sustainable Economic Transaction Development in Pathum Thani, Thailand

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Abstract. Pathumthani Province is on fertile plains and river valleys offering suitable land for agriculture. In 2019, a large number of agricultural lands, particularly farmland, is accounted for over 40 percent of the total province. However, the revenue of the agricultural sector contributes less than 3 percent of the gross provincial product (GPP), while the industrial sector becomes a major economic-based activity of this province, accounting for half of the GPP revenue. This research seeks an opportunity to enhance economic values and optimize the efficiency of agricultural-related supply chains. The research aims 1) to assess the need assessment of the agricultural sector in the issue of an intelligent exchange for sustainable economic transaction development, 2) to map a relationship between current situations of the agricultural sector and the commercial sector. Through the process of focus group and in-depth interview, the result of this study demonstrated the potential and current problems include the need to exchange agricultural goods/resources. The results could allow for an enhancement of the exchange of goods, especially agricultural products, to increase the potential of connectivity between producers and consumers in Pathumthani.

1. Introduction
The urban growth and city population are growing at a fast pace causing different dynamic issues to the environment, economic and social sustainability of cities [1]. Recently, Bangkok and its vicinities have been growing and become a megacity. With this overwhelming situation of growth in the country, when the consideration is taken for the metropolitan areas, it was found that the growth has expanded due to continuous migration, far beyond its traditional jurisdictional boundaries. It was also known as greater Bangkok as of the high speed in the growth of urban area further than the boundary of its surrounding which includes 5 adjacent provinces; Nonthaburi, Samutprakan, Pathumthani, Samutsakhon, and Nakhonpathoms[2]. Pathumthani Province is part of the Bangkok Metropolitan Region (BMR). In the past, agriculture was the main economic-based activity; however, since the 1960s, significant numbers of agricultural land have transformed into residential areas, commercial districts, and industrial estates. Pathumthani Province has dramatically promoted itself as a zone for industrial estates as well as an education zone where more than 11 higher education institutes are located[3]. Pathumthani area has convenient access. Affect the development of the industry. This can be seen as the location of many...
large industrial estates, causing large employment. This is beneficial for jobs-housing balance[4]. In the last decades, the expansion of rapid urbanization has transformed the province to become an alternative residential area for the metropolitans. Currently, approximately 25 percent of the population in the BMR resides in Pathumthani [5].

The transformed Pathumthani Province contributes to rapid economic growth and land-use changes as well as de-promoting the value of land that is suitable for agricultural purposes. During 2014 – 2018, the gross provincial product (GPP) of Pathumthani Province had a growth rate of 3.8 percent, which is relatively lower than the average growth of the nation (at 4.2 percent) [6]. Focusing on the data in 2018, Pathumthani's GPP was 403,797 million baht, ranked sixth in the country. In this year, more than 90 percent of the GPP was based on the industrial sector (53.4 percent) and the service sector (44.9 percent), while the agricultural sector contributed less than 2 percent of the GPP. The gross province product per capita of the province in 2018 was 233,593 baht, ranked 12th in Thailand, considering Pathumthani's GPP and per capita income relatively high compared to other provinces [7].

Figure 1. Gross Product Value of Pathumthani Province between 1995-2018

The GPP corresponds to the percentage of occupation classified by sectors; 95.4 percent engaged in the industrial sector, and 4.6 percent engaged in the agricultural sector [8]. The evolvement of industrialization in Pathumthani has been triggered by 'the Cluster Policy' that prioritizes the province as the industrial field automotive and parts cluster, electrical appliances, and electronics and telecommunication equipment Cluster. The industry clusters are set to promote the spatial concentration of relative industries in order to pool infrastructure and service together. This sharing will substantially boost the level of support and cooperation in all facets of the business in order to strengthen the industrial value chain, which will enhance Thailand's investment potentials and competitiveness and expand socioeconomic development to regional and local levels [9]. As a result, the industrial sector of Pathumthani Province is quite efficient and has a high competitive potential. There is a disproportionate amount of land use and provincial revenue. Even though agriculture contributes less than 2 percent of the GPP, this sector covers over 36 percent of the land usages of the province. Most cropland devotes to growing rice, fruit, and vegetable crops [10]. Nevertheless, the agricultural sector has been facing a decline. The land area of agricultural usages dropped more than 50 percent during the period between 2015 to 2019 (Figure 2) [11]. It is assumed that the major cause of this phenomenon has been triggered by an increased land price and the prosperity of real estate development, which has turned farms into gated communities.
This was evident from the nationwide condominium registrations in 2018; as shown in Figure 3, there was a significant recovery of 42% from the previous year. A positive 63.5% (Figure 3) shows that Pathum Thani Province is one of 11 provinces with potential for real estate sector expansion. Therefore, the development of the land-use model in Pathumthani Province has resulted in the process of urbanization and leapfrog development. It is a result of the terrain and the advantage of the location near Bangkok and availability in terms of land, rail, and water transport networks. This has changed the use of land that was formerly farmland to become an industrial factory, wholesale and residential areas.

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![Figure 2. The proportion of land use in Pathum Thani between 2015-2019](image-url)
industrial demand-supply chain system, including the development of real estate transaction models and more efficient land use database organization.

Therefore, this research is aimed to assess the need assessment of the community in the issue of an intelligent exchange for sustainable economic transaction development and to develop a model for the creation of mechanisms/tool designs that enable the exchange of goods or resources in transactions and economic activities. Through the process of focus group and in-depth interview, the result of this study demonstrated the potential and current problems include the need to exchange agricultural goods/resources. And design mechanisms for the development of sustainable economic transactions using the Driver-Pressure-State-Impact-Response (DPSIR) framework. This framework was developed and proposed by the Organization of Economic Co-operation and Development (OECD) [8] in order to illustrate cause-effect relationships between environment and human systems and to guide decision-makers on the environmental issue. This study adopts DPSIR to illustrate the cause-effect relations among the potential diving forces, pressures that agriculture faces, the state of the environment change, and the consequent impacts (socioeconomic environment). This may lead to a societal response to restore the lost equilibrium, which can be proactively or reactively depending on the resilience of the stakeholders and systems.

2. Literature review

2.1. Smart economy

The definitions and perspectives of the smart economy are quite different and varied according to the context of economic development and the potential of the area. Yann Le Floch has defined a smart economy as an economy using smart money & smart payment tools, to modify the classical way for an economic system to operate. The smart economy can change the traditional way to define, a payment, a price, a tax rate, a yield, an interest rate, fix rate, parameter investment rules, parameter financing rules, parameter growth definition, and thus create a global economy managed by programmable rules defined by democracy, collective intelligence, or centralized power (democratic or authoritarian). The programmable economy uses the development of new technologies, especially smart contracts, blockchain, artificial intelligence, internet of things, to develop new social & natural contracts between the money users, humanity, and balancing rules on other parameters, which were exogenous to a traditional economic definition. "Smart Economy is like an atom, can save or can kill" [12].

Thus, the definition of a smart economy can be coined via a democratic and/or non-democratic lens, which makes the definition and the quality of this term are slightly different from one another. A democratic approach is seemingly the best way to embrace public interest. Bakici claimed that a smart economy involves the establishment of innovation clusters and mutual cooperation between enterprises, research institutions, and the citizens in order to develop, implement, and promote innovation through
these networks [13]. Anttiroiko highlights that the importance of a smart economy in developing new cooperation models in production, distribution, and consumption. On the other hand, the concept of smart economy is used as sustainable development with such definitions as "green economy," "green industry" used for describing the effective modern economy. UNEP defines a green economy as one of the factors that result in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." The UN Environment Program shows that the "green" economy becomes a new engine of growth, a promotion for decent jobs creation and a vital factor in eliminating chronic poverty. Davies and Mullin use the term that smart economy as a mechanism to create a green economy. They call for a reduction of the amount of carbon dioxide in industry and suggest investing in the "clean economy" [14].

A smart economy is also defined as one of the fundamental principles for a smart city. A smart economy involves the creation of innovation clusters and a triple helix concept where companies, faculties, and citizens can interact and collaborate [15]. Smart economy describes all actions aiming at transforming and strengthening a municipality's economy. Improving the overall business climates, a city will increase its attractiveness for start-ups, investors, businesses, and new (highly qualified) talent. It also promotes a growing economy in an innovative and sustainable way to increase competitiveness are the most important goals. Utilizing (digital) technology and intelligent approaches lead to economic prosperity that, in turn, generates stable and favorable conditions for all stakeholders. Based on the government's perspective, "smart economic development" is regarded as an important tool to seize an opportunity to support the creation of jobs and businesses [16].

According to the above definitions of the smart economy, we found that there is a set of common qualities that are used to describe the terms the smart economy, which are innovative ideas that increase efficient productivity by adding value to the products and lowering the cost of production and transactions. This term also emphasizes the use of technology and ICTs to enable another possibility for optimizing the production, increasing the competitiveness based on the knowledge-driven approach, obtaining a higher quality of products, and making efficient costs. Some sorts of the smart economy also follow the sustainable development goals (SDG) by including the use of green or clean energy. As a result, this study applies the term 'smart economy' as a concept to seek for enhancing agricultural-tourism-related productivity, cultivating innovative mindsets, and improving resource efficiency.

2.2. The phenomenon in Thailand agricultural sector

Before the 1980s, the agricultural sector was a crucial engine of national growth. A majority of the land is devoted to cultivation. This enabled farmers to produce new commodities in new lands and increase exports in large quantities, thus creating a distinct comparative advantage from another sector. However, this comparative advantage was endangered by the policy bias against agricultural trade across countries. The exports of rice and rubber, the two top earners, were heavily taxed, while export controls were imposed on maize and were on the point of being introduced into cassava [17]. At that time, among all the major export commodities, merely sugar was subsidized. Despite these adverse measures from the government, production and exports of most agricultural commodities continued to grow, in some cases rapidly. The early 1980s was an extremely painful period for the Thai economy. There was the structural problem created by the declining comparative advantage of Thai agriculture. The severe crisis of the macroeconomic adjustment to recover from the fiscal imprudence of the late 1970s was induced by the reluctance of the government to adjust to higher petroleum prices. Since the 1970s, the economic share of the agricultural sector has been declined. Thailand's economy has dramatically shifted toward a new growth path into non-agricultural sectors. The dilapidated conditions of the Thai agricultural sector were similar to what happens in other countries that had preceded Thailand in industrial and commercial-led development. The workers have started to migrate out of agricultural pursuits [18].

Although the decline in agriculture, Thailand remains one of the world's leading rice exporters. There were more than 25 million people working in the farm sector, or about 38 percent of the country's population in 2015. Unfortunately, this sector accounted for less than 10 percent of the country's gross
domestic product (GDP). Despite the fact that the country houses some of the giant food companies, most of the workers in this sector are low-income households trapped in the poverty cycle.

There are a number of projects aiming at alleviating problems of agricultural production, marketing, and etc. Talat Thai Select is one of the projects that tackle adding values of organic agricultural products and differentiating organic products from chemical products' market prices. The project initiates a marketplace called "Talat Thai Selection" that agglomerates organic products from the farmers, who are barely access to the markets and the customers of organic products. The market incorporates the standard of Good Agricultural Practice (GPA) in order to certify the production of organic products in the market. Nevertheless, the certification comes with the cost, and some small farmers can not afford it [19]. On the contrary, Farm to project tackles a similar problem of the organic product market with a different approach. The founder emphasizes engaging customers and entrepreneurs in the early process of farming and cultivation at different levels. At the highest level of engagement, the customers and the farmers can mutually invest in the organic cultivation, which they both can get the production in return. While at the primitive level of customer engagement, customers can monitor and trackback the cultivation processes and plant growth. This creates a direct platform of investment and product sale of both business-to-customers and business-to-business, which helps farmers identify the demand of their organic product in advance prior to the cultivation, raising investment capitals for the cultivation, and merchandising the products [20].

A way to boost the income of small farms is defined as a major challenge of this sector. Many stakeholders and relevant authorities attempt to enhance the higher quality and re-banding agricultural products based on the approach of "value added": for example, local herbs could be turned into medicine or cosmetic products. They also emphasize the use of the digital economy by creating an infrastructure conducive to modern services and industries, such as medical wellness services and fuels for vehicles. More efforts would be made to support small and medium-sized enterprises as well as newborn startups.

2.3. Participatory need assessment

The study adopts the approach and the process of participatory needs assessment (PNA) as a research method, which allows the community members to question what they perceive as the most important needs or problems of their community and how to improve those conditions. This process will serve as a guideline for future actions to be undertaken in the community. The results of this process shall be transposed in priority action goals. The use of PNA aims to emphasize the principle of participative democracy, which upholds the citizens' active participation in democratic life, encourages the dialogue between citizens and public authorities, and advances innovating share-capital consolidation forms within local communities. The strength of the share capital and its concurrent social movement is recognized in sociologic theories [21]. Various sources of information can be drawn upon to inform a participatory needs assessment, including informal discussions with voluntary or community groups, focus groups, interviews with key informants and service users, and community mapping [22]. It is needless to mention that the repertoire of participatory methods to collect data for assessing the needs of a target group is unlimited. Remarkably, PNA offers lived experiences and fresh interpretations, which are highly relevant to the local context, but participation is. However, time-consuming process and labor-intensive [23]. Selecting methods for PNA will determine the quality and the degree of participation.

2.4. Analytical Tool

In order to conduct a good analysis and go through all the steps in the analysis spectrum, analysts are encouraged to use an analytical framework. Analytical frameworks are designed to structure an analyst's thinking and to help logical thinking in a systematic manner. In short, analytical frameworks are models that aim to guide and facilitate sense-making and understanding. An analytical framework is often presented visually. Frameworks within the humanitarian sector often need to be both needs, and risk-based, meaning they allow for a model to build that looks at the current and future humanitarian developments. A good framework ensures the data is structured in a way that the analysis will result in
tangible outcomes. Defining a theoretical framework forces analysts to be selective. The analysis of the frameworks is constructed based on the research questions, which will make the research framed systematically and comprehensively as well as reduces the impact of selective biases. If multiple researchers are involved in the data analysis, a framework will help them study the same phenomenon using the same categorization, reducing duplication of information. In this research, all researchers agreed to adopt the DPSIR model as a framework for data analysis and adapt it into our context.

DPSIR (Drivers, Pressures, States, Impacts, Responses) is used to surface and analyze the important and interlinked relationship between social and environmental factors, which is extensively used. It highlights a chain of causal links starting with 'driving forces' (economic sectors, human activities) through 'pressures' (emissions, waste) to 'states' (physical, chemical, and biological) and 'impacts' on ecosystems, human health, and functions, eventually leading to political 'responses' (prioritization, target setting, indicators). By describing the causal chain from driving forces to impacts and responses, we develop a better understanding of the complexity of the phenomenon by breaking down the chain into sub-tasks, for example, considering the pressure-state relationship.

![Figure 5 The DPSIR assessment framework](source: courtesy of the EEA, 2017)

3. Research methods
This research aims to explore the needs of the province from a governmental perspective by focusing on the relevant agencies to reflect the problems of the exchange of goods and services that occurred in Pathum Thani Province as well as ranking problems and linking them to problems. Therefore, the researchers wanted to collect information from the participants through focus groups and in-depth interviews. In this research, the researchers used two data collection methods. Divided into focus group discussions and in-depth interviews. By in-depth interviews is a useful qualitative data collection technique that can be used for a variety of purposes, including needs assessment, program refinement, issue identification, and strategic planning. In-depth interviews are most appropriate for situations in which you want to ask open-ended questions that elicit a depth of information from relatively few people. And focus group discussion is frequently used as a qualitative approach to gain an in-depth understanding of social issues. The method aims to obtain data from a purposely selected group of individuals rather than from a statistically representative sample of a broader population. Objectives and expectations of the method as shown in Table 1.

The selected research methodologies are suitable for identifying different attitudes, problems, situations, and solutions. Government agencies may have attitudes or opinions at the provincial level or in a holistic. Therefore, the researcher used the focus group method to allow the departments operating in one sector to reflect the problems and integrate the solutions to the problems together. As for a richer perspective from the key-informants, the researchers chose to use an in-depth interview method to inquire about details of the problems and situations that the farmers would face and cope with the phenomenon, so the data that the researchers obtained would have a different scale. Then researchers analyzed the thematic analysis process and displayed the results as a DPSIR model to demonstrate the
real needs of the agricultural sector in Pathum Thani Province. As well as the linkages of phenomena occurring in agriculture and trade and commerce.

### Table 1. Objective and Expectation of method

| Method          | Objective                                                                 | Expectation                                                                                           |
|-----------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| In-depth interview | The goal is to explore the current situation in Pathum Thani Province based on the view of farmers who are both farmers and entrepreneurs. Through the narrative of lived experience, we are expected to deeper understand the main points and gain some insights related to the problem-solving of a young early-career farmer with an innovative mindset. | Reflection of the farmer on the phenomena related to agricultural production and supply-chain systems. This reflection shall be used in 1) identifying problematic issues that farmers face, and 2) exploring the possibility of coping with the situation and/or challenging the obstacles by structuring alternative solutions. |
| Focus group     | The goal is 1) to explore the foreseen needs of the provincial authorities (Pathum Thani Province) who are in charge of agricultural and commercial sectors, 2) to identify the interconnected problems of agricultural and commercial sectors, and 3) to surface possible solutions and strategies that the authorities have tangibly (plans or projects) and intangibly (ideas or proposals). | The relevant departments can reflect the problems of the exchange of goods and services that arose in Pathum Thani Province. And prioritize problems as well as connect them. Along with specifying basic guidelines for solving problems |

3.1. Participants

Focusing on the in-depth interview, the researchers interviewed a young farmer who developed his business from a start-up project. In this case, he could share perspectives of a traditional farmer as well as different points of view through the lens of entrepreneurship who develops applications to solve common agricultural problems related to marketing and capital pooling.

According to the focus groups, scholars have identified different types of focus groups and recommended a suitable number of participants in each type. Greenbaum [24] suggested three types of focus groups: full group (ten to 12 participants), mini-group (four to six participants), and telephone groups (the number of participants is limited by the technology). However, it has been noted that a group of four may generate fewer concepts than a group of eight [25]. The proper number of participants had been a debate over 1980-2000. In 1998, Greenbaum [26] produced "The Handbook for Focus Group Research" and changed his recommendation to five to six participants for the mini group, which is quite similar to Twinn's advice [27] (four to five participants). In this study, we follow the recommended principles, and we proposed to have up to seven participants In a mini group, which offer us to hear the voice of all participants while it still provides substantially greater coverage than a smaller group.

Our focus group aims to conduct a participatory need assessment by inviting government authorities in Pathum Thani Province - who is in charge of the agricultural sector, trade and service sector, and industry sector - to portrait curial agricultural and commercial problematic phenomena. The researchers foresaw that different stakeholders may share. Within the focus group activities, participants were divided into three mini-groups, namely, 1) the agricultural sector, 2) the trade and service sector, and 3) the industry sector and agencies. The researcher's team was also divided into three groups in order to facilitate and moderate discussions in each group.
In focus group activities, there were a total of thirteen participants from eight organizations.

- Office of Agriculture and Cooperatives Pathum Thani Province
- Pathum Thani Chamber of Commerce
- Business Development and Innovation Cluster (Science Park of Thailand)
- Pathum Thani Provincial Commercial Office
- Pathum Thani Provincial Agriculture Office
- Pathum Thani Provincial Industry Office
- Pathum Thani Provincial Tourism and Sports Office
- Pathum Thani Province Office

3.2. Procedure

The research began with a one-hour in-depth interview, which aimed to shed some light on the current phenomenon of the province. This could be served as a preliminary finding and the foundation of the focus group discussion process. The interview was designed as a semi-structured interview comprising the following issues:

- (Re)Defining Problems and weaknesses occurring in the agricultural sector of Thailand.
- Highlighting Opportunities, Potential for Agricultural Development
- Identifying what is still missing in the Thai agricultural product management system
- Detailing of the project performed
- Positioning the respondent's projects in a wider map of the Thai agricultural system
- Revealing obstacles and challenges arising during the implementation of the project
- Reflecting the respondent's views as a producer and a consumer

The result of the interview was used for an activity-based focus group, which is shown in Figure 5. The activities that we conducted during the focus group discussion. The whole process took about 3 hours. The activities can be divided into two sections regarding the objective of each section.

Section 1: Reflecting the problems of product and service exchange occurring in Pathum Thani (Classified by sector)

We applied a technique of affinity mapping, which was used to organize ideas or insights. It allows large numbers of ideas stemming from brainstorming to be sorted into groups, based on their natural relationships, for review and analysis. It is also frequently used in contextual inquiry as a way to organize notes and insights from field interviews for synthesis and analysis. Additionally, it can be used for organizing freeform comments, such as open-ended survey responses, support call logs, or other qualitative data [28].

Section 2: Linking issues that relate to (Across the production) with a prioritization of the problem.

This section was led by a think-pair-share process and followed by the use of the problem tree technique. This allows participants to share their perspectives in order to understand the context of the problem and build frame insights. The problem tree, together with the objective tree and analysis of strategies, is a methodology of three steps for identifying main problems, along with their causes and effects, helping project planners to formulate clear and manageable objectives and the strategies of how to achieve them.
4. Results and discussion

In this session, the results are presented and divided into 3 sub-sessions: 1) in-depth interview, 2) Fokus group, 3) the analysis based on the DPSIR framework. The results of mini focus groups will be reported separately: 1) the agricultural sector, 2) the trade and service sector, and 3) industry sector and agencies. Each mini-group comprises the affinity map and the problem tree analysis. The affinity map was used for problem identification and prioritization, while the problem tree analysis was used to describe cause-effect relationships of the first prioritized problem of each group.

The affinity map activity was conducted by dividing participants into three sub-group regarding their responsibility: agriculture, commerce, and industry groups. Participants in each group were asked to respond to the prompt "In the role of responsibility, what are some obstacles/problems or challenges of the province in the past five years?". Each participant in the same group was motivated to discuss, sharing their points of view, write their response down on the post-it papers, and attach them on the board designated to their group. The listed problems would later be categorized into sub-groups by the participants.

After the participants shared their perspectives on the current problematic phenomenon through the affinity map activity, they were asked to work on developing deeper insights by selecting the most significant problem that serves as a foundation to solve another problem. The problem tree technique was used as a medium to stimulate participants to portray the complexity of interconnected issues by identifying the causes and effects of the identified problem. By the problem tree analysis, participants with the support of the research team mutually found a better understanding of the problem and its context, which could frame insights for proposing alternative solutions. Problem tree analysis helps to find solutions by mapping out the anatomy of cause and effect around an issue in a similar way to a mind map, but with more structure.

To analyze results, the researchers applied a thematic analysis approach based on the DPSIR framework. This facilitates us in developing a deeper understanding of the stakeholders' needs finding as well as exploring alternative solutions for the context of Pathum Thani Province. The results from the activity are shown in Figure 6.
4.1. In-depth interviews

The research team retrieved information about various projects that aim at developing a new way of enhanced agricultural productivity, marketing, and management. We found out that there are three significant projects running in Pathum Thani; 1) a project on creating a group of organic farms to promoting branding by the use of digital marketing (Farmto), 2) a project on agglomerating organic products into one market place, 3) a project of farm groups to provide mutual support among their neighboring farms. The research team chose the key informant of the first project to interview. In creating a semi-structured interview, the research team studied information and details of the preliminary project execution in order to understand the concept and nature of the project.

The key informant from Farmto firm arose a problem on middleman that lower than the price of organic agricultural products once to be similar to the non-organic products for their wholesale management. This phenomenon is described by the key informant as a "normalizing market" that has not to attempt to distinguish the different product quality and value the organic products. This makes the price of conventional and organic products does not significantly differ from one another. In fact, the cost of organic agriculture is higher than conventional agriculture. The firm has realized this problem and put its effort in to promoting small organic farms nationwide by providing rebranding strategies to the framers and supporting them in marketing through putting their product on the Farmto platform. This channel enables the direct chain of business-to-customer (B2C) without the middleman and allows customers to mutually invest in the cultivation to get the organic product as a return. This platform offers the pre-demand of farmers' organic products, which helps them in optimizing the cultivation and foreseen their future income. The key informant also highlights that the cost of transportation is higher than the price of the product itself. In addition, the small farms have less capital in investing in innovative agricultural equipment to enhance their productivity and lower the cost of cultivation. These issues make a smaller margin than farmers from their agriculture. Therefore, Farmto has a plan to develop a logistic for their farmers and customers and a plan for sharing agricultural tools and equipment in the near future.

In sum, the key informant emphasizes the need to "shift a transitional farmer with the entrepreneurial mindset." The determination of small farmers is identified by the key informant as a driving factor for
this shift. The Farmto does not provide merely a platform with an accessible organic market, but the learning space for small framers who would like to develop their organic farm to learn how to do branding themselves, managing their cultivation and customers, and predict the demand of their product prior their cultivation. The project, therefore, works together with farmers in the creation of the branding where each farmer brings out his strength with the concept of "agricultural entrepreneurs".

4.2. Mini focus groups

4.2.1. Agricultural group. Figure 8 is a result of an affinity map activity, which reveals that the problems and prioritizing the problems regarding the strategic possibility to resolve. The biggest issue designated by the number in figure 8 is farmers do not have their own land. More than 80-90 percent of the farmland is not owned by the farmers. When it is not their own land, farmers have less motivation to invest in long-term land improvement in order to earn more income, together with the lack of incentives and the lack of marketing mechanisms to stimulate agricultural products, especially products from the eco-agriculture. Besides, the participants expressed their opinion that farmers are not committed to agriculture. They can access tons of knowledge and knowhow to improve their productivity as well as their marketing strategies, but they are lack fresh, innovative mindsets and perspectives on modern data-driven agriculture and digital marketing. The issue that the agency gave the second priority was the eco-agricultural products without chemical contaminants. Since the Good Agriculture Practice (GAP) is a project supported by the Ministry of Agriculture and Cooperatives to encourage farmers to grow vegetables without toxic substances. However, there was an issue where growing vegetables without chemical contaminants may take more time, budget, cost, and care than a conventional approach. This product shall be sold at the unique, organic market where consumers prioritize the concern on chemical contamination. But once they sell organic products in the wider national markets where buyers are sensitive to the price, their organic products are forced to sell at the same price as the conventional product. Government agencies also address the issue of the lack of agricultural integration. Government agencies said that the agricultural sector in Pathum Thani is still lack of newcomer to serve the labor force of the sector as the wages are lower than the other industries. Therefore, the current farmers in this province are relatively old, and they do not want their children to make a career as farmers. Many farmers who own the land decide to sell their land due to the increased land price. Without suitable actions to resolve this problem, the prosperity of the agricultural sector will continue to decline.

![Figure 8. Agricultural problems in Pathum Thani](image_url)
The crucial problem in the agricultural sector perceived by the participants is the lack of incentives for change; for example, the inability of small farmers to access an organic agricultural market that follows the GAP standard, and the incapability of small farmers to adapt to the digital market and efficient cultivation driven by data and technological implication. In addition, the majority of farmers just hold the land as a tenant rather than owning their land, which may make them have less motivation in long-term investment to improve their physical condition of the land. This can block framers from transforming their traditional way of thinking and cultivating new suitable approaches in the era of digital marketing and technology disruption. As a result, small farmers would not recognize themselves as a profession that has to learn and develop over time. The participants emphasize the need to raise farmers’ awareness of agricultural professionalism and to call for repositioning farmers from agricultural producers to agricultural entrepreneurs with a new mindset of efficient management and digital marketing. Improving incentives, mindsets, and agricultural visions are regarded as a foundation for the agricultural transformation.

**Figure 9.** A problem tree of the agricultural sector in Pathum Thani

4.2.2. Commercial and tourism group. Figure 9 illustrates that the problems and their priority. The number in Figure 9 refers to the priority of each group of the problem (number one is the most important problem). The most important issue is identified as lacking identity and selling points of places, goods, and services. Participants expressed that the cultural traditions of Pathum Thani are not outstanding, and none of them is a tourism destination. The lack of facilities and transportation infrastructure to the possible tourism attractions as well as the insecurity in the tourist spots lead to fewer tourism revenues when is compared to other provinces. The other issue is the lack of involvement of various agencies in tourism management, especially community-based tourism. The agency also brainstormed that Pathum Thani is still lacking efficient public relations, resulting in having less perceived as tourism attractions. The participants highlighted the important role of marketable tourism products and the comprehensive database of goods and products in promoting tourism.

This mini focus group highlighted the lack of tourist attractions and key selling points of local products and services as a major problem. The cause of this may stem from the lack of a database, relevant touristy activities, and tourism promotion and campaigns. In addition, places in the province
are not embraced with unique tourist activities and saleable stories that can be developed as the set of provincial identity for tourism—these result in having a poor perception of tourists and a less tourist-based revenue as a consequence. The majority of the tourists come to Pathum Thani for a one-day trip rather than a long stay. These tourists’ travel duration could not make tourists spend more expenses on traveling and sightseeing, resulting in less value of tourism income compared to other provinces. Alternatively, the participants share their idea that the situation can be leveraged by constructing a new story of agricultural-based tourism. It may enhance the revenue of both the tourism and agricultural sectors.

Figure 10. Commercial and tourism problems in Pathum Thani

Figure 11. A problem tree of commercial and tourism sector in Pathum Thani

4.3. DPSIR framework

Drawn on the data from focus groups and the interview, the DPSIR framework is used as a graphic aid for the result discussion. The DPSIR aids in analyzing the complexity of existing phenomena that each problem is interrelated with another. Figure 11 showing the driving factors (Driver: D or the factor that causes the problem) and pressures (P) that shed some light on policy problematization. Statistics or situations (State: S) shows the problems that affect (Impact: I) on each side of the agricultural system.
This depends on the stakeholders' response or management (Response: R), which can further serve as a policy recommendation. The driving forces of the current agriculture situations stem from two dominant problems.

- **Land insecurity:** The majority of small farmers do not own their arable land and reply on a short-term land lease agreement, basically one to five years. This causes a pressure of land insecurity and discourages small farmers from investing in the physical improvement of the land. The other limitation of short-term land lease is that the possibility of improvement and readjustment of the physical features on the land depending on the negotiation and agreement. As a result, many small farmers prefer monocropping over intercropping due to less investment in the short-term period.

- **Insufficient incentives and lack of entrepreneurship:** To avoid selling management, the conventional farmers often sell their products to the middleman, not selling directly to the customers. The middleman extensively focuses on selling agricultural products to the wholesale and retail conventional market, where the price of organic and non-organic products has no significant difference. Therefore, it forces farmers to either seek a niche organic market by themselves. Many farmers avoid this marketing complication and stick to conventional agriculture instead. This mindset of some farmers may limit themselves to develop a new approach to agricultural cultivation and management, which could enhance their productivity and effective sales strategies. To respond to this situation, participants emphasize a need to cultivate farmers with agricultural entrepreneurship, not just a regular producer.

Recently, many various projects have been initiated to promote modern agriculture technology and knowledge transfer in terms of production and marketing, for example, a co-invest farming platform and a young smart farmers' project. Nevertheless, that available knowledge does not successfully transfer to the majority of small farmers at the current level that can lead to action due to land insecurity, insufficient incentivized markets, and inadequate supporting policy. Consequently, those pressures force the small farmers into the poverty trap, where they earn litter less margin, while the middleman earns much more. This may imply that Thailand is in need of innovative small farmer's outreach programs.

Focusing on trade and tourism, this sector faces difficulty in positioning their tourist attractions and promoting local products due to a lack of distinct identity. The status quo of tourism activity in this province is relatively in a recession in terms of tourist spending and the perception of a tourism destination. In order to respond to this limitation, the participants agreed that knowledge sharing and creative government to university collaboration can help in promoting tourist attractions, creating innovative activities, and initiating tourism campaigns. By strategizing a strong perception of people on Pathum Thani about the land of agriculture, we may strengthen the tourism and agricultural sector by incorporating an agricultural-based tourism approach or community-based tourism, which participants were heating up this debate during the focus groups.
The participatory need assessment sheds the live experiences on agricultural problems and their related causes and consequences. Pathum Thani Province has an advantage in the physical features of the land and soils that are suitable for agricultural cultivation and the location that is prime for agricultural distribution. Nevertheless, conventional agriculture may not be worthwhile to invest in when we compare the profit and the cost of production and land. Due to the lower margin of agricultural profits, many agricultural lands have been developed for other purposes such as manufacturing industry and residential development projects. At the same time, the current small farmers are facing difficulty in the land tenant, the incapacity to access the organic market, and lack of incentives to transform their monocrop into a new approach of agriculture.

The new paradigm of multi-cropping and innovative mindset as agricultural entrepreneurship shall be cultivated to the conventional farmers. The future agricultural policy and strategies may need to take a concept of 'agricultural professionalism' into the account of agricultural knowledge management and passing awareness to another generation. While the new set of digital marking, eco-branding, and technological farming shall play an important role in improving the revenue of the agriculture sector. At the same time, we found the possibility to promote agricultural tourism in Pathum Thani province through various kinds of tourism campaigning, such as festivals, mutual investment between the customer and the framers, and etc.
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