

**Hochschule Rhein-Waal**  
**Rhine-Waal University of Applied Sciences**  
**Faculty of Society and Economics**

**Market Participation of Maize Farmers**  
**Who Adopted Good Agricultural Practices (GAP)**  
**under the Mega Farm Project in the North of Thailand**

**Master Thesis**  
**Submitted in Partial Fulfillment of the Requirements of the Degree of**  
**Master of Arts**  
**in Sustainable Development Management**

**By**  
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## Abstract

The attempt to integrate Good Agricultural Practices (GAP) into the procurement standards of maize supply chain has been led by the Thai Feed Mills Association since 2015 to mitigate environmental impacts of maize production in the North of Thailand. Maize production was condemned by researchers and civil society as one of the culprits of deforestation and haze crisis. Up to now, maize in compliance with GAP in the North of Thailand is mostly produced as part of the Mega Farm Project and limited to a handful of farmers and planted areas. With rather unclear and unpromising circumstances, this study aims to examine the progress of GAP implementation and the market participation of farmers who adopted GAP. By using qualitative and quantitative research methods, it tried to find the reasons for the slow progress and limited coverage of GAP maize production. The results show that market incentives, institutional support, and farmers' resource endowment are key determinants of GAP adoption and market opportunities. Although the government's support under the Mega Farm Project has made GAP adoption accessible, affordable and achievable, the stagnation in GAP implementation and adoption is caused by a lack of market incentives, enforcement of regulations, engagement of the private sector, and government's resources. Farmers' market participation as a result of GAP adoption has not substantially changed over time. Their market access and prices received remained the same. Their market opportunities have not significantly been enhanced owing to the lack of market incentives for sustainable maize production, insufficient institutional support on harvest and post-harvest management, and farmers' limited capacity to upgrade and reach an economy of scale.

**Keywords:** Good Agricultural Practices, sustainability certification, market participation, upgrading, supply chain

## Table of Contents

Acknowledgement .....	i
Abstract .....	ii
Table of Contents .....	iii
List of Tables .....	v
List of Figure.....	vi
Chapter One .....	1
Introduction.....	1
1.1. Background of the study .....	1
1.2. Objectives of the study .....	5
1.3. Research question.....	5
1.4. Significance of the research .....	5
Chapter Two.....	7
Market Participation and Sustainability Standards .....	7
2.1. Market participation .....	7
2.2. Determinants of market participation.....	8
2.3. Degree of market participation.....	9
2.4. Market participation and sustainability standards.....	9
2.5. Sustainability standards, market inclusion, and upgrading in supply chain.....	10
Chapter Three.....	12
Research Methodology .....	12
3.1. The study area .....	12
3.2. Study population .....	12
3.4. Data collection and analysis .....	12
3.5. Conceptual Framework .....	14
Chapter Four .....	17
Farmers' Livelihood Assets, GAP Implementation, and Market Participation .....	17
4.1. Antecedent variables at the farm level - Farmers' livelihood assets.....	17
4.2. Value chain structure and procurement standards.....	18
4.3. Standard system for GAP certification.....	20
4.4. Institutional Context of GAP implementation .....	21
4.5. The Mega Farm Project and GAP Adoption.....	24
4.6. Progress of the Mega Farm Project and GAP Adoption .....	25
4.6.1. Phayao Province .....	26
4.6.2. Lampang Province.....	26

4.6.3. Phrae Province .....	27
4.7. Market Participation .....	29
4.7.1. Maize Commercialization and profitability .....	29
4.8. Degree of market participation and upgrading.....	31
4.8.1. Process upgrading .....	31
4.8.2. Product Upgrading:.....	32
4.8.3. Functional Upgrading .....	33
4.8.4. Chain Upgrading.....	33
4.8.5. Horizontal Coordination: .....	33
4.8.6. Vertical coordination: .....	34
Chapter Five.....	35
Factors Influencing GAP Adoption and Market Participation .....	35
5.1. GAP adoption.....	35
5.1.2. Bridging endowment gap with government support .....	35
5.1.3. Limitations of the government’s support to further increase GAP adoption .....	36
5.1.4. Inadequate market incentives and regulatory enforcement to boost GAP adoption .....	37
5.2. Market participation .....	39
5.2.1. Upgrading to seize better market opportunities.....	39
5.3. Hindrance to product and functional upgrading.....	41
5.3.1. Insufficient asset and extension support for harvest and post-harvest management .....	41
5.3.2. Insufficient asset despite access to credit .....	43
5.3.3. The lack of market incentives to enhance market opportunities for sustainable maize production .....	44
Chapter Six.....	48
The Unfinished Business of GAP Implementation.....	48
6.1. Conclusion.....	48
6.2. Recommendations .....	52
6.3. Suggestion for further research .....	54
Reference .....	55
Annex I GAP registration list of the Department of Agriculture.....	61
Annex II Permissible level of maize spoilage.....	62
Annex III Eight principles of Good Agricultural Practices for maize production.....	63
Annex IV In-depth interview questionnaires .....	65
Declaration of Authenticity.....	69

## **List of Tables**

Table 3.1 Sample group of GAP maize farmers derived from GAP database.....	13
Table 3.2 Sample group from government sector, private sector and Mega Farm Project.....	14
Table 4.1 Extension services provided under the Mega Farm Project.....	22
Table 4.2 Maize price received by maize farmers in the study area.....	30
Table 5.1 Maize price from various market outlets and provinces in Thailand.....	40
Table 5.2 Market participation and opportunities of maize farmers who adopted GAP under the Mega Farm Project.....	47

## List of Figure

Figure 3.1 Generic framework by FAO on the impact of voluntary standards on the participation of smallholders.....	15
Figure 4.1 Location of Lampang, Phrae, and Phayao .....	25



# Chapter One

## Introduction

### 1.1. Background of the study

Commercialization of agricultural production – a transformation from subsistence production to market-oriented production – is viewed as the engine of economic growth and rural income generation. In Thailand - one of the world’s leading exporters of rice and various agricultural products, agricultural commercialization and industrialization have driven economic growth for several decades (Jatuporn, Chien, Sukprasert & Thaipakdee, 2011; FAO, 2006). However, over the past four decades, the economic growth contributed by agricultural production and the agricultural value-added growth have declined due to the expansion of industrialization as well as a limitation and inefficient use of the Total Factor Productivity (TFP) and technology (Attavanich, Chantararat, Chenphuengpawon, Mahasuweerachai & Thampanishvong, 2019; Ahmad & Isvilanonda, 2003). At the farm level, market-oriented production has led to household income generation. Nevertheless, the income gained by many farmers in the rural area is not substantial due to inadequate and inequitable access to resources such as land, water, capital and technology required for leveraging farm productivity and product quality; limited access to high-value market due to poor product quality and small-scale production; low price transmission to farmers due to monopoly of domestic buyers including local and regional intermediaries; price fluctuation of agricultural produce despite rising production cost; market-distorting government policies; and growing frequency and intensity of natural disaster (Napasinsuwong, 2019; Thamthanakoon, 2018, Attavanich et al., 2019; Poapongsakorn, Ruhs & Tangjitwisuth, 1998). To make the matters worse, this unsustainable economic gain comes at the expense of widespread environmental degradation.

Maize production in Thailand is one of the examples of unsustainable commercialized agricultural production. Maize has been commercialized and expanded beyond household consumption since the 1960s. After the introduction of the National Economic and Social Plan in 1961, maize was promoted by the government as an export crop. It had become one of the major field crops along with cassava and sugarcane during the 1960s - 1980s. Since the 1990s, maize has mainly been supplied for domestic feed production instead of export due to growing demand from the animal feed and livestock industry (Ekasingh et al., 2004). With an improvement of the production process, successful development of High Yield Varieties, and

growing maize demand, maize production in Thailand has increased from 3.72 million tons in crop year 1990/1991 to 4.47 million tons in crop year 2000/2001 and to 4.53 million tons in crop year 2019/2020, according to Department of Agricultural Economics (2020). For many farmers, maize has become one of the main sources of their household income. The Department of Agricultural Economics (2020) reported that, in 2018, maize was produced by 460,825 households nationwide.

In the northern part of Thailand - the largest maize producing region, 3.12 million tons of maize were produced in crop year 2019/2020 accounted for 68.9 % of total domestic volume in the planted area of 754,602.24 hectares accounted for 67.14% of the nation's maize planted area (Department of Agricultural Economics, 2020). An increase in maize production in the region has started since the 1990s. But, a widespread expansion was due to a surge in maize price in 2007 (Nunsong, 2008; RYT9, 2019). Maize prices in 2004-2006 were between 5.30-5.68 THB per kilogram; but in 2007, the price soared to 7.01 THB per kilogram and continued to rise to 8.41 THB per kilogram in 2008. After that, maize production in the northern region continued to rise dramatically. According to the Bank of Thailand (2009):

Total maize production in the northern region had increased from 2.78 million tons in crop year 2008/2009 to 2.98 million tons in crop year 2009/2010 (by 7.4%), which hit the highest record in 18 years since 1991 thanks to the expansion of maize planted area and rising prices. Maize production in the northern region in crop year 2009/2010 was accounted for 65% of total domestic production. (p.11)

A substantial increase of maize production and planted area in 2007-2012 is consistent with a notable increase of maize price. Maize planted area had increased from 633,241 hectares to 812,583 hectares in 2012 which was in the same period that maize price rose to 9.66 THB per kilogram in 2012 and peaked to 10.39 THB per kilogram in 2013.

The increase in maize production over almost two decades has contributed to deforestation and haze crisis in the North of Thailand, indicated by various research. Achavanuntakul et al. (2014), using the satellite image of Geo-Informatics and Space Technology Development Agency (GISTDA), found that the expansion of maize planted area from 2008 to 2013 in Palaeu Luang, Pong, and Du Pong Sub-District of Nan Province involved deforestation as 60% of these areas were originally covered by the forest. Regarding to haze problem, Greenpeace (2019) stated that it is associated with a massive expansion of maize production in the North of Thailand and neighboring countries because the concentration of

P.M2.5 and hotspots were usually intensified in March which is the period that farmers burn remaining residue to clear and prepare the land before starting the next crop. Chantara et al. (2018), monitoring open burning in the northern region in 2010-2015, also pointed out that the concentration of PM10 in agricultural and forest areas rose extensively in March. In addition, Achavanuntakul et al. (2014) stated that unsustainable maize production is also associated with various environmental problems such as land slide and flash flooding, especially in slope terrain, and soil contamination caused by overuse of hazardous agricultural chemicals.

With the evidence from the research pointing out adverse environmental impacts of maize production, efforts have been made by researchers, NGOs, government and private sector to find solutions. Achavanuntakul et al. (2014) called for a sustainable maize supply chain in which feed factories impose measures for environmental protection such as a prohibition of deforestation, proper use of agricultural chemicals and traceability measures in their procurement process. Concurrently, farmers should be subsidized with sufficient resources and assistance to keep up with the new environmental requirements. To find the middle ground between commercialization and environmental protection amidst rising societal pressure over environmental concern, in 2015, the Thai Feed Mills Association overseeing all feed factories in Thailand declared that Good Agricultural Practices (GAP) for Maize Production developed by the Ministry of Agriculture and Cooperatives in 2010 would be incorporated into maize procurement standards, and that a ban on non-GAP-certified maize would be enforced to induce farmers to adopt sustainable farming methods by complying with GAP in order to ensure their access to the market (CP-enews, 2015).

According to FAO (2016, p.5), Good Agricultural Practices (GAP) are:

“a collection of principles to apply for on-farm production and postproduction processes, resulting in safe and healthy food and non-food agriculture products, while taking into account economic, social and environmental sustainability...[which is also used as] a prerequisite for procurement [by buyers and importers] to ensure the quality and safety of their produce.”

Moreover, GAP is found to contribute to the efficient and proper use of resources – soil, water, fertilizers, and pesticides. In Thailand, the first Good Agricultural Practices called Q-GAP was introduced in 2004 to promote food safety (Rattanakreetakul & Korpraditskul, 2015). It was developed to cover three types of agricultural production: 1.) Food crops such as fruits, vegetables and field crops; 2.) Livestock; and 3.) Aquatic livestock (Agricultural Land Reform

Office, n.d.). For food crops, GAP sets out principles to ensure productive, safe, and environment-friendly use of water, soil, fertilizer, and pesticide; and management of on-farm production, pre-harvest to post-harvest handling, storage, and transportation of produce (Agricultural Land Reform Office, n.d.). Regarding deforestation and air pollution, it requires that the land used for crop production be in compliance with the law and not associated with any form of environmental degradation such as deforestation and large-scale burning. The task of GAP implementation has been managed by three departments of the Ministry of Agriculture and Cooperatives: 1.) The standards-setting is developed by the National Bureau of Agricultural Commodity and Food Standards; 2.) Program outreach and preliminary farm audit is conducted by the Department of Agricultural Extension; and 3.) Final farm audit and GAP certificate issuance are done by the Department of Agriculture (Schreinemachers, 2012).

Currently, GAP is not being implemented as part of maize procurement standards by all actors in the supply chain. Farmers can sell their maize to local buyers, intermediaries, and some feed factories regardless of GAP certificate and production source. There is neither premium price set for GAP-certified maize nor market barrier for non-GAP-certified maize in the study area. So, the market environment has not changed significantly. In the North of Thailand, a tiny number of maize farmers are found to produce maize in compliance with GAP under the Mega Farm Project implemented by the Department of Agricultural Extension and Agricultural Land Reform Office, which are subsidiaries of the Ministry of Agriculture and Cooperatives. Starting in 2016, this three-year project targeted farmers who have farmland in the land reform area regulated by the Agricultural Land Reform Act B.E. 2518 (1975) in order to form a group for mega-scale agricultural production. According to the Technology Transfer and Development Bureau (n.d.), the goal of the project is to enhance competitiveness, income and well-being of farmers by improving their production efficiency – reducing production cost, increasing productivity, upgrading product quality – through the adoption of Good Agricultural Practice (GAP) or Organic Agriculture Certification Thailand (ACT) and the strengthening of group management. In this regard, farmers would receive various trainings on agricultural technology and sustainability standards; marketing support; provision of farm inputs and machinery; and advice on low-interest credit access.

Maize production in compliance with GAP in the North of Thailand is mainly done as part of the Mega Farm Project of which objectives are mainly on enhancing production efficiency and product quality and not directly related to haze mitigation. Compared to the extensive areas of maize production in the northern region, the size of GAP-certified maize

planted areas is quite small. The progress of expanding GAP maize production has indeed been static. Across nine provinces in the North, less than one percent of maize volume and of the planted area are GAP certified. As of May 2021, the certified area of 564.8 hectares were found in three provinces: Lampang, Phrae and Phayao, under the ownership of 526 farmers producing a total output of 3,954 tons, according to GAP database of the Department of Agriculture (2021). Moreover, there has been no research on the status of GAP implementation and its effect on maize production and market participation in the North of Thailand. Given unclear and unpromising circumstances, it is vital to explore an up-to-date situation of GAP certification, GAP enforcement, market environment, and market participation of farmers who adopted GAP in order to find the reasons for the slow progress of GAP implementation as well as practical solutions toward sustainable maize production in the future.

## **1.2. Objectives of the study**

1.2.1. To examine the impact of GAP adoption on market participation of maize farmers in the North of Thailand

1.2.2. To find socioeconomic characteristics and resource endowment of maize farmers who adopted GAP

1.2.3. To determine factors influencing GAP adoption among maize farmers

1.2.4. To determine factors influencing market participation of maize farmers who adopted GAP

## **1.3. Research question**

1.3.1. How has GAP adoption under the Mega Farm Project impacted market participation of maize farmers?

1.3.1.1 How have farmers who adopted GAP participated in the market?

1.3.1.2. What are enabling and restraining factors for GAP adoption?

1.3.1.3. What are enabling and restraining factors for the farmers' market participation?

## **1.4. Significance of the research**

The environmental degradation caused by commercialized agricultural activities can be mitigated by sustainable agricultural practices. In the North of Thailand, maize production has been condemned as one of the causes of deforestation and haze crisis proven by growing research evidence. Societal pressure for sustainable maize production and supply chain had led to a declaration by the Thai Feed Mill Association to integrate GAP requirements into maize

procurement standards in 2015 which were expected to alter institutional environment in maize supply chain from the downstream where feed factories impose procurement standards on their suppliers requiring that maize has to come from sustainable source, to the midstream where local traders and intermediaries adhere to new procurement standards, and to the upstream where farmers are bound to comply with GAP throughout the production processes in order to gain market access. It is believed that sustainability certification such as GAP would lead to better market opportunities for farmers in exchange for their effort in environmental protection. But, so far, there has been a limited number of study on the adoption of GAP and market participation of maize farmers who adopted GAP. Therefore, it is crucial to explore the progress and challenges of GAP implementation and market participation of maize farmers as a result of GAP adoption and provide meaningful recommendations for policy improvement ensuring both environmental protection and survival of maize farmers.

## **Chapter Two**

### **Market Participation and Sustainability Standards**

#### **2.1. Market participation**

Market, stated by Hebinck, van der Ploeg and Schneider (2015, p.24), is “an abstract system of prices, preferences, supply, demand and automatically generated equilibriums”. It can also be regarded as a concrete place or institution where an exchange of goods and services and coordination and allocation of resources between buyers and sellers occur (Hebinck, van der Ploeg & Schneider, 2015; ADB-DFID, 2005, as cited in SOAS, n.d.a). Furthermore, according to a market-led paradigm of agricultural development in the 1980s, market is an engine of economic development and structural transformation as it involves a transformation of agricultural production from subsistence mode – input obtained and output consumed in the household – to a commercialized mode – input purchased and output sold in the market (Reardon and Timmer, 2006; Timmer, 1988; Staatz, 1994, as cited in Boughton et al., 2007). The production decision of subsistence farmers is mainly based on subsistence requirement and household preferences; while the production decision of commercialized farmers regarding what to produce, how much to produce, how to produce, and what factors of production to be used is driven by profit maximization and based on market information (Kahan, 2013; Pingali, 1995, as cited in Mbitsemunda & Karangwa, 2017). Kahan (2013) explained that the commercialization of agricultural production has turned a farm into a business unit operating with specialized production processes and sophisticated management. Under this circumstance, farmers become integrated into the complex system of market and supply chain.

It was believed that market-oriented production would lead to welfare gain due to comparative advantage, new opportunities from large-scale production, and technological change effects (Romer 1993, 1994, as cited in Boughton et al., 2007). However, according to Barrett and Mutambatsere (2005), the experience of agricultural market in developing countries showed that resource allocation signalled solely by price in a free market is not always efficient due to weak institution – high transaction cost, binding liquidity constraints, the lack of property right, and imperfect contract monitoring and enforcement; incomplete physical infrastructure; and imperfect competition. They indicated that “market openness may accentuate the latent dualism of a modern, efficient marketing sector, accessible only to those

with adequate scale and capital, alongside a traditional, inefficient marketing channel to which the poor are effectively restricted.” (Barrette & Mutambatsere, 2005, p.2).

## **2.2. Determinants of market participation**

The determinants of market participation, as indicated by various studies, are 1.) Farmer’s socio-economic characteristics such as age, sex, education, farming experience, household size, income, and membership of associations; 2.) Farmer’ resource endowment such as land size, livestock, farm equipment, and labor; 3.) Institutions such as government policies, law, market, and access to extension support, credit, and market information; 4.) Physical infrastructure such as road connectivity and transportation to the market, irrigation system, and access to electricity and telecommunication network (Bellemare & Barret, 2006; Omiti, 2009; Goetz, 1992; Rios et al., 2008; Pngali, 1997, as cited in Mbitsemunda & Karangwa, 2017). Combining all aspects together, the Sustainable Livelihood Framework offers a holistic view showing that farmers’ livelihood outcomes are determined by livelihood assets and transforming structures and processes (SOAS, n.d.b). The livelihood assets consist of human capital, financial capital, social capital, natural capital, and physical capital. As farmers are not equally endowed with livelihood assets, those who are poor-resourced would be disadvantaged. However, the disadvantageous circumstances could be transformed into positive livelihood outcomes if the structures and processes – policies, laws, and extension support – allow farmers to get equitable access to resources required to catch up on production advancement and take advantage of emerging market opportunities.

Barrett (2007) summarized that price, institution, and farmers’ resource endowment are the main factors influencing farmers’ market participation and marketable surplus. Owing to growing specialization in commercialized production yet weak institution and deficient infrastructure, it is vital that institutional and physical infrastructure be improved with substantial investment to facilitate broad-based and low-cost access to the market and make the market more competitive and well-functioning. In addition, farmers must be assured of adequate and equitable access to technology, public goods and private goods to bridge the endowment gap and enhance their competitiveness in the market.

“Those with access to adequate assets and infrastructure and faced with appropriate incentives engage actively in markets, while those who lack one or more of those three essential ingredients largely do not. Such multiple market participation equilibria commonly arise due to the fixed and sunk costs of investment, the coordination



problems that arise in many cases of public goods provision, and the liquidity constraints that hamper households, as well as governments at all scales, in the low-income world” (Barrett and Swallow, 2006, as cited in Barrett, 2007, p. 300).

### **2.3. Degree of market participation**

The extent of market participation can be quantified with various indicators. The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification – SIIL (n.d.) uses the ratio of the quantity of output sold to the total quantity of output produced and compares it with the ratio of the quantity of output kept for household consumption. The higher the ratio of output sold to the market, the better the access to the market. However, it cannot be implied that high market participation would lead to high profitability. Household Commercialization Index (HCI), which is “a ratio of the gross value of all crop sales per household per year to the gross value of all crop production”, is used to identify the degree of household’s market participation (Govere et al., 1999; Strasberg et al., 1999, as cited in Jaleta, Gebremedhin & Hoekstra, 2009, p.5). The HCI result ranges from zero, indicating absolute subsistence production, to 100, indicating the highest degree of commercialization as 100% of output is sold to the market. Alemu, Gabre-Madhin, and Dejene (2006) pointed out that market participation involves both input side – “the ratio of the value of agricultural inputs acquired from the market to the total value of agricultural production of a household” (p.10) – and output side – “the ratio of the value of agricultural outputs sold to the total value of agricultural outputs produced by a household” (pp.6-7); and can be identified based on types of activities – “a ratio of the gross value of cash crops produced to the total gross value of crop production” (p.7); level of specialization – “a ratio of the value of purchased agricultural products not produced by the farmer to the value of own agricultural production” (p.10); and market position of the household – a ratio of sales to the sum of the volume stored at the beginning and volume produced during the season.

### **2.4. Market participation and sustainability standards**

The commercialization and growing social and environmental standards of supply chain “offer new opportunities for smallholder farmers, [b]ut can also marginalize them, isolating them from lucrative markets and making them unviable economic units” (Rapsomanikis, 2015, p.1). Whether or not farmers can access the market and how much they benefit is context-specific (Blackmore & Keeley, 2012). Various studies underline pre-existing assets and institutions as the main determinants of farmers’ participation in the market.

Seville, Buxton and Vorley (2011) stated that farmers' pre-existing livelihood assets play a vital role in determining their ability to access and benefit from the market. They highlighted that productive assets, such as natural capital – natural resources stocks farmers can utilize; financial capital – saving and access to financial services; and human capital - ability, skill, and knowledge of farmers, are major factors determining farmers' market inclusion. Donovan (2010), studying the effects of certifications in the Nicaraguan coffee market, found that only farmers with high natural, financial and human capital were able to gain positive benefit; while farmers with low natural, financial and human capital were unable to handle the period of asset de-accumulation during the transitioning from conventional to organic production, thus, received only marginal benefit (as cited in Seville, Buxton & Vorley, 2011). High initial investment and recurring costs of certification could also prevent farmers with low financial assets from profiting or participating in the market. Many vegetable smallholders in Kenya withdrew from EurepGAP or were rejected by export companies, thus being excluded from EU market, mainly because the cost of compliance was too high to gain a positive return (Graffham, Karehu & MacGregor, 2007). Moreover, participating in the market which requires knowledge-intensive production such as Organic market can be challenging for farmers who have low human capital as it would be difficult for them to achieve high productivity and product quality (Blackmore & Keeley, 2012).

Regarding institutions, enabling policies and technical and financial support from the government and private sector can bridge the gap between pre-existing assets and additional assets required for leveraging farmers' participation and competitiveness in the market. According to Seville, Buxton and Vorley (2011), a market opportunity for all farmers can be facilitated through institutional support such as investment in capacity development; adjustment of buyers' trade structure to be more inclusive; improvement of supply chain coordination to set clear goals and equal share of cost and risk between buyer and suppliers in the chain; forming effective market linkages through networks of intermediaries; and providing equitable access to experts' support, financial services, training, and inputs.

## **2.5. Sustainability standards, market inclusion, and upgrading in supply chain**

FAO's framework classifies market participation in relation to certified products into 1.) Exclusion – suggesting that farmers are excluded from the market due to their ineligibility or inability to adopt sustainability standards, or indicating that participating in the market is not economically viable for them; 2.) Inclusion – signifying that farmers get the access to the

market by complying with sustainability standards (FAO, 2014). Furthermore, when farmers participate in the market and become integrated into a supply chain, their market opportunities would depend on upgrading – leveraging production to meet domestic and international quality and safety standards – which can be achieved through knowledge and technology transfer, capacity building, and joint learning (Bolwig et al, 2011; Lee et al, 2012; McCullough et al, 2008; Anandajayasekeram and Gebremedhin, 2009; Ayele et al, 2012, as cited in Kilelu et al., 2017). According to Mitchell and Coles (2011), putting the idea of value chain and upgrading into perspectives would provide a clearer picture of why many farmers who are already participating in the market still remain poor and are not benefiting from market-oriented production.

Upgrading can take four forms: 1.) Process upgrading – improving production efficiency such as increasing yield and reducing production cost; 2.) Product upgrading – improving quality of the product to meet buyers’ requirements; 3.) Functional upgrading – taking up other functions in the different stages of the supply chain; and 4.) Chain upgrading – expanding one’s own specialized function to a different chain or sector (Humphry & Smitz, 2002 as cited in Mitchell & Coles (2011; Kilelu et al., 2017). According to Mitchell and Coles (2011, p.23), “upgrading is the possibilities for producers to move up the value chain, either by shifting to more rewarding functional position, or by making products with more value-added invested in them, and/or providing better returns”. The upward trajectory of value addition in the value chain starts from process upgrading to product upgrading, functional upgrading and, lastly, chain upgrading (Kaplinsky & Morris, 2013, as cited in Kariuki, 2018; Cattaneo et al., 2013, as cited in Marcato & Baltar, 2020). Moreover, some literature suggested that there are other forms of upgrading such as improving chain coordination in two dimensions: 1.) Horizontal coordination – collaborating with other farmers or actors at the same stage of the value chain to reduce cost, increase bargaining power and reduce risk; and 2.) Vertical coordination – shifting from one-time to longer-term business relationship with buyers or other actors at the different stages of the value chain (Poulton et al, 2010; Trienekens, 2011, as cited in Kilelu et al., 2017).

## **Chapter Three**

### **Research Methodology**

To explore the impact of GAP adoption on maize farmers' market participation, this study used quantitative and qualitative research method to examine enabling and restraining factors of GAP adoption and farmers' market participation in Lampang, Phrae and Phayao Province.

#### **3.1. The study area**

The northern region is the largest maize producing region in Thailand with the planted area of 754,602.24 hectares and production volume of 3.12 million tons in crop year 2019/2020, accounted for 68.9% of domestic maize output (Department of Agricultural Economics, 2020). Maize farmers who were registered as GAP-certified in GAP database of the Department of Agriculture are found in three provinces: Lampang, Phrae, and Phayao.

- In Lampang, there were 257 GAP-certified farmers across four districts: Mueang Pan, Ngao, Some Ngam, and Mae Tha.
- In Phrae, there were 156 maize farmers across three districts: Rong Kwang, Long and Wangchin.
- In Phayao, there were 113 farmers across two districts: Pong and Phusang.

#### **3.2. Study population**

The target population of this study is maize farmers in the North of Thailand who were registered in GAP database. As of 28 May 2021, there were 526 certified farmers in Lampang, Phrae, and Phayao Province.

#### **3.4. Data collection and analysis**

The study was conducted by using quantitative and qualitative method to obtain both official statistics of GAP adoption and insights regarding GAP implementation and market environment from maize farmers, government, and private sector.

**3.4.1. Quantitative methods:** Secondary data on GAP registration from GAP database of the Department of Agriculture was obtained and analyzed to find GAP-certified planted area, the volume of output and the number of certified farmers in the North of Thailand.

**3.4.2. Qualitative methods:** In-depth interviews using a semi-structure questionnaire were administered with 33 participants encompassing 15 farmers and 18 representatives of the Mega Farm Project, government and private sector. Due to the concern over the rise of Covid-19 infection in Thailand, the interviews were conducted by telephone.

**3.4.2.1. Stratified sampling procedure:** A sampling frame is GAP registration list (Annex I) extracted from GAP database showing names, production information and contact information of 526 maize farmers in the North of Thailand. Farmers' names were arranged by province which is divided into districts. From each district, 1 - 4 farmers were **randomly selected**, as shown in table 3.1, with an exception of Wang Chin District where farmers' phone number could not be reached; Phusang District where Agricultural Officers informed that farmers did not extend their GAP certificate; and Pong District where three farmers were selected to represent the whole province. To sum up, the sample group consists of 15 farmers randomly selected from the population of 526 farmers to examine the socio-economic background, market participation, and factors influencing their market opportunities.

**Table 3.1 Sample group of GAP maize farmers derived from GAP database**

Province	District	Number of GAP certified farmers	Number of farmers randomly selected
Lampang	Mueang Pan	82	2
	Ngao	81	2
	SoemNgam	54	1
	Mae Tha	40	1
	<b>Total</b>	<b>259</b>	<b>6</b>
Phrae	Rong Kwang	134	4
	Long	12	2
	Wang Chin*	10	0
	<b>Total</b>	<b>156</b>	<b>6</b>
Phayao	Phusang**	94	0
	Pong	19	3
	<b>Total</b>	<b>113</b>	<b>3</b>
<b>Grand Total</b>		<b>526</b>	<b>15</b>

Note: \* Farmers could not be reached

\*\* Agricultural Officers informed that farmers in Phusang District did not extend GAP certificate

**3.4.2.2. A group of 18 people** were **selected** by snowball sampling based on the information acquired from preliminary interviews with Agricultural Officers and farmers and desk research on GAP implementation and the Mega Farm Project, as shown in table 3.2. The interviews were conducted to find insight

about GAP implementation, provision of agricultural extension services, market situation and maize procurement standards.

**Table 3.2 Sample group from the government, private sector and Mega Farm Project**

Province	Organization	Position	Number of interviewees
Lampang	Provincial Agricultural Land Reform Office	Land Reform Officer	1
	Provincial and District Agricultural Extension Office	Agricultural Officer	2
	Agricultural Research and Development Office	Inspector	1
	Mega Farm Group	Group Leader	2
	Local traders	-	1
	Farmers' group supplying maize to CP	Manager	1
	<b>Total</b>		<b>8</b>
Phrae	Provincial Agricultural Land Reform Office	Land Reform Officer	1
	Provincial and District Agricultural Extension Office	Agricultural Officer	2
	Mega Farm Group	Group Leader	2
	<b>Total</b>		<b>5</b>
Phayao	Provincial Agricultural Land Reform Office	Land Reform Officer	1
	Provincial and District Agricultural Extension Office	Agricultural Officer	2
	Mega Farm Group	Group Leader	1
	<b>Total</b>		<b>4</b>
-	Betagro (Feed Factory)	Procurement Officer	1
<b>Grand Total</b>			<b>18</b>

Note: CP's representative could not be reached

Data collected from in-depth interview was analyzed with narrative analysis to find insights and compare the similarities and contrast of different groups of farmers and representatives from the government and private sector to ensure the consistency and balance of information between various groups of stakeholders. Finally, the information was incorporated into FAO impact framework to draw a comprehensive conclusion taking into account information from all stakeholders.

### 3.5. Conceptual Framework

A generic impact framework developed by FAO, as demonstrated in figure 3.1, was used to explore and analyze the variables at the farm level and institutional level which influence production outcomes and market participation of farmers.

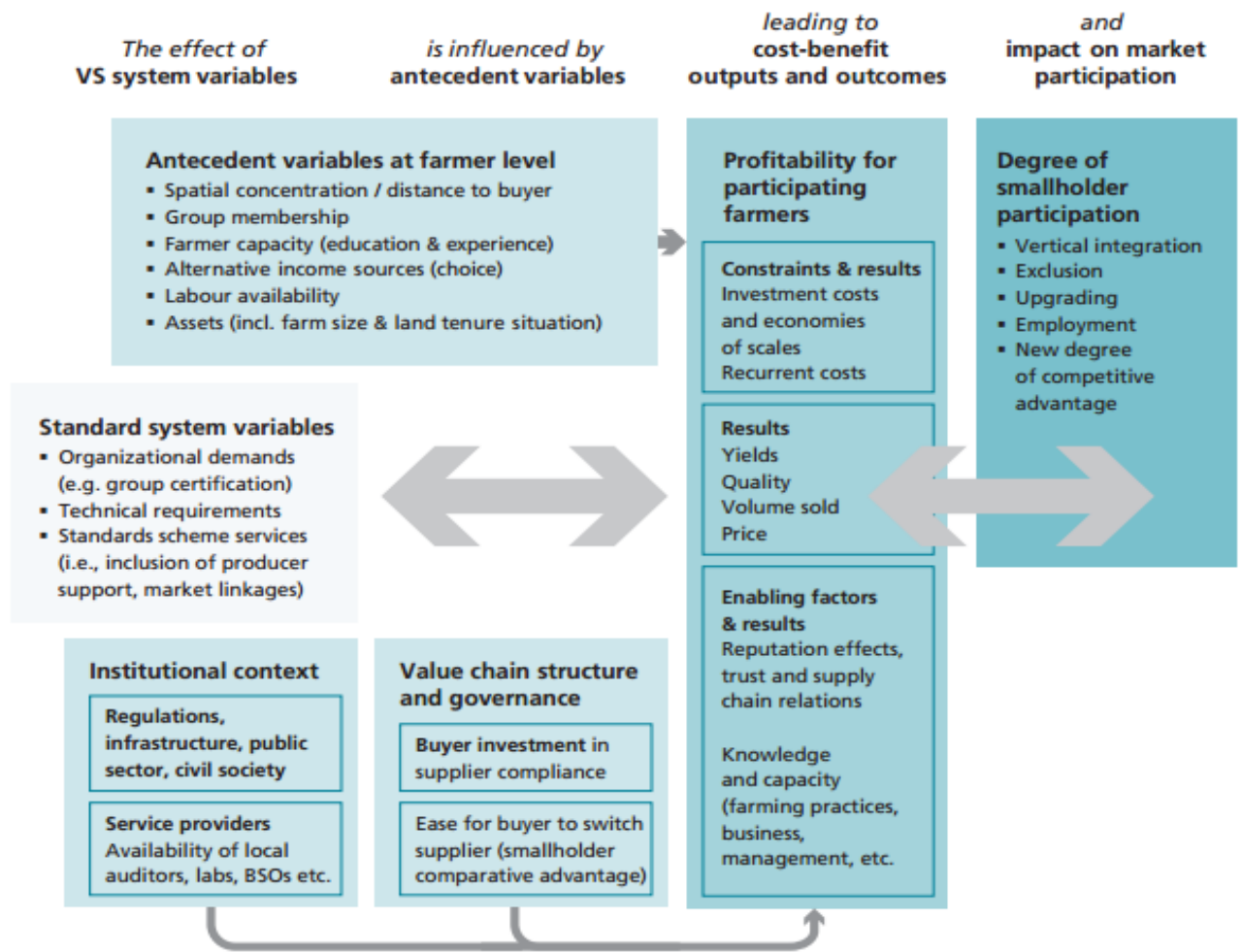


Figure 3.1 Generic framework by FAO on the impact of voluntary standards on the participation of smallholders  
 Reprinted from “Impact of international voluntary standards on smallholder market participation in developing countries,” by FAO, 2014, 13, Rome: FAO

The framework provides an in-depth analysis of farmers’ market participation through the relationship of six components:

- **Antecedent variables at the farm level** refer to farmers’ socio-economic characteristics and livelihood assets which influence their ability to adopt GAP and enhance the market opportunities.
- **Standard System Variables** refer to requirements of the certification system and extension services to facilitate GAP adoption and market linkages for farmers
- **Institutional Context** refers to institutions, legislation, and policies of the public and private sector which affect farmers’ access to livelihood assets in order to adopt GAP and seize better market opportunities.

- **Value chain structure and governance** refer to the structure of maize supply chain, the relationship between players at each stage of the chain, and maize procurement standard requirements.
- **Profitability for participating farmers** refers to results of adopting GAP such as yield, quality, volume sold and price which can be restrained by investment cost and recurring cost if it is too high and not supported by institutions or can be enhanced by improved knowledge and capacity if farmers receive sufficient supports.
- **Degree of market participation** refers to farmers' access to the market which can be divided into inclusion and exclusion. With regard to inclusion, once farmers get access to the market, their ability to take advantage of the market opportunities would be advanced by upgrading which consists of process, product, functional, and chain upgrading and vertical and horizontal chain coordination.



## **Chapter Four**

### **Farmers' Livelihood Assets, GAP Implementation, and Market Participation**

#### **4.1. Antecedent variables at the farm level - Farmers' livelihood assets**

Farmers in the sample group produce maize in the area of 0.4 – 12.8 hectares with an output of 3 – 82 tons. So, their scale of production ranges from small scale to large scale. Their annual net income from maize production varies from 15,000 THB to 250,000 THB. Most farmers owe some debts in the amount of 100,000 THB to more than 500,000 THB. Only a few of them have no debt. All farmers have a land certificate (title deed) or usufruct certificate issued for the land reform area which can be used for GAP and the Mega Farm Project application. The total land size used for all agricultural production ranges from 1.12 – 12.8 hectares. Some farmers rented parts of the farmland from their relatives at a low price.

Concerning social and educational background, these farmers live in a household size of 4-5 members while only 1-2 members are farmers. The young generation in the household normally leave the agricultural sector for higher education and employment in other sectors in Bangkok or big cities. Most of the farmers in the sample group are in their late fifties. The youngest one is a 36 years-old female farmer, while the oldest one is 62 years old. Their education level ranges from primary-school level to high-school level or high vocational certificate. All farmers have been farming for more than 15 years. Concerning social capital, most of them informed that they are a member of a cooperative of the Bank of Agricultural and Cooperatives. All of them participate in at least one social group, while some participate in multiple social groups such as a district agricultural cooperative, village fund, village saving group, and fertilizer cooperative. Cooperation in harvesting and transportation among relatives, neighbors, and friends is still practiced by some farmers. With regards to gender, there are a lot of female farmers adopting GAP and participating in the Mega Farm Project. Although the number of women exceeds the number of men, the majority of leaders of the Mega Farm Groups are men. Only two women are found to be the leader of the Mega Farm Group. At the village level, the position of Village Head is mostly taken by men, while women usually hold the position of Village Assistant in a Village Committee.

Regarding access to credit, all farmers in the sample group have access to the credit provided by the Bank of Agricultural and Cooperatives which is the main source of low-interest credit for farmers. The most popular form of credit is a short-term loan in the form of cash card which can only be used for the purchase of farm inputs such as seed, fertilizer, and pesticide. Some farmers also take a low-interest loan from a district's agricultural cooperative, village fund or village saving group. Only four farmers who are large-scale farmers mentioned that they do not need the credit.

Farmers have different production strategies. Some large-scale farmers rely on maize production as the main source of income, while small-scale farmers rely on diversified crop production. Apart from maize, they grow rice, peanut, garlic, tobacco, papaya, or cassava. Rice is grown by most farmers mainly for household consumption and partly for commercialization if the price is high. Tobacco, cassava, and papaya are grown by maize farmers in Phayao Province; garlic and cassava in Lampang Province; and tobacco in Phrae Province. Tobacco is widely grown and is the main source of income for some farmers in Rong Kwang District, Phrae Province. Livestock such as cows is raised by some farmers in Phrae and Lampang Province. Apart from farming, small-scale farmers make a living as occasional wage laborers.

#### **4.2. Value chain structure and procurement standards**

In the study area, there are three main actors in the maize supply chain: 1.) Maize farmers at the upstream who are primary producers supplying maize directly to feed factories or to local traders; 2.) Local traders and agricultural cooperatives at the midstream buying maize from farmers at sub-district, district or provincial level as well as offer various kinds of services such as milling and transportation and have their own drying and storage facilities to properly store maize before distributing it to livestock producers or feed factories; and 3.) End buyers at the downstream such as feed factories and livestock producers purchasing maize from farmers, local traders, or intermediaries. At the national level, there are more actors such as regional intermediaries at the midstream buying and supplying maize to exporters and feed factories; and exporters selling maize to the international market.

Farmers informed that they produce maize for commercialization without relying on contract farming. In the North of Thailand, maize is mainly grown in the rain-fed areas. Sowing starts in rainy season in May – July, and harvest is carried out in August-October. In the plain area where irrigated water is available, some farmers grow maize after harvesting rice from November to December as suggested by the government to reduce the over-supply of rice and

increase maize production to meet rising maize demand. The cost of maize production varies from 18,750 to 31,000 THB per hectare (3,000 – 5,000 THB per Rai) depending on the type and quantity of maize seed, fertilizer, labour, and services used. Farmers are free to choose maize seed and are not required to choose only the buyer's seed. The most popular maize hybrids chosen by farmers are CP, NK, and a publicly-developed Nakhon Sawan-3 hybrid. Maize seed, chemical fertilizer and labor take the largest share of production cost. After maize is harvested, the farmers transport their maize to shops of local traders by shared vehicles of relatives and neighbors or by hired vehicle. To avoid spoilage which can easily occurs during drying and storing process, many farmers sell harvested maize ears to local traders within a day and leave the milling, drying and storing process to traders.

Local traders are the most accessible buyers for farmers. Due to close proximity to the farm, various services offered, and the acceptance of all kinds of maize without quality standard requirements, farmers prefer to sell their maize to local traders. In the study area, local traders accept all kinds of maize, but the prices they offer depend on the quality of maize and market situation. With the mix of maize quality from low to high grade, traders have to handle drying, storing, grading, and finally distributing graded maize to various buyers in the upper stage of the supply chain such as livestock producers, feed factories and regional intermediaries. With regard to GAP, traders are not regulated by the government or end buyers such as feed factories and livestock producers to inspect a GAP certificate or the source and method of maize production. Because of high demand for maize in the feed and livestock industry and undersupply of domestic maize, all kinds of maize will be accepted.

Feed manufacturers such as CP and Betagro, which are the major feed manufacturers and agro-food corporate in the country, have stricter quality standards than local traders. CP, which is the most influential player in the industry, usually offers the highest price in the domestic market and in the study area. Concerning environmental sustainability, the company has implemented a traceability measure to ensure that maize supplied to the factory is produced in certified areas unassociated with deforestation. Betagro, which is the second-largest agro-food corporate after CP, offers slightly lower maize price than CP and less strict procurement standards without a traceability measure, land certificate requirement, or farm inspection. While Betagro has devoted continuous support on GAP maize production to a group of farmers in Lopburi Province in the central part of Thailand, the same kind of project has not been implemented in the northern region due to the lack of manpower. Betagro's Procurement Officer informed that there is only one team of Agricultural Extension Officers providing such

intensive support. And most importantly, GAP maize is explicitly used for feed exported to the international market, and all Betagro's exported feed is produced exclusively at the factory in Lopburi Province.

Major feed manufacturers such as CP and Betagro prefer to buy maize directly from farmers at their factory gate or buying points rather than through intermediaries. There is no minimum quantity requirement for maize sold to the factory. Small volume of maize can be accepted as long as it is transported by at least a six-wheel vehicle which is compatible for grain unloading. Moreover, only maize kernels will be accepted, so maize has to be milled before delivery to the factory. Unlike local traders, feed factories do not accept maize ears or unmilled maize. So, the handling and cost of milling, storage and transportation must be responsible by farmers. In addition to the two major feed manufacturers, there are livestock producers and smaller feed factories that are end buyers but have less strict standards.

Maize procurement standards used by feed manufacturers require that the moisture content of maize should be at 14.5%, 18%, 20% or 30% depending on the season, with 14.5% being the optimal moisture level and indicator of high quality. Other important features of maize quality are the physical condition of kernels and quantity of spoilage. Damaged grain caused by insects or molds; imperfect kernels such as broken and incomplete kernels; extraneous matters; aflatoxin; and insects such as grain moths should be kept to the marginal level. Maize procurement standards per guidelines of the Thai Feed Mill Association indicate that maize production must comply with Good Agricultural Practices (GAP) or Good Manufacturing Practices (GMP). It also specifies permissible levels of maize spoilage, as described in Annex II.

#### **4.3. Standard system for GAP certification**

Eligibility for GAP application and selection is tied with land ownership and civil registration status. To be eligible for GAP application, a farmer must have a civil registration certificate or house registration certificate and land certificate designating the ownership over the land. In addition to a land certificate, a usufruct certificate designating ownership over the land reform area is also accepted. There are still rooms for those who do not have land ownership but have made use or been in possession of the land before the Land Title Deed Issuance Act B.E. 2479 (1954) came into effect. To do so, they have to enquire a Chief Executive of the Sub-district Administrative Organization or municipal mayor to sign a form called "a certified letter on land use for sustainability certification"; however, the land must not

be prohibited by law for land occupation such as conservation area, national park, or government-owned land. For rented land, farmers have to submit a certified copy of the landlord's land certificate and a certified letter or lease agreement signed by the landlord.

“Good Agricultural Practices for Maize” ( per Annex III) sets out eight main principles with regards to water, planted area, chemical use, on-farm production, harvest, post-harvest management, transportation, worker's health and safety, and record-keeping to ensure productive, safe, and environment-friendly production. The three most important mandatory principles emphasized by Agricultural Officers and Inspectors are the prohibition of illegal land use, widespread residue burning for land clearance, and the use of hazardous chemicals forbidden by the government. Concerning the implementation, GAP certification scheme is governed by the Ministry of Agriculture and Cooperatives. The task of implementing GAP has been managed by three departments: 1.) Standards-setting is responsible by the National Bureau of Agricultural Commodity and Food Standards; 2. Program outreach for awareness-raising, application processes, training on GAP production practices, and preliminary farm audits are responsible by Provincial and District Agricultural Extension Office; and 3.) Advanced farm auditing, approval, GAP certificate issuance, and yearly inspection are done by the Agricultural Research and Development Center under the Department of Agriculture. Under the Mega Farm Project, the certification process is also supported by the Provincial Land Reform Office. To get a GAP certificate which is valid for three years, the certification process takes around 90 days and is free of cost.

#### **4.4. Institutional Context of GAP implementation**

There have been efforts by the government to promote GAP since 2015. However, the adoption of GAP in maize production has become tangible after the implementation of the Mega Farm Project – a three-year project starting in 2016 covering various types of agricultural production nationwide – led by the Agricultural Land Reform Office and the Department of Agricultural Extension to encourage farmers to form a group consisting of at least 30 farmers with the accumulated land size of no less than 48 hectares and the potential to carry out high quality and efficient mega-scale farm production. The project report developed by the Technology Transfer and Development Bureau (n.d.) stated that the goal of the project is to enhance competitiveness, income and well-being of farmers by improving production efficiency – reducing production cost, increasing productivity, reinforcing business and group management, market linkages, and upgrading products quality with GAP.

The information obtained from the interview shows that the application and certification of GAP are free of cost and fully supported by the government. There are various extension services provided as part of the Mega Farm Project and originally provided by the Department of Agricultural Extension to facilitate GAP adoption, as shown in table 4.1.

**Table 4.1 Extension services provided under the Mega Farm Project**

Extension Services	Responsible Organization
<ul style="list-style-type: none"> <li>• Awareness-raising through outreach activities</li> <li>• Application</li> <li>• Screening and preliminary farm audit</li> </ul>	Provincial Agricultural Land Reform Office Provincial and District Agricultural Extension Office
<ul style="list-style-type: none"> <li>• Farm audit and approval</li> <li>• Issuance of GAP certificate</li> <li>• Surveillance</li> </ul>	Provincial Agricultural Land Reform Office Agricultural Research and Development Center
<u>GAP-related training:</u> <ul style="list-style-type: none"> <li>• GAP standards</li> <li>• Production planning and quality control</li> <li>• Soil analysis and management</li> <li>• Utilization of chemical and organic fertilizer</li> <li>• Fertilizer use in accordance with soil nutrients</li> <li>• Integrated Pest Management</li> <li>• Safe handling of agricultural chemicals</li> <li>• Record keeping</li> </ul>	Provincial Agricultural Land Reform Office Provincial and District Agricultural Extension Office
<u>Production-related training:</u> <ul style="list-style-type: none"> <li>• Maize reproduction</li> <li>• Production of organic fertilizer</li> <li>• Production of Tailor-made fertilizer</li> <li>• Integrated Pest Management</li> <li>• Harvest and post-harvest management</li> <li>• Plowing and residue decomposition</li> <li>• Field visit to the role model farm</li> <li>• Farm management</li> <li>• Marketing and supply chain</li> </ul>	Provincial Agricultural Land Reform Office Provincial Land Development Office

<b>Extension Services</b>	<b>Responsible Organization</b>
<u>Provision of inputs:</u> <ul style="list-style-type: none"> <li>• Maize seed for reproduction trial</li> <li>• N-P-K fertilizer and organic fertilizer</li> <li>• Sunn hemp used as green manure</li> <li>• Molasses for pest control</li> </ul>	Provincial Agricultural Land Reform Office Provincial Land Development Office
<u>Laboratory test</u> <ul style="list-style-type: none"> <li>• Soil testing and analysis</li> <li>• Water testing</li> </ul>	Provincial Agricultural Land Development Office
<ul style="list-style-type: none"> <li>• Supervision of the Mega Farm Project</li> </ul>	Sub-district Agricultural Office District Agricultural Extension Office Provincial Agricultural Land Reform Office
<ul style="list-style-type: none"> <li>• Evaluation of the Mega Farm Project</li> </ul>	Provincial Agricultural Land Reform Office

Furthermore, it was claimed that the project would offer marketing supports such as linking farmers with buyers, creating market plans, and expanding access to a wider range of market outlets. However, there is little progress on marketing improvement. A Land Reform Officer in Lampang Province mentioned that there was an effort to link farmers with feed factories such as CP by inviting the company's representative to talk about marketing; however, farmers were not satisfied with the guaranteed minimum price offered by the factory at that time. In general, there has been little engagement of feed manufacturers in the project. Likewise, a Land Reform Officer in Phrae Province informed that there is no market outlet in the province offering premium prices for GAP maize. In the end, farmers have to sell GAP maize at the same price as non-GAP maize.

Concerning support from feed factories to promote GAP adoption in the study area, it is mostly limited to general trainings and field trips. For example, one farmer informed that he once joined the field trip to CP's role model farm in Nakhon Rachasima where maize production, harvest and storage were properly managed to deliver high-quality maize. Advanced technology such as electric drone flying for fertilizer and pesticide spray was also demonstrated. However, it was a one-time event. There was no follow-up training, financial support, or equipment provision to help farmers acquire such advanced technology. With

regards to sustainability standards, a farmer who supplies maize to CP informed that farm audits and GIS land mapping for a traceability measure were performed by CP's Agricultural Extension Officers without any fee before their maize get accepted by the factory. For Betagro, there is no extension support for GAP maize production in the northern region. The extension support provided in the study area mainly involves general training on marketing and procurement standards in collaboration with the Bank for Agriculture and Agricultural Cooperatives and Provincial Agricultural Extension Office. Betagro only supports GAP maize production in Lopburi Province for their exported feed production.

#### **4.5. The Mega Farm Project and GAP Adoption**

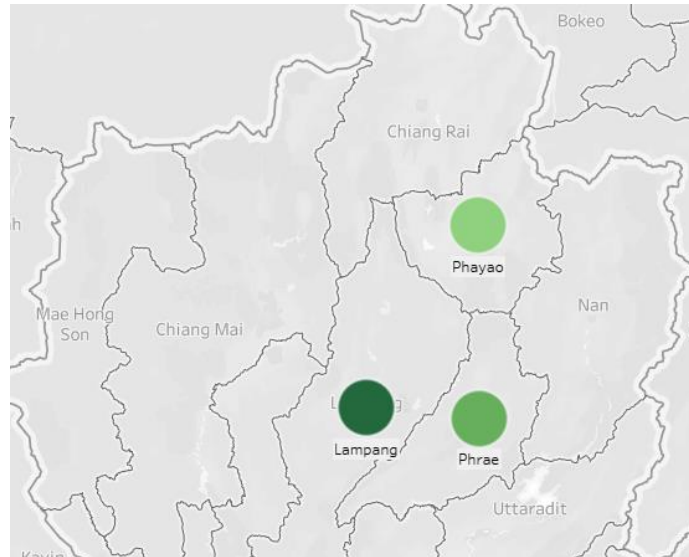
The Mega Farm Project has made GAP adoption possible for all farmers through various extension supports. Farmers in the sample group reported that they adopted GAP because it was required by the Mega Farm Project. They were eligible to participate in the project and could apply for GAP regardless of land size or production scale. They found that the application process was not complex and the initial investment was not costly because they were fully supported by the government. In addition, since maize is used for feed production, GAP requirements for maize production is not as strict as GAP for edible crop production such as rice, vegetables, and fruits. As a result, farmers did not have to undertake significant changes in terms of production methods or farm infrastructure. The things they are not allowed to do are large-scale residue burning for land clearance and the use of dangerous chemicals forbidden by the government. Concerning residue burning, all farmers mentioned that they had never or hardly burnt the residue during the land clearance and preparation phase because their farms are situated in plain areas or hilly areas where land preparation can be done by plowing.

With regards to the participation in the Mega Farm Project, promising market opportunities such as higher selling prices, higher bargaining power, assured market access; reduction of production cost; financial support; and provision of farm machinery such as maize inter-row cultivator were listed as the main reasons most farmers decided to join the project. Their most accessible and reliable source of information with respect to project participation is the Village Head. The news about the project was communicated by District Agricultural Officers and Agricultural Land Reform Officers to the Village Head and Village Assistants who then passed on the information to farmers in the village meeting, news announcement via village's speaker, and chat group on social media platforms. So, all villagers were able to access to the information. Some groups were able to recruit more than 100 farmers from different



villages and sub-districts in the first year. However, in the following years, many farmers dropped out. Some groups faced management problems and were not able to deliver mega-scale production as they had planned.

#### 4.6. Progress of the Mega Farm Project and GAP Adoption



**Figure 4.1. Location of Lampang, Phrae, and Phayao**

Across nine provinces in the North, less than one percent of maize output and planted area are GAP-certified. The data obtained from GAP registration database, as of May 2021, showed that the certified areas of 564.8 hectares were found in three provinces: Lampang, Phrae and Phayao with a total output of 3,954 tons. Although there were 526 certified farmers registered in the database, the number of farmers who still have a valid GAP certificate is much less than that because some of them did not or failed to extend the certificate after reaching the initial validity period of three years. After several interviews, it was found that farmers who are registered in GAP database are participants of the Mega Farm Project. There are several reasons that some farmers opted out from GAP and the Mega Farm Project such as the group's disagreement, low output volume, and unsuccessful seed reproduction; long distance to the main market; a decision to convert maize production to cassava; and personal reason. Out of 15 farmers interviewed, only five of them confirmed that they are currently in possession of a valid GAP certificate. Over the past years of the implementation of the Maize Mega Farm Project, different groups of farmers in each province have achieved different outcomes.

#### **4.6.1. Phayao Province**

In Phayao Province, farmers who participated in the Mega Farm Project in 2016/2017 informed that they adopted GAP as guided by Agricultural Officers but have not been able to collectively sell a large volume of maize and increase their bargaining power due to their failure to operate as a group. Many farmers had difficulties following the group's cropping schedule and production plan owing to financial urgency caused by debt repayment and children's school fee payment. After one year of participation, many members started to produce maize according to his/her own schedule. They harvested fresh maize and sold the output to nearby local shops which are 1-5 kilometers away at the price of 5.00 – 6.00 THB per kilogram. For these farmers, participating in the Mega Farm group and following GAP have not led to a better market opportunity. They mentioned that the failure is rooted mainly in the lack of group unity and leadership and partly in the discontinuation of extension support after the project completion. Moreover, some farmers mentioned that they did not know about their GAP status as they had never received a certificate, and there had been no farm inspection after the first registration. Agricultural Officer and Agricultural Land Reform Officers also informed that the Maize Mega Farm Projects in Phayao Province had ended, and the farmers' GAP certificate had not been extended. In 2021, there are no outreach activities regarding GAP maize production because the government is now prioritizing food safety for edible crops rather than industrial crops like maize. So, there is no budget to promote GAP maize production at the moment. However, general training on maize production will still be available.

#### **4.6.2. Lampang Province**

In Lampang Province, Maize Mega Farm Projects were initiated in four districts: Mae Tha, Soem Ngam, Ngao, and Mueang Pan with the support from District Agricultural Extension Office and Provincial Agricultural Land Reform Office during 2018 – 2020. Overall, participating farmers did not face significant challenges in GAP adoption. Using sustainable farming methods, they have been able to reduce production costs and increase yield. Still, group management and marketing remain the big challenges for all Mega Farm groups.

With extension support from Provincial Land Development Office, some groups of farmers have been able to reproduce maize seed using a public Nakhon Sawan-3 hybrid, produce tailor-made chemical fertilizer, organic fertilizer, and organic pesticide. However, when it comes to marketing and selling, they cannot operate as a group and, therefore, still lack bargaining power. At first, it was planned that the groups would sell their output directly to

feed factories. But in the end, they failed to deliver a large volume of maize due to financial issues, armyworm outbreak, and unattractive price, according to Agricultural Land Reform Officer. A leader of the Mega Farm Project in Soem Ngam District explained that many farmers who faced financial emergencies could not wait until the maturity period of maize cultivation. They usually rushed to harvest and sold some of their maize just enough to cover arising expenses such as debt payment and children's school fees. In Mueang Pan and Ngao District, some farmers opted out of the group due to management problems, low production volume, long distance to the group's collection point and market outlet, unprofitable production due to drought and armyworm outbreak, and a decision to replace maize with cassava. Of all farmers in the Mega Farm Projects, only ten farmers out of 50 members in 'Mae-Tha Mega Farm Group', have managed to be accepted by CP offering the highest price. However, this subgroup's manager informed that they had been in business with CP for many years before the Mega Farm Project started.

Concerning the project implementation, there are six problems raised by an Agricultural Land Reform Officer and Agricultural Officers: 1.) The Land Reform area targeted by the project is not irrigated, so maize yield was severely affected by drought; 2.) Many farmers are old and have difficulties using new technology and keeping a farm record; 3.) Many farmers whose land ownership has not been transferred from their deceased parents or ancestors faced an eligibility problem when applying for the Mega Farm Project and GAP; 4.) Most of the Mega Farm Groups faced management problems and the lack of members' cooperation to attend the group's meeting and activities; 5.) Due to different production schedules and practices as well as financial needs, many farmers prefer to sell their produce individually to local traders rather than with the group, so their bargaining power has not improved; and 6.) The number of farmers who are still actively participating in the Mega Farm Project and complying with GAP has decreased from the first year. After the completion of the three-year Mega Farm Project, farmers are expected to start a farm enterprise independently in the fourth year. Without the government's support, it is uncertain that they would continue to comply with GAP and be able to establish their own business enterprise in the future.

#### **4.6.3. Phrae Province**

Maize Mega Farm Projects were initiated in Rong Kwang and Long District in 2018. Farmers participating in the Mega Farm Group could adopt GAP with support from Agricultural Officers and Land Reform Officers. Similar to the experience of farmers in

Lampang and Phayao, they faced the same problems of cropping schedule, marketing, and group management due to individual's financial urgency and the lack of collaborative effort from the group's members. With the training and raw material provided for seed reproduction and organic fertilizer and pesticide production by Provincial Land Development Office, the majority of farmers have minimized the production cost and increased yield owing to reduced quantity of expensive farm inputs such as seed, chemical fertilizer, and pesticide. 'Tung Sri Group' in Rong Kwang District has been able to reproduce maize seed and was awarded as a role model group. The group's leader also trained other Maize Mega-Farm groups in the district on seed reproduction. However, farmers in other groups have not successfully reproduced the seed because their farmland has no access to irrigated water. Furthermore, they lack the experience and solid theoretical foundation of seed reproduction. Without access to water, follow-up training, and on-farm mentoring, it was hard for them to achieve a good result. Apart from cost reduction and yield increase, none of the Mega Farm groups in the province is able to enhance their market opportunity. In the fourth year, it was expected that 'Tung Sri Group' would set up a business enterprise. Nonetheless, it is unlikely that the group will take any further steps toward establishing a business enterprise due to complex administrative processes of enterprise registration, document preparation, and tax declaration.

With respect to the project implementation, there are seven problems raised by an Agricultural Land Reform Officer and Agricultural Officers: 1.) After GAP certificate expired, many farmers decided not to extend it because it does not add any value to their produce; 2.) Although over hundreds of farmers joined the Mega Farm Project in the first year, many of them did not actively attend the project meetings and activities and eventually dropped out in the following years; 3.) Different levels of educational background, age, assets, and financial needs of farmers has posed considerable challenges for group management. Successful operation of the Mega-Farm Project requires experienced, efficient and proactive group leaders; 4.) Some farmers, especially old farmers, could not keep a proper farm record or failed to submit their farm record and thus did not get their GAP certificate extended; 5.) There was a lack of coordination between Agricultural Extension Offices, Land Reform Offices, Agricultural Cooperatives, Provincial Office of Commerce and feed factories to improve market linkages and post-harvest management; 7.) The main factors hampering GAP compliance or the adoption of sustainable farming are the lack of market incentives and low proportion of young farmers who are ready to adopt and develop new technology and understand business management and marketing.

## **4.7. Market Participation**

### **4.7.1. Maize Commercialization and profitability**

According to Govereh et al. (1999) and Strasberg et al. (1999), a household's market participation can be measured by Household Commercialization Index (HCI) (as cited in Jaleta, Gebremedhin & Hoekstra, 2009). Zero value indicates an absolute subsistence production, and 100 indicates absolute commercialization as 100% of output is sold to the market. Considering only maize production, HCI of the household in the sample group is 100, indicating absolute commercialization as farmers sell all of their output to the market. Although it can be implied that the production is market-oriented and that farmers can participate in the market without any barrier, this high level of commercialization does not mean that they earn a high profit.

As for marketing, local agricultural shops, district agricultural cooperatives and feed factories are market outlets where maize farmers in the sample group sell their maize. The most accessible market outlet to which farmers sell their output is agricultural shops of local traders situated close to the farm. Not only do they accept all kinds of maize regardless of moisture content, contaminations, and physical condition, but they also offer various kinds of services such as transportation, milling, and input credit. However, the price at this market level is the lowest, and the price that farmers receive could be lower after the service charge is deducted. Some farmers also opt for a district agricultural cooperative if available in the area. In respect of market information, most farmers usually visit the local shops and agricultural cooperatives to check the price. The price information is also shared among friends and neighbors. Some farmers search on the internet for information about price trends and prices at different market levels to ensure that the price they get from local traders is fair. If there is more than one shop in the area, they also do market research by checking the prices from different shops for comparison before making a sale decision.

Either GAP certificate or Mega Farm Group membership does not lead to premium price or higher bargaining power. The prices that farmers receive at the local market is solely set by buyers and conditioned by the moisture content and physical condition of maize without any consideration of GAP certificate. In the study area, maize price ranges between 5.00 THB to 6.80 THB per kilogram for fresh maize of which moisture content is higher than 14.50%, and between 7.00 THB to 8.90 THB per kilogram for dry maize of which moisture content is 14.50% or lower. The highest price offered in the market is the factory-gate price of approximately 8.00 – 9.95 THB per kilogram for maize which meets the feed factories'

standards. When it comes to price-setting and negotiation, farmers have no power to bargain for higher prices or influence the buyer's procurement policy. They are merely a price-taker in the chain. Apart from the local market, there is a market outlet of feed factories in Lamphoon Province. It is found that ten farmers in Mae Tha District, Lamphoon Province are able to get access to the outlet of CP feed factory since their maize is of good quality with optimal moisture content and minimal contamination. However, their ability to produce high-quality maize is not associated with GAP adoption or the Mega Farm Project because they have already secured a long-term business relationship with CP for over 10 years. In this regard, it shows that farmers can actually get a higher selling price by delivering products that meet the end buyer's requirements.

To sum up, there are different levels of prices depending on the quality of maize and market outlets. The highest price is given to maize with optimal moisture content and physical condition. The lower the quality, the lower the price. Moreover, the price also varies at different market outlets. The highest price is given at the factory-gate for maize which meets the factory's standards while lower prices are offered by local traders. Farmers, regardless of GAP status, can participate in the market without any barrier, but only a fraction of farmers producing good quality maize can access the market outlet of CP feed factory offering the highest price.

**Table 4.2 Maize price received by maize farmers in the study area**

Province	Market Outlets	Distance to market	Price (THB)	
			moisture >14.5%	moisture $\leq$ 14.5%
Phayao	Local traders	1-5 km.	5.00 – 6.50	-
Lampang	Local traders	2-5 km.	5.00 – 6.80	7.00 – 8.50
	CP Feed Manufacturer in Lamphoon Province	85 km.	-	8.00 – 9.95
Phrae	Local traders	1-10 km.	5.00 – 6.50	7.00 – 8.90
	District Agricultural Cooperative			

Regarding the initial investment and profitability of GAP maize, since farmers did not have to bear the cost of the application, farm audit, lab test, or training, GAP adoption has not negatively affected their net income. Indeed, farmers reported that their net income had slightly increased. With correct approaches of sowing and soil nutrient and pest management and

reduction of chemical use, most farmers found that the production cost had moderately reduced and yield had moderately increased. Most farmers rated the profitability level of GAP maize production as moderate and estimated that they get approximately 40-50% profit margin. For large-scale farmers who sell good-quality dry maize at the optimal moisture level, their profit margin is approximately 55-57%. With a higher profit margin and larger sale volume, they earn a much higher income than small-scale farmers.

All farmers accepted that it is hard to indicate a definite amount of profit or long-term profitability because it depends on various factors such as input cost, selling price, market situation, and the weather condition which vary from year to year. Many farmers are very concerned about drought and armyworm outbreaks which can cause both yield loss and financial loss. Two farmers in Lampang Province mentioned that they decided to quit maize production and opt for cassava because the yield loss from drought and armyworm outbreak was unbearable. All farmers mentioned that if the weather is good and disease is under control, they can still earn a good profit. Overall, most farmers interviewed will continue to produce maize because the market is always available and domestic demand for maize is consistently high.

#### **4.8. Degree of market participation and upgrading**

Commercialized maize production in compliance with GAP under the Mega Farm Project has led to the first stage of upgrading. Farmers have reached process upgrading and partial product upgrading which are the most easily attainable levels of upgrading. Still, they have not been able to reach the full stage of product upgrading and functional upgrading and chain upgrading.

**4.8.1. Process upgrading:** Complying with GAP, farmers have improved their production efficiency leading to yield increase from 3.75 - 4.38 tons per hectare (600 - 700 kilograms per Rai) to 5.63 – 6.89 tons per hectare (900 – 1,100 kilograms per Rai) as well as reduction of production cost and chemical use especially chemical fertilizer. They have converted their way of farming from conventional farming relying heavily on chemicals without considering soil condition, seed, and sowing methods toward sustainable and productive farming minimizing chemical fertilizer and pesticide and utilizing more organic inputs, suitable types of seed and fertilizer based on soil analysis, climate and geographical condition; maintaining appropriate sowing space for optimal yield; reproducing seed; producing tailor-made chemical fertilizer and organic fertilizer and pesticide; and plowing and

decomposing residue. Farmers accepted that they are reluctant to completely abandon the use of chemicals given their immediate effect in clearing out weeds and diseases. So, they try to opt for less harmful chemicals and reduce their quantity. Some farmers reported that the quantity of chemical fertilizer used had decreased by approximately one third or half. They still use chemical pesticides and herbicides but less frequently and more safely. So, the reduction of production cost is primarily contributed by less quantity of chemical fertilizer and pesticide which are expensive and the addition of organic fertilizer which is cheap or free of cost if produced by the group. Some Mega Farm Groups such as ‘Tung Sri Group’ in Phrae Province and ‘Mae Tha Group’ in Lampang Province have been able to reduce even more production cost by successfully reproducing ‘Nakhon Sawan - 3’ hybrid which is a high-yield drought-tolerant hybrid publicly developed and distributed by Nakhon Sawan Field Crops Research Centre (NSFCRC). Moreover, despite yield decrease occurring to some farmers in the first year, GAP farming practices have led to improved soil condition and, thus, increased yield in the long term. Farmers also informed that the soil has remarkably softened and nourished leading to stronger maize stem and bigger kernel.

**4.8.2. Product Upgrading:** With a more suitable use of seed, fertilizer, pesticide, herbicide, and sowing method as well as improved soil condition, the strength of maize stem and quality of maize kernels have improved. However, low moisture content and contamination – vital indicators of maize quality at the time of selling – have not been preserved by the majority of farmers in the sample group. Selling fresh maize with high moisture content right after harvesting is common among farmers who grow maize in plain areas in Phayao and Phrae Province. They prefer to harvest and sell fresh maize instead of drying and storing them to the optimal moisture level due to complications that may occur in the drying process, such as the risk of damage caused by animals or rain or by molds and insects if kept in the storage. Also, many farmers do not have drying and storage facilities. Some farmers in Lampang Province harvested maize after field drying but sell maize ears the next day to local traders without additional drying for fear of spoilage as well as the lack of drying platform and storage. Only some farmers in Mae Tha District, Lampang Province and a few farmers in Rong Kwang District, Phrae Province who are large-scale farmers and have large storage can keep their maize dry to the optimal moisture level and minimal contamination. For maize to be accepted by feed factories, the most critical quality criteria is that kernels must be free from or marginally contaminated with aflatoxin, insect and extraneous matters. Maize weight will be deducted if there is more than 1% of extraneous matter. Only ten farmers in Mae Tha District are able to



deliver output that meets the quality standards of feed factories. Although it was expected that GAP and holistic supports under the Mega Farm Project would help improve the quality of the product to meet buyers' or consumers' standards and add more value to maize output, proper harvest and post-harvest management which are the final steps to preserve the product quality have not been followed through by the majority of farmers. Consequently, there is no significant value addition since the quality of the final output does not entirely meet the end buyers' standards.

**4.8.3. Functional Upgrading:** Most farmers in the sample group have not levelled up their capacity to take up milling, drying, storage, and distribution due to the lack of assets and extension support on post-harvest management. These tasks are still left to traders, millers or intermediaries. Only a group of 10 farmers in Mae Tha District can manage milling, storage, and distribution to the feed factory themselves. However, their ability to reach functional upgrading is not associated with the Mega Farm Project or GAP adoption. Farmers in this small group have already had both the know-how and storage to keep their maize dry to the optimal moisture level and prevent microbial growth. Milling and distribution to the feed factory are managed by the group's manager who also acts as a focal person between the group's members and CP feed factory.

**4.8.4. Chain Upgrading** has not been attained by any farmers. 100% of the output is commercialized directly to local traders or feed factories as raw materials for animal feed. There is no shift or integration of maize farmers toward other supply chains which produce different types of commodity.

**4.8.5. Horizontal Coordination:** The group establishment under the Mega Farm Project gave rise to horizontal coordination. As GAP is one of the main indicators for the Mega Farm Project evaluation, the members must join forces to attend the training and comply with GAP in order to be certified and pass the group's evaluation. Instead of leaving the individual farmer to go through the application, farm audit, and learning processes alone, joint effort in a group setting with government supports has encouraged many farmers to step out of their comfort zone and opt for GAP. There were exchanges of knowledge between members within each group through group activities and between different groups through field visits to the role model farm and seed reproduction training by a leader of the role model group. Some farmers or groups also sell maize seed, fertilizer, and pesticides which they produce to other farmers at low prices. Input sharing through collective production as well as cost-sharing

through bulk purchase of seed and fertilizer have occurred within some groups. The apparent benefits gained from horizontal coordination is cost reduction and knowledge sharing. Regarding risk reduction and bargaining power, the group setting has made it easier for farmers to request for disaster relief assistance or other forms of assistance from the government than having an individual farmer going through all administrative processes alone. However, their bargaining power has not been improved as the groups' members failed to collectively follow production plans and deliver their output as a group.

**4.8.6. Vertical coordination:** Only ten farmers in Mae Tha District, Lampang Province having the access to the market outlet of CP feed factory have been able to develop and maintain vertical coordination. However, it is not related to GAP adoption and the Mega Farm Project as it had occurred prior to their participation in the Mega Farm Project. Through the long-term business relationship with CP and CP's Extension Officers, they usually get the latest updates about the company's policy and market information such as price, market demand and supply, and the possibility of maize import from neighboring countries which could affect domestic maize prices. As a result, they can make an informed decisions and production planning which help assure profitable sales and reduce the risk from price fluctuation. Regarding production improvement, they sometimes receive a small portion of CP's hybrid seed for planting experiments, trainings and field visits to the role model farms in other provinces. But, the support is not as intensive and frequent as those provided by the government.

## **Chapter Five**

### **Factors Influencing GAP Adoption and Market Participation**

#### **5.1. GAP adoption**

##### **5.1.2. Bridging endowment gap with government support**

Extension services provided by the government in the form of awareness-raising, application support, training and provision of farm inputs under the Mega Farm Project have made GAP adoption accessible, affordable, and achievable. Regardless of age, gender, educational background, land size, and income level, all farmers in the sample group were able to adopt GAP at the beginning of the project. Since all farmers who adopted GAP identify themselves as participants of the Mega Farm Project, it can be implied that the first wave of GAP uptake among maize farmers in the North of Thailand is directly associated with the Mega Farm Project.

The Ministry of Agriculture and Cooperatives has played a prominent role as an enabler creating a supportive environment for GAP adoption through the implementation of the Mega Farm Project which sets clear objectives, indicators, targets, budget allocation, time frame, and planned activities holistically undertaken by the Agricultural Land Reform Office, the Department of Agricultural Extension, and the Department of Land Development. This is in line with Henson and Jaffee (2008) pointing out the importance of the government's role in making the participation in sustainability certification easier that "it is important to recognize that government policy and institutional frameworks create enabling policy environments for investment in certification...For example, to lower implementation costs, and thereby ease adoption and increase the chance that the net result is profitable."(As cited in FAO, 2014, p.60).

GAP adoption of farmers in the sample group is more associated with the Mega Farm Project than with the imposition of GAP as procurement standards in the maize supply chain by the Thai Feed Mills Association in 2015. Only one farmer mentioned that his main motivation to adopt GAP is related to market assurance due to the imposition of GAP as part of maize procurement standards. Many farmers are not concerned about GAP requirement in the maize supply chain because the regulation has not been effectively enforced by the government, Thai Feed Mills Association or end buyers at the downstream, and is not complied by traders at the midstream. So, it is clear that the government support through the Mega Farm

Project has played a significant role in triggering GAP adoption among maize farmers even without strict enforcement of GAP requirements in the supply chain.

### **5.1.3. Limitations of the government's support to further increase GAP adoption**

Although the Mega Farm Project has led to an uptake of GAP among hundreds of maize farmers in Lampang, Phrae and Phayao Province, it covers only a fraction of farmers and planted area. So far, GAP-certified planted area is less than one percent of the total maize planted area in the North of Thailand. Slow progress in extending, sustaining and increasing GAP adoption in the longer term can be partially linked with various limitations of the government.

The Mega Farm Project and GAP implementation are largely directed by the government's top-down policy instruction. The target areas were selected, and the project was initiated entirely by the government. In the study area, the main target group of the Mega Farm Project is farmers who have farmland in a land reform area. So, GAP adoption is largely limited to usufruct certificate holders directly overseen by the Provincial Agricultural Land Reform Office. The farmers whose farms are not in the land reform area can also participate in the project. But, those who do not have a land certificate, usufruct certificate, or certifying letter for legal land ownership signed by local authorities are not eligible to participate in the project or apply for GAP. On the one hand, the project has engaged and enabled many farmers to adopt GAP; on the other hand, the project coverage is still limited to specific areas and sections of farmers.

As for the government capacity, the supervision and support to push forward for efficient agricultural production and business management that Agricultural Land Reform Officers and Agricultural Officers had to carry out for various Mega Farm Groups not limited to maize farmers were quite intensive. So, with limited manpower and budget, it was hard to expand the project coverage to the wider agricultural areas in the province and the region within a short period of time. In regards to GAP certification outside of the Mega Farm Project, the process of application, audit and approval are handled by Provincial and District Agricultural Extension Office and Agricultural Research and Development Center. Outreach activities and trainings are normally conducted by Agricultural Officers according to policy priorities, targets and available budget allocated in each year covering all types of agricultural production. In 2021, Agricultural Officers in Phayao Province informed that the government is now prioritizing edible crops rather than maize which is used for animal feed production. As a result,

there is no budget for awareness-raising activities to recruit new applicants and training on GAP maize production. Moreover, the lack of land certificate is another problem that has obstructed many farmers from being selected for GAP application and prevented Agricultural Officers from proceeding with the application. Since the budget is limited, they have to consider and invest in the applicants who are eligible and have the potential to finally pass through all selection and auditing processes. An inspector of Lampang's Agricultural Research and Development Center and of Phrae's Provincial Agricultural Land Reform Office mentioned that there are not enough qualified inspectors, especially for industrial crops like maize and sugar cane which requires additional special training and examination. Moreover, with a growing number of GAP applications for all kinds of crops not limited to maize, they are having difficulties keeping up with the workload.

With the Mega Farm Projects in the study area coming to an end in 2020-2021, the expansion of GAP maize production would utterly be sluggish. Although any maize farmers whose land is legally certified will still be able to apply for GAP with Agricultural Research and Development Center and Agricultural Extension Office, the scale of adoption would not be as large as that occurred under the Mega Farm Project. According to all Agricultural Officers and Land Reform Officers interviewed, without proactive awareness-raising, training and, most importantly, price incentives, the majority of maize farmers would not be eager to adopt GAP.

#### **5.1.4. Inadequate market incentives and regulatory enforcement to boost GAP adoption**

According to Piñeiro et al. (2019), market-based incentives – altering market prices, improving the way the market works, and creating a new market – and regulatory incentives – effective law enforcement, flexible regulations, and accompanying measures to support law enforcement – help motivate the adoption of sustainable practices. Without worthwhile market incentives and environment protection regulations, it would be difficult to trigger a rapid and extensive surge in GAP adoption in the North. Even worse, many farmers who had earlier adopted GAP did not or failed to extend their GAP certificate after it expired.

There is neither premium price for GAP-certified maize nor barrier for non-GAP-certified maize in the market. Although maize procurement standards published by the Thai Feed Mills Association (n.d.) stated that maize production must be in compliance with GAP, it has not been enacted as a regulation in the chain or by the law. Also, there is no specification

about sustainability requirements for maize and feed raw materials in the government's Animal Feed Quality Control Act, of which the latest version was updated in 2015 (Animal Feed and Veterinary Control, 2015). Moreover, there is no mechanism to link sustainability standard enforcement between the upstream, midstream and downstream of the supply chain. While farmers and feed factories are at the center of attention, traders and intermediaries at the midstream which are the vital link between various actors in the chain have not played much role in promoting, enforcing, or complying with GAP or sustainability standards.

Among feed factories at the downstream, it is clear that there is no uniformity in GAP or sustainability standard enforcement. CP implements a traceability measure, while Betagro sets GAP requirements for maize used exclusively for exported feed production in Lopburi Province. The implementation of GAP or sustainability standards by other feed manufacturers are still unknown. At the midstream, traders/intermediaries still buy all kinds of maize from farmers without GAP or sustainability requirements. They do not give any special recognition to GAP-certified maize or reject uncertified maize. They mentioned that many feed manufacturers have unlimited demand for maize and would accept all kinds of maize even if it is not GAP-certified. In case non-GAP maize is rejected by any feed factory, several other feed factories will still buy it. It is worth noting that this situation persists because there is not enough maize to meet the domestic demand. The demand for maize has been surpassing the quantity supplied since 2004. In crop year 2020/2021, it was expected that the volume of maize output would rise to 4.8 million tons. However, it is not enough to meet the quantity demanded of 8.34 million tons (Prachachart, 2021, as cited in EXIM, 2021).

Widespread uptake of GAP in maize production is less likely to happen without market incentives and uniform regulation enforcement. Depending on the government's outreach activities alone to raise awareness on GAP or sustainable maize production would take a long time to persuade hundreds of thousands of maize farmers in the northern region to finally embrace GAP. According to all Agricultural Officers interviewed, maize farmers in general are not interested in GAP because they can still sell their maize to local traders who accept all kinds of maize and there is no significant price difference between GAP-certified maize and non-GAP maize. As GAP certificate does not lead to a better market opportunity, the farmers think it is useless to comply with GAP and get a certificate. Without the Mega Farm Project or awareness-raising activities, Agricultural Officers believe that farmers will not be interested in GAP. Without worthwhile market incentives, regulatory enforcement, and compliance by feed

manufacturers and traders, it would be challenging to turn the entire northern region into a sustainable source of maize production.

## **5.2. Market participation**

### **5.2.1. Upgrading to seize better market opportunities**

Regardless of socio-economic profiles - age, gender, educational background, land size, and income level - all farmers are able to achieve process upgrading by following GAP and have no difficulties accessing the market at the local level. However, focusing on the market access to feed factories' market outlet which offers the highest price, only a small group of farmers with the capacity to achieve process, product, and functional upgrading are able to get accepted by and enter into a long-term business relationship with the factory.

Farmers who sell maize to CP factory stated that their advantage lies with the product quality – dry maize kernels at 14.5% moisture content without or with the permissible levels of spoilage: molds, aflatoxin, insects and defect allowing them to receive the highest price of 8.00 – 9.95 THB per kilogram at the factory-gate which is approximately 1.00 THB higher than the price of 7.00 – 8.90 THB per kilogram at the local market for dry maize with 14.5% moisture content, and 3.00 THB higher than the price of 5.00 – 6.80 THB per kilogram given to fresh maize or dry maize with the moisture content higher than 14.5% at the local market. Farmers who sell dry maize with optimal moisture content to local traders can still get a good price of 7.00 – 8.00 THB per kilogram, but farmers who sell fresh maize and fail to attain the market's primary quality standards receive the lowest price. So, the product upgrading and functional upgrading which help ensure good-quality maize that meets the market requirement are vital to a better market opportunity.

The best way to get the highest price is to sell good-quality maize directly to feed factories. Comparing the price information from in-depth interviews with the price statistic collected from various market outlets in Thailand by the Department of Agricultural Economics (2021) in table 5.1, it is clear that the moisture content and access to different market outlets can make a difference in the opportunity to earn higher prices. Moreover, the level of contamination and defect also determine the final sale revenue and whether the maize will be accepted or rejected by feed factories. And if the moisture content is higher than 14.5%, maize's weight will be deducted in proportion to the moisture content level. Lower quality leads to lower prices. At the local market, the price offered by traders is lower because they

take the cost of drying, storing, grading and loss from defect into account. Sale revenue will be deducted even more if milling and transportation services are provided. So, in addition to product upgrading, farmers would benefit more if they can reach functional upgrading – managing milling, drying, and storing themselves with optimal cost – instead of leaving these processes to buyers to handle. This would be possible only when they have the economy of scale through cooperatives or group settings. Unfortunately, the lessons learned from the Mega Farm Project show that farmers failed to operate as a group.

**Table 5.1 Maize price from various market outlets and provinces in Thailand**

Province	Nakhonrachasima	Ayudthaya	Petchaboon	Nan	Phrae	Petchaboon
Market outlets	CP Feed Factory	Leam Thong Feed Factory	Siam Products Ltd. (Large Agricultural Trader)	Local Agricultural Shop/Trader	Rong-Kwang District Agricultural Cooperative	Siam Products Ltd. (Large Agricultural Trader)
Moisture content	<b>14.50%</b>					<b>30%</b>
1-Oct-20	9.25	9.10	8.30	8.20	8.10	6.30
2-Nov-20	8.85	8.75	8.20	7.95	7.00	6.20
1-Dec-20	8.70	8.80	8.40	8.10	7.80	6.40
2-Jan-21	N/A	8.90	8.30	8.15	8.15	6.30
1-Feb-21	9.15	9.10	8.40	8.40	8.30	6.40
1-Mar-21	N/A	N/A	N/A	N/A	N/A	N/A
2-Apr-21	N/A	9.10	8.50	8.50	7.80	6.50
3-May-21	8.70	9.15	8.60	8.50	7.70	6.60
1-Jul-21	9.20	9.80	N/A	N/A	7.60	N/A

Note: The price information was collected by the Department of Agricultural Economics (2021)

According to the interview, farmers whose maize gets accepted by feed factories and even farmers who sell their dry maize at 14.5% moisture content to local traders informed that they were satisfied with their income and financial security. Some of them do not have to rely on credit. This is in line with Market Link (n.d., para.1) indicating that upgrading - making production, processing and marketing more efficient through the development of knowledge and capacity to meet the buyers’ standards – is the way to “respond effectively to market opportunities [assuring farmers with] higher returns and a steady, more secure income”. Furthermore, upgrading not only enables farmers to get the access the market but also helps them maintain their position in the market (Bolwig et al, 2011; Lee et al, 2012; McCullough et al, 2008; Anandajayasekeram & Gebremedhin, 2009; Ayele et al, 2012, as cited in Kilelu et al., 2017).



### **5.3. Hindrance to product and functional upgrading**

Upgrading involves an upward trajectory starting from process upgrading to product upgrading, functional upgrading and lastly to chain upgrading (Kaplinsky & Morris, 2010, as cited in Nariuki, 2018). There are some farmers who are able to move from process upgrading to product and functional upgrading; while others are unable to do so. Various factors such as farmers' asset endowment, extension support, market and non-market institution and infrastructure play a key role in influencing their ability to upgrade, production strategies, market opportunities and livelihood outcomes.

#### **5.3.1. Insufficient asset and extension support for harvest and post-harvest management**

The quality indicators such as level of moisture content, contamination and defect are pivotal determinants of market opportunities. Farmers' assets can be linked with the ability to preserve optimal moisture content and keep contamination and defect to a minimal level. Large-scale farmers are the ones who can deliver high-quality maize owing to their capacity in production, harvest and post-harvest management, while small-scale farmers still lack the capacity in harvest and post-harvest management. In spite of process upgrading attained under the Mega Farm Project, product upgrading has not been fully accomplished because farmers still lack advanced skills and facilities to keep their maize dry and prevent spoilage caused by humidity, heat, microbial growth, and insects during drying and storing process.

To preserve grain quality, it is crucial that maize is dried to the optimal moisture level and unspoiled from breakage, molds, and insects. However, drying and storing processes are complicated. Over-drying or under-drying would lead to several complications. According to Jones, Casada and Loewer (n.d., pp.2-3):

“Overdrying grain causes cracking, darkening, and seed damage...Improper [temperature and moisture] management provides conditions for increased insect infestation and mold damage. Toxins caused by molds and kernel damage caused by insect infestation reduce the uses and value of the product being stored. In fact, the product may not be marketable if damage is extensive.”

This is consistent with the farmers' concern that any damage occurring in the drying and storing process would cause them massive financial loss. Moreover, field drying which is the easiest method may leave un-harvested maize susceptible to damage from mice, insects, rain and other

uncontrollable environmental conditions. According to GAP's recommendation, harvested maize ears have to be dried under the sun on a cement platform or in ventilated storage until the moisture content drops to at least 23% within seven days (National Bureau of Agricultural Commodity and Food Standards, 2010). But, many farmers perceive that it is too complicated and requires a proper facility. They cannot afford a storage or drying machine which would cost them a lot of money. So, it is easier for them to deliver fresh maize and leave drying and storing processes to local traders who have a drying platform, machine or storage. Moreover, many farmers who harvest dry maize even with the right moisture content still prefer to sell their maize to local traders rather than feed factories due to strict standard requirements. For example, the factories only accept maize kernels. Maize ears or unmilled maize will not be accepted. If molds or aflatoxin contamination exceeds the permissible level, the whole batch of maize will be rejected. In this case, farmers would have to find other feed factories or traders who are willing to accept lower-grade maize. Since feed factories are far from the farm, it is not worth taking the risk if their maize gets rejected or sold at a lower price while higher transportation cost must still be paid. Without enough capacity and facilities, most farmers prefer a small or moderate profit margin rather than a high profit margin which comes with high risk.

To ease the risk of damage which could occur during drying and storing process, farmers have to be equipped with sufficient skills, equipment and facilities. The strength of farmers who supply good-quality maize to CP and earn good income rests on their large-scale production and capacity in on-farm, harvest, and post-harvest management. Unlike the majority of farmers who rely on local traders for post-harvest management, this group of farmers can minimize the risk of maize spoilage during drying and storing process with their distinct know-how and large storage for post-harvest management. With a storage in place, they can also reduce the risk of price fluctuation since a proper storage allows them to keep maize safely and sell it when price rises. While the Mega Farm Project has bridged the endowment gap facilitating GAP adoption and process upgrading, it has missed out the final steps of harvest and post-harvest management which are essential to preserving maize quality. The training related to harvest and post-harvest management had been organized once or twice through GAP training and demonstration at the role model farm without any follow-up training or mentoring. Moreover, there was no investment or financial support from the government or feed factories to help farmers afford a proper storage, drying machine, drying platform, and milling machine. On the farmers' side, the problem of group management and failure to come up with a solid

business plan and result have impeded their chance of getting financial and machinery support from the government and achieving the economy of scale. As a result, product and functional upgrading have not been accomplished.

### **5.3.2. Insufficient asset despite access to credit**

The problem of financial emergency has been raised by farmers in all three provinces as a hindrance to mega-scale production and group management. Many farmers did not sell their maize collectively with the Mega Farm Group because of financial emergency despite their access to credit. On the one hand, the Mega Farm Project aims to improve market opportunities with product quality improvement, horizontal linkages among farmers as well as market linkages between farmers and buyers through group establishment encouraging farmers, especially small-scale farmers, to become part of large-scale production which they would never be able to accomplish alone. On the other hand, differences in assets, especially financial assets have weakened the group's ability to pull off unified mega-scale production and sale.

Financial or liquidity constraint plays a critical role in impeding the group's cropping schedule and output gathering. To increase bargaining power and reach an economy of scale through mega-scale production, the group members must collectively deliver their maize to the group by following a mutual cropping schedule in accordance with the group's production and marketing plan. It was expected that sowing, harvest, drying and output delivery to the group would be executed by all members at the same pace. However, many farmers had failed to adhere to the schedule. They rushed to harvest their maize and sell it immediately to local traders due to urgent financial need for their children's educational expenses and debt payment.

Despite having access to credit, the majority of farmers still face liquidity constraints because of low profit margin associated with the lack of product upgrading as well as low net income from a limited scale of production. They do not face substantial loss from maize production, but their income is not sufficient to fulfil several competing needs. Most importantly, it is not enough for them to invest in human capital: education and training for their children, family members, and the farmers themselves; physical capital: buying farm machines and building storage; social capital: actively participating in and contributing to farmers' group or cooperative; natural capital: adopting sustainable farming and environmental production; and financial capital: having enough savings and assets to further make productive investments and enjoy financial security; all of which are ultimately vital for their long term

welfare development. In spite of the access to credit, the inability to gain a high return from agricultural production would endlessly prevent many farmers from taking up alternative sustainable approaches and making a fruitful investment.

### **5.3.3. The lack of market incentives to enhance market opportunities for sustainable maize production**

The marketing policy of powerful actors in the market can influence farmers' production decision and net return from agricultural production. To encourage farmers to adopt sustainable farming practices, market incentives must be in place to generate a high return to offset sustainability-related costs and enhance profitability; otherwise, they would be reluctant to invest in long-term sustainability (Hansen, 1996, as cited in Castano, 2001). With regard to maize farmers in the sample group, the cost of GAP adoption has already been absorbed by the government; even so, the income from sustainable maize production has not significantly increased due to the lack of market incentives.

Limited adoption of GAP and unpromising market opportunity are the results of the lack of chain coordination and unclear market signals such as the announcement of GAP as procurement standards by the Thai Feed Mills Association without actual enforcement by both the private sector and government; the lack of agreement and uniformity by feed factories and traders in GAP or sustainability standard implementation; and the absence of optimal premium price for GAP maize. In this market environment, farmers do not see any substantial change which would transform their production decision. They are neither motivated by prices nor compelled by the regulation to produce sustainably. Moreover, no information or support is provided to ensure that the cost of sustainability standard enforcement and compliance and investment in upgrading would be equally shared between farmers, traders/intermediaries, and feed manufacturers. Although sustainable maize production is known to be promoted by CP and Betagro in some provinces of the central and north-eastern region of Thailand, farmers and Agricultural Officers in the study area informed that the extension services to boost GAP adoption and upgrading have been conducted mainly by the government with little engagement from traders and feed factories.

Maize price-setting in the domestic market is dominated by a few major feed factories, with CP being the most powerful price-setter. According to WWF Thailand (2018), the maize supply chain is dominated by buyers. The most powerful buyers are feed factories regarded as price-setters. From downstream to midstream, feed factories are price-setters while

traders/intermediaries are price-takers. From midstream to upstream, traders/intermediaries are price-setters and farmers are price-takers. Similarly, Achavanuntakul et al. (2014) indicated that the maize supply chain embodies unequal structure and bargaining power among various players along the chain. Feed factories, especially CP, which is the largest maize buyer and agro-food corporate selling farm inputs, feed, and livestock products, has the highest bargaining power. In addition, Pojanaprasert, Pathumnakul and Suchato (2015) stated that maize market and supply chain in Thailand have indeed become increasingly oligopolized over time.

Maize farmers who are primary producers at the upstream hold the lowest bargaining power and receive the lowest price compared to the price received by other players in the upper hierarchy. Large intermediaries and local traders would set their local price based on factory-gate prices set by feed factories, quality of maize and transaction cost for post-harvest handling and distribution. Under this circumstance, significant price increment in favor of sustainable maize production has to be initiated by feed factories and followed by traders/intermediaries. CP has already included environmental protection requirements in their procurement standards such as traceability of production source and prohibition of deforestation and residue burning. Nevertheless, the factory-gate price is around 1.00 THB higher than the price of dry maize sold at the local market. Despite the high factory-gate price, most farmers still rely on local traders rather than selling maize directly to the factories because 1.) The transportation cost to feed factories in Lumphoon Province can substantially reduce the profit margin which is a big concern for those who are not large-scale farmers and whose farm locations are too far from the factory; 2.) Due to strict standard requirements, farmers do not want to take a risk of being rejected by feed factories if kernel damage and contamination exceed the permissible level; 3.) Local traders accept all kinds of maize regardless of maize quality; and 4.) Without milling, drying and storage facilities, farmers would rather leave post-harvest handling to local traders. It is clear that the factory-gate price which is 1.00 THB higher than the local market price is not appealing for farmers. It cannot incentivize farmers to adopt GAP and offset the cost of post-harvest management and transportation.

The economic outcome of GAP maize production is not as promising as it was expected to be. On the farmers' side, process upgrading – reduction of production cost and yield improvement – has been achieved. But product and functional upgrading are still beyond the capacity of most farmers to reach. Thereby, the marketed value of their output remains low to moderate and their net income has not improved significantly. On the buyers' side, feed

factories, local traders and intermediaries have not put enough effort to incentivize GAP adoption. Although CP has implemented traceability measures to prove sustainable sources of maize production, its factory-gate price which is usually the highest price in the market is still not substantial enough to outweigh the cost of post-harvest management and transportation from farm to the factories. Without much economic gain, farmers do not find GAP maize production attractive.

**Table 5.2 Market participation and opportunities of maize farmers who adopted GAP under the Mega Farm Project**

Livelihood Assets	Standard Requirements	Institutional Context	GAP adoption	Market Participation		Market Opportunity		
				Exclusion	Inclusion	Upgrading	Market outlets	Price/kg.
<ul style="list-style-type: none"> <li>◆ Land: 2 - 80 Rai</li> <li>◆ Scale of production: small - large scale</li> <li>◆ Age: 36-62</li> <li>◆ Education: primary-secondary-high school-vocational certificate</li> <li>◆ Years of farming: 15-40</li> <li>◆ Maize net income: 15,000 - 250,000</li> </ul>	<p><b>Quality</b></p> <ul style="list-style-type: none"> <li>◆ Moisture</li> <li>◆ Aflatoxin</li> <li>◆ Insect</li> <li>◆ Defect</li> </ul> <p><b>GAP</b></p> <ul style="list-style-type: none"> <li>◆ Land certificate</li> <li>◆ Residue management</li> <li>◆ Chemicals</li> </ul> <p><b>CP</b></p> <ul style="list-style-type: none"> <li>◆ Quality</li> <li>◆ Traceability</li> <li>◆ Land certificate</li> </ul> <p><b>Betagro</b></p> <ul style="list-style-type: none"> <li>◆ Quality</li> <li>◆ No sustainable requirement</li> <li>◆ GAP (only maize for exported feed production)</li> </ul>	<p><b>Government</b></p> <ul style="list-style-type: none"> <li>▶ GAP application, certification, inspection</li> <li>▶ Lab test</li> <li>▶ Training</li> <li>▶ Input provision</li> <li>▶ Equipment</li> <li>▶ Investment (for GAP adoption but not drying and storing facilities)</li> <li>✗ Regulation enforcement</li> </ul> <p><b>Feed manufacturers</b></p> <ul style="list-style-type: none"> <li>▶ Training</li> <li>▶ Compliance (partially)</li> <li>✗ Investment</li> <li>✗ Premium Price</li> </ul> <p><b>Trader/intermediary</b></p> <ul style="list-style-type: none"> <li>✗ Compliance</li> <li>✗ Extension support</li> </ul> <p><b>Feed Mills Association</b></p> <ul style="list-style-type: none"> <li>▶ Standard setting</li> <li>✗ Regulation enforcement</li> <li>✗ Extension support</li> </ul>	▶ All	⊖None	▶ All	<p>▶ <b>Process upgrading (All)</b></p> <ul style="list-style-type: none"> <li>- Small- to medium-scale farmers achieved process upgrading and marginal product upgrading</li> </ul> <p>▶▶ <b>Process + Product upgrading</b></p> <ul style="list-style-type: none"> <li>- Some farmers achieve process upgrading and partial product upgrading – dry maize/damaged</li> <li>- Some farmers owning storage fully achieve process and product upgrading but sell maize to local traders</li> </ul> <p>● <b>Process + Product + Functional Upgrading</b></p> <ul style="list-style-type: none"> <li>- Not fully associated with GAP adoption and the Mega Farm Project</li> <li>- Process upgrading was enhanced by GAP adoption and the Mega Farm Project</li> <li>- Product and functional upgrading were achieved prior to GAP adoption</li> <li>- 10 farmers supplying maize to CP</li> </ul> <p>▶ <b>Horizontal Coordination</b></p> <ul style="list-style-type: none"> <li>- Achieved via Mega Farm Project’s group establishment</li> </ul> <p>● <b>Vertical Coordination</b></p> <ul style="list-style-type: none"> <li>- Not associated with the Mega Farm Project</li> <li>- Achieved by 10 farmers supplying maize to CP</li> </ul>	<p>Local traders</p> <p>Local traders</p> <p>Feed factory</p>	<p>5-6 THB (Fresh)</p> <p>7-8 THB (Dry)</p> <p>8-9 THB (Dry)</p>

## **Chapter Six**

### **The Unfinished Business of GAP Implementation**

#### **6.1. Conclusion**

The Mega Farm Project gave rise to the first wave of GAP adoption among maize farmers in the North of Thailand. However, it is less likely that maize production in compliance with GAP will gain any further momentum in the future as it has not led to significant improvement in the market opportunities and income. Farmers' access to the market and prices received from buyers remained unchanged. Out of four stages of upgrading which are the key to better market opportunities, GAP adoption has contributed to process upgrading which has slightly improved farmers' market opportunities owing to reduced production costs and increased yields. Yet, product upgrading which is another critical step to enhance the market opportunities has not been fully achieved by the majority of farmers. As a result, they can only access the local market offering low to moderate prices, and thus their profit margin and income have not been considerably improved. Three factors: farmer's resource endowment, market incentives, and institutions have been identified as primary factors influencing the farmers' ability to adopt GAP, upgrade, and benefit from the market. The finding is in line with Barrett (2007) stating that farmers who have all three ingredients – sufficient resources, the right prices, and enabling institution/infrastructure - would be able to participate actively and productively in the market, while those who lack one or more of these ingredients would not be able to do so.

The government has played a vital role in creating an enabling environment for GAP adoption, yet various limitations have impeded the progress. By making GAP certification accessible, affordable, and achievable, the extension support by the government under the Mega Farm Project has bridged an endowment gap enabling farmers regardless of their socio-economic characteristics and assets to adopt GAP. It has triggered the expansion of GAP uptake among maize farmers in the North of Thailand since 2016. Nevertheless, only a handful of farmers and less than one percent of total maize planted area in the North of Thailand have been certified due to various limitations of the government such as insufficient qualified personnel for farm audit; minimal policy priority given to sustainable maize production; limited area targeted by the Mega Farm Project; and complicated legal issues of land ownership and land reform in some areas which excludes farmers who do not have land certificate from getting the government support on sustainable farming, and GAP and Organic Label certification. Furthermore, the market environment has remained unchanged due to the lack of regulatory



enforcement and market incentives. There is neither premium price for GAP-certified maize nor market barrier for non-GAP-certified maize in the market. So, a widespread uptake of GAP in maize production is less likely to happen. Depending on the government's outreach activities alone to raise awareness on GAP or sustainable maize production would take a long time to persuade hundreds of thousands of maize farmers to finally embrace GAP. Without a worthwhile market incentive, standard enforcement and investment, it would be challenging to turn the entire northern region into a sustainable source of maize production.

While upgrading can be instigated by GAP and lead to better market opportunities, reaching advanced stages of upgrading requires that farmers have sufficient resources and support. GAP implementation under the Mega Farm Project has helped many farmers to upgrade, but their upgrading capacity is still limited to process upgrading which is the first stage of upgrading. Farmers who sell fresh maize to local traders and receive the lowest price of 5.00 - 6.00 THB per kilogram are the majority of maize farmers who have achieved only process upgrading but failed to reach product upgrading owing to inadequate resources and the lack of extension support on harvest and post-harvest management. Farmers who sell dry maize to local traders and receive a selling price of 7.00 – 8.00 THB per kilogram at the local market are the ones who have achieved process and product upgrading with their own capacity and government support. Many of them rely on the local market because of insufficient capacity to control contamination levels of aflatoxin, insects and extraneous matters which may result in rejection by feed factories. Some of them, despite the ability to preserve acceptable quality, still rely on the local market because of high transportation cost given long distance to feed factories or small production scale. The well-off farmers who get access to the market outlet of CP feed factory and receive the best selling price of 8.00 – 9.00 THB per kilogram are those who have accomplished process, product and functional upgrading owing to adequate asset endowment, capacity, the economy of scale, government support, and efficient group management. Their long-term relationship with the factory also leads to better access to market information allowing them to make informed decisions, get more support from the factory, and have better market opportunities. Indeed, they were able to elevate their upgrading level to product and functional upgrading before participating in the Mega Farm Project. But, adopting GAP has helped them reduce the production costs, increase yield, and improve soil condition.

Hindrances to product and functional upgrading are inadequate asset endowment and extension support particularly on harvest and post-harvest management. Most farmers who sell their maize to local market lack drying and storing skills and facilities. They perceive that these

processes are complicated and involve high risk if microbial growth and insects are out of control. Since they are not well equipped to manage this risk, they tend to give up and leave drying and storing process to local traders. Also, drying and storage facilities which require a great deal of investment is unaffordable for them. Although the Mega Farm Project has enabled farmers to adopt GAP which enhances production efficiency, the final step of harvest and post-harvest management was not profoundly supported. There was no intensive training and investment or cost-sharing for drying and storage facilities by the government or feed manufacturers. As a consequence, the produce they deliver doesn't meet one or more of the standard requirements – optimal moisture content with minimal or no Aflatoxin, contamination, and defect – thus, the marketed value of their maize is low. The sales revenue is reduced because the cost for drying, storing, grading, milling and transportation handled by traders are accounted.

The failure to pull off mega-scale production is rooted in the weakness of the farmers' group under which lies various fundamental problems of the agricultural sector such as farmers' low asset endowment, inability to upgrade, low profit from agricultural production, lack of optimal price incentives and incompetency in business management. The group's production plans and activities were obstructed by inactive participation of many farmers and their inability to adhere to the group's cropping schedule mainly due to several financial needs and emergencies. Despite access to credit, most farmers still face liquidity constraints because of low profit margin associated with a deficiency in product upgrading and low income from a limited scale of production. Without optimal price incentives for sustainable farming and concrete income opportunity from mega-farm production, they were less motivated or unable to invest their time, labor and money with the group and for sustainable production. Being able to obtain credit without being able to gain high return from agricultural production, many farmers would be trapped in a never-ending un-improvable situation which discourages them from trying out alternative approaches or making a productive investment.

The cost of GAP adoption has already been absorbed by the government; even so, farmers' income from sustainable maize production has not significantly increased due to the lack of market incentives, regulatory enforcement, and farmers' capacity to upgrade. Without chain coordination in GAP or sustainability standards implementation and optimal premium price for sustainable maize production, there would be no tangible change in the market environment. Currently, farmers are neither motivated by price nor compelled by regulatory enforcement to adopt sustainable farming. Also, it is not clear whether sustainability-related

costs would be equally shared between farmers, feed factories, and traders. Furthermore, unpromising economic gain from GAP maize production is due to the failure to reach product and functional upgrading. On the farmers' side, process upgrading – reduction of production cost and yield improvement – has been achieved. But product and functional upgrading are still beyond the capacity of most farmers to reach. Thereby, the marketed value of their output remains low to moderate and their net income has not improved significantly. On the buyers' side, feed factories and local traders have not put enough effort to incentivize GAP adoption. Without much economic gain, farmers do not find GAP maize production attractive.

It is hard to expect any transformative change to happen without a synergy between adequate and equitable access to resources, enabling institutional environment, and the right market incentives. And in the Thai agricultural sector, the perfect synergy of these three factors has not been completely fulfilled. Low return and low productivity from market-oriented agricultural production have been experienced by the majority of farmers in Thailand especially those in the rural area due to limited asset endowment, inequitable access to resources, deficient technological capacity, unfavorable market environment, and the lack of government's investment in Research and Development (Napasinsuwong, 2019; Attavanich et al., 2019; Poapongsakorn, Ruhs & Tangjitwisuth, 1998). With the experience of maize farmers who adopted GAP in the North of Thailand, it is clear that the benefit that each farmer gain from commercialized maize production varies depending on their resource endowment, institutional support received, and market incentives.

The government's support under the Mega Farm Project has made GAP adoption accessible, affordable and achievable resulting in process upgrading. However, a lack of market incentives, regulatory enforcement, engagement of the private sector, and government's resources have led to the stagnation of GAP implementation and adoption. The market opportunities of maize farmers are still limited due to their insufficient capacity to upgrade and reach an economy of scale, unattractive prices, and insufficient institutional support on harvest and post-harvest management. Moving forward, the Mega Farm Project or the project of a similar kind with more emphases on harvest and post-harvest management, market linkages, business management, and team building should be extended in the longer term and expanded to accommodate wider groups of maize farmers in the North of Thailand in order to stimulate GAP adoption and environmental protection. In addition, more collaboration should be made between the government and private sector to mobilize resources for the enforcement of sustainability-related regulations, market incentives, and capacity building.

## **6.2. Recommendations**

While the government policy and extension supports can fill the gap between farmers' pre-existing assets and required assets for GAP adoption and leveraging farmers' ability to upgrade; a long-term broad-based expansion of sustainable maize production and better market opportunities require enabling market environment – price, regulatory enforcement of sustainability standard, market channel and investment by the private sector – to ensure a worthwhile economic return for farmers. If substantial surplus can be gained through sustainable maize production, farmers would be able to save up and invest their time, effort and money to adopt alternative sustainable farming approaches, acquire advanced farming technology, actively participate in the farmers' group or cooperative, finance their children's education, and commit to environmental protection.

In the short to medium term, in order for farmers to get better market opportunities and attain higher incomes in return for their sustainable production through GAP compliance, upgrading would be the best and most effective strategy for them to increase their profit margin. For the Mega Farm Groups which have already been supported by the government for three years but failed to achieve product upgrading, additional extension supports to build farmers' capacity on harvest and post-harvest management should be initiated. Also, the Maize Mega Farm Project should also be expanded to other provinces where maize is widely grown such as Nan - the largest maize producing province in the northern region, Chiangmai, and Chiangrai. In the long term, to increase the coverage of the Mega Farm Project to help maize farmers adopt GAP and upgrade, it is crucial that the government law and policy be more accommodative and inclusive to disadvantaged farmers such as those who are not in possession of a land certificate, excluded from the government's support and susceptible to deforestation or other forms of environmental degradation. Moreover, as long as the demand for maize in the animal feed and livestock industry is still high and continues to exceed the quantity supplied, the private sector such as feed factories which are parts of large multi-national agro-food corporates should play a more active role in supporting or investing in GAP implementation and capacity building on harvest and post-harvest management which are associated with the improvement of maize yield and quality. The share of resources from private sector in this regard can also ease the problem of resource limitation faced by the government.

Regarding market incentives and enforcement of regulations for sustainable maize production, an example of the government policy on creating market linkages for Organic and GAP rice can set a good example for the promotion of GAP in the maize supply chain. According to Jiarakongmun (2017), to create market linkages and mechanisms for premium prices and sustainability standard enforcement throughout the supply chain; in 2017, the government implemented GAP and Organic certification for rice buyers: millers, local traders, intermediaries, and exporters requiring that GAP and Organic-certified rice must be purchased with premium prices – approximately 300 – 2,000 THB/ton higher than market price depending on rice varieties and types of the certificate. In return, certified buyers will be eligible for soft loans, government subsidies, or the export quota of 2,000 tons of organic rice per year to the European Union (Jiarakongmun, 2017). This positive step toward enabling market environment for safe, sustainable, and profitable rice production and supply chain could possibly be applied with maize production in the future. Yet, the progress of this policy implementation is yet unknown and requires further study. Moreover, since maize is used for animal feed production, it may not be given as high prices and as many alternative market outlets as rice, fruits and vegetables. Hence, appropriate strategies to generate optimal prices, market channels and consumer awareness on the connection between sustainable maize production and meat consumption must be holistically researched, planned and implemented.

To turn the northern region into a sustainable source of maize production by harmoniously fulfilling the goals of both environment protection and economic prosperity, GAP implementation must be integrated with capacity building on product and functional upgrading; farmers' group strengthening to reach the economy of scale; a mechanism for sustainability standards enforcement throughout the chain; and optimal market incentives for sustainable products. The findings show that advanced levels of upgrading lead to better market opportunities and GAP can empower farmers to take the first step of upgrading. To further stimulate GAP adoption and strengthen farmers' ability to attain higher levels of upgrading, according to Seville, Buxton and Vorley (2011), it is vital to have a supportive institutional setting such as investment in enhancing farmers' capacity to upgrade in order to meet production, social and environmental requirements; adjustment of the government's and buyers' policy to be more inclusive for small-scale and marginalized farmers; supply chain coordination to set clear goals and uniform standard compliance between buyer and suppliers and ensure equal share of cost and risk in the chain; effective market linkages and infrastructure; and equitable access to resources.

### **6.3. Suggestion for further research**

There are some groups of farmers who are not targeted by the Mega Farm Project or excluded from GAP application and the government's extension support such as those who produce maize in mountainous terrain and those who do not have a land certificate. Since these farmers are more susceptible to marginalization and unsustainable agricultural production causing deforestation, agricultural burning and other environmental problems, further study should be conducted to find the possibility for them to adopt GAP and receive support from the government, private sector or NGOs. Furthermore, feed manufacturers mostly support maize farmers in plain areas in the central and north-eastern part of Thailand who have already possessed a good extent of capacity to achieve the economy of scale and high product quality. So, it would be crucial to investigate why they do not put much investment in sustainable maize production in the northern region and whether the risk and cost of investment is too high.

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## Annex I

### GAP registration list of the Department of Agriculture

The list of GAP-certified farmers was accessed via <http://gap.doa.go.th/searchgap>

The screenshot shows a web browser window with the URL [gap.doa.go.th/searchgap](http://gap.doa.go.th/searchgap). The page displays a search filter for 'ตำบล' (District) set to 'ทั้งหมด' (All). A search button labeled 'ค้นหา' is visible. Below the search area, there is a table with 6 columns: 'ชื่อ - นามสกุล' (Name - Surname), 'รหัสแปลง' (Plot ID), 'ชื่อพืช' (Crop Name), 'ชนิดของแปลง' (Type of Plot), 'สถานะ' (Status), and 'รหัสแปลงเดิม' (Original Plot ID). The table contains 9 rows of data. At the bottom of the page, the Windows taskbar is visible, showing the search bar and system tray with the date 17/8/2564 and time 9:56.

ชื่อ - นามสกุล	รหัสแปลง	ชื่อพืช	ชนิดของแปลง	สถานะ	รหัสแปลงเดิม
นายชิน จิตตะ	56060200-9600-0128	ข้าวโพดเลี้ยงสัตว์	MOU	ได้รับการรับรอง	
นางทองเหลือง กาศสกุล	54021400-9600-0007	ข้าวโพดเลี้ยงสัตว์	MOU	ได้รับการรับรอง	
นางประชัน ยะนันโด้	54020700-9600-0012	ข้าวโพดเลี้ยงสัตว์	MOU	ได้รับการรับรอง	
นางรำไพ เปงแก้ว	630605-9600-0001	ข้าวโพดเมล็ดแห้ง	MOU	ได้รับการรับรอง	
นายสมบูรณ์ สุธรรม	54020500-9600-0006	ข้าวโพดเมล็ดแห้ง	MOU	ได้รับการรับรอง	
นางอรสา หมุดมื่น	54020500-9600-0005	ข้าวโพดเมล็ดแห้ง	DOA	ได้รับการรับรอง	
นางจพารัตน์ สีชาติ	54020500-9600-0024	ข้าวโพดเมล็ดแห้ง	MOU	ได้รับการรับรอง	
นางสมนึก แก้ววิเศษ	54020500-9600-0036	ข้าวโพดเมล็ดแห้ง	MOU	ได้รับการรับรอง	
นางสาวเพ็ญดาว สอนใจ	54020500-9600-0009	ข้าวโพดเมล็ดแห้ง	MOU	ได้รับการรับรอง	

## Annex II

### Permissible level of maize spoilage

Spoilage	Maximum		
	Grade 1	Grade 2	Grade 3
Damaged grain	1 %	4 %	6 %
Mold-damaged grain	0.5 %	2 %	3 %
Damaged grain with visible mold appearance	0 %	0 %	0 %
Imperfect grain	4 %	8 %	16 %
Live insects	None	None	None
Extraneous matters (tiny pieces)	0.5 %	1 %	2 %
Extraneous matters (large pieces)	0.1 %	0.1 %	0.1 %
Aflatoxin	10 ppb	20 ppb	50 ppb

Note: Reprinted from "Maize Procurement Standards," by the Thai Feed Mill Association, n.d.  
Retrieved from <http://www.thaifeedmill.com/tabid/57/Default.aspx>.

## **Annex III**

### **Eight principles of Good Agricultural Practices for maize production**

**Eight principles of Good Agricultural Practices for maize production**, according to the National Bureau of Agricultural Commodity and Food Standards, Ministry of Agriculture and Cooperatives (2010).

- 1.) Water used in agricultural production must not be contaminated with hazardous substance. Sample of water should be tested in accredited lab before the production begin.
- 2.) Planted area must be legal according to the Land Act. It must not involve any form of environmental degradation and must not be contaminated with hazardous substance or situated in the industrial area. Sample of soil should be tested in accredited lab.
- 3.) Agricultural chemicals use and handling must be in compliance with the Department of Agriculture's guidelines and regulations as well as the product's direction for use. Hazardous chemicals banned by the government such as Chlorpyrifos, Chlorpyrifos-methyl, Paraquat, Paraquat Dichloride, etc are prohibited. To keep the pest under control without relying heavily on toxic chemicals, farmers shall use Integrated Pest Management.
- 4.) On-farm production must be sustainable. Maize seed must be in good quality, suitable for the soil and climate, and come from reliable sources. Residue burning for the purpose of land clearance and preparation is prohibited. Burning unearthed weed if there is uncontrollable disease outbreak and burning infected leaves can be done outside the planting area. Type and quantity of chemical fertilizer used should be in accordance with soil nutrients and reduced by an uptake of organic fertilizer to improve soil biophysical properties. To prevent soil erosion, maize should not be planted on a land with more than 10% slope. Otherwise, terracing should be made.
- 5.) Harvest should be done 110 days after sowing for crop starting in rainy season and 120 days for crop starting in dry season or according to recommended period of each breed. A suitable moisture content for harvesting is 25% or lower and should not exceed 30%. To prevent aflatoxins, harvested maize ears must be sun dried for 2-3 days or air dried for 5-7 days to keep the moisture below 23%. Maize ears with

more than 30% moisture content and maize seed must be sold within 24 hours. Facilities for maize drying and storing must be clean, dry and not exposed to the rain and humidity.

- 6.) Transportation should be carried out on clean and dry container which is uncontaminated and unexposed to rain and humidity.
- 7.) Measures to ensure workers' health and safety should be in place.
- 8.) Record keeping with regards to sources of farm inputs, hazardous chemicals use, planting and harvesting, and buyer's information should be regularly maintained and kept for more than 2 years.



## Annex IV

### In-depth interview questionnaires

1. Name: \_\_\_\_\_
2. Address: \_\_\_\_\_
3. Age: \_\_\_\_\_
4. Gender:  male       female
5. Level of Education:     Elementary School                       High School  
     Vocational Training School             Bachelor's degree  
     Others (please specify) \_\_\_\_\_
6. Years of experience in farming: \_\_\_\_\_
7. Apart from being a farmer, do you have off-farm jobs?  
 Yes, please specify: \_\_\_\_\_                       No
8. Total income from maize production: \_\_\_\_\_ THB
9. Debt (THB)  
 less than 100,000                       100,000 – 250,000  
 250,001 – 500,000                       more than 500,000

#### 10. Land

How much land do you use for maize production? And for other crops?

Ownership	Size (ha.)	Land Certificate	
		Yes	No
<input type="checkbox"/> Own land			
<input type="checkbox"/> Family land			
<input type="checkbox"/> Rented land			
<input type="checkbox"/> Other, _____			

11. When did you adopt GAP?
12. Why did you decide to adopt GAP?
13. How did you learn about GAP?
14. What kind of change did you have to undertake to adopt GAP?
15. Did you have to put more investment to adopt GAP?
16. Was the initial investment cost high? What was the cost related to?
17. How was GAP application and certification process?

18. Did you have to pay for application, farm audit, lab test, and certificate issuance?
19. What kind of extension support did you receive?
20. Comparing GAP with conventional production, what are the difference in production process?
21. Do you sell maize individually or with the group?
22. Where do you sell maize? How far is it from your farm?
23. How do you transport maize to the market?
24. Do you sell dry or fresh maize? Why?
25. How much price did you receive from buyers?
26. Can you bargain for better price?
27. Is being GAP certified give you any market advantage? Why? (price, bargaining power, market channel)
28. How do you find market information?
29. How much is the production cost?
30. How much income did you earn?
31. How much profit did you earn?
32. Are you satisfied with your income? Please rate: slightly, moderately, highly satisfied.
33. What are the changes or result of maize production in compliance with GAP?
  - Production process
  - Production cost
  - Farm inputs: seed, fertilizer, pesticide
  - Yield
  - Quality of kernel
  - Income
  - Environment
34. What are the challenges in complying with GAP?
35. What kind of supports provided under the Mega Farm Project?
36. What are the benefits and challenges of the Mega Farm Project?
37. Are you satisfied with government support?
38. What kind of extension support have you received from private sector?

## **Government Officials**

1. When did you first initiate GAP implementation?
2. What is the process and cost of GAP certification?
3. What are the eligibility criteria for GAP application?
4. Which area are you responsible for?
5. What kind of extension support did you provide with regards to GAP adoption?
  - Training
  - Provision of input
  - Marketing
  - Equipment
  - Financial support
6. Please explain about the Mega Farm Project and GAP implementation?
  - Progress
  - Challenges
7. Has GAP certificate led to better market opportunity? Why?
  - Price
  - Bargaining power
  - Expansion of access to different market outlets
  - GAP enforcement
8. Do you think maize production in compliance with GAP will be sustained?
9. Without outreach activities by the government, do you think farmers would take their own initiative to adopt GAP?
10. Why aren't maize farmers not interested in adopting GAP?

## **Feed factory**

1. Please explain your company's procurement standards for maize.
2. How do you determine the price?
3. Do you require GAP certificate and land certificate?
4. Do you give price premium for GAP maize?
5. What kind of extension supports do you provide to promote sustainable maize production?
6. How many buying points do you have? Where are they located?
7. Is the volume maize bought by your factory enough for feed production?

**Local trader**

1. Do you check GAP certificate or land certificate before buying maize from farmers?
2. Is there any system to check the source of maize production?
3. Is there any sustainability standard enforcement for maize procurement?
4. What kind of maize do you buy?
5. How do you determine the price?
6. What kind of services do you provide?

## **Declaration of Authenticity**

I, Ms. Jittawadee Tantihachai, hereby declare that the work presented herein is my own work completed without the use of any aids other than those listed. Any material from other sources or works done by others has been given due acknowledgement and listed in the reference section. Sentences or parts of sentences quoted literally are marked as quotations; identification of other references with regard to the statement and scope of the work is quoted. The work presented herein has not been published or submitted elsewhere for assessment in the same or a similar form. I will retain a copy of this assignment until after the Board of Examiners has published the results, which I will make available on request.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_