In the Era of Climate Change: Moving Beyond Conventional Agriculture in Thailand

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ABSTRACT

Thailand is ranked among the top 10 countries most vulnerable to climate change, and its farmers have faced the risk of natural disasters almost every year for nearly 30 years. However, those affected by climate change have also been the largest contributors to climate change, increasing the risks they will face in the near future. The intensive use of chemical pesticides in conventional agriculture has harmed not only the environment and biodiversity but health of both users and consumers. Responding to these problems, several policies have been put in place over the past decades to reduce pesticide usage as well as to encourage farmers to switch to low-carbon and low-pesticide agriculture, namely, organic agriculture.

This study reviews policies related to the development of organic agriculture in Thailand and examines whether organic agriculture is an effective adaptation and mitigation strategy to climate change that can also generate enough food. This study finds that the organic sector has been largely driven by the private sector, particularly the agricultural cooperatives and non-governmental organizations (NGOs), which have provided various support ranging from technology transfer, production, financing, distribution, to marketing of organic products. Their role is vital in encouraging farmers to switch to organic farming and growing market opportunities for organic goods. Nevertheless, constraints including inconsistent policies and limited support from the government remain, which, to some extent, weakens the efforts to build sustainable agriculture and climate resilience. To improve organic farming, there is a need for the government agencies to work together with all relevant stakeholders in the organic sector, namely agricultural cooperatives, NGOs, and consumers.

Keywords: Thailand, organic agriculture, climate change adaptation, agricultural cooperatives, sustainable development

JEL code: Q1, Q5

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INTRODUCTION

Climate change is one of the most significant threats facing the world today. The Intergovernmental Panel on Climate Change (IPCC 2015) predicts that the pace of climate change will be faster than before, and advises that risks may vary depending on how humans are trying to adapt to climate change over the next 20 to 30 years. In other words, limiting global warming to 1.5°C would depend on how fast humans can make a transition to a low-carbon system in land, energy, industry, buildings, transport, and cities (Hoegh-Guldberg et al. 2018).

Southeast Asia, consisting of many island nations, is considered as one of the regions that is most vulnerable to climate change. Countries in this region are vulnerable not merely due to their geographic location, but also because of how a large share of their populations have a livelihood that is highly exposed to nature (ADB 2010). This means that those countries are subject to other climate change-induced social problems such as life destruction, food shortage, disease, and migration. All these create unprecedented challenges for millions of people in this region, which is already burdened by poverty and oppression (UNDP 2016). Further, more than half of their population resides in rural areas, engaging in agriculture and its allied activities (OECD and FAO 2017). While the importance of the agriculture sector in the GDP and employment may have declined in most Southeast Asian countries over the past 20 years, a large share of the population is still engaged in agriculture. As such, climate change is expected to cause significant harm to the agricultural economy and the farmers in these countries.

The purpose of this study is to explore effective mechanisms to strengthen climate resilience in Thailand, which is included in the top 10 countries most affected by climate change (Eckstein et al. 2018). Thailand, thereby, faces the risk of massive flooding in the near future, and a large part of the country is projected to be heavily inundated by 2030 due to extreme rainfall and changes in weather patterns. Thus, millions of lives in this country are at immediate risk, and urgent actions are needed to strengthen their resilience to climate change.

In Thailand, often referred to as the "Rice Bowl of Asia", agriculture is one of the most important sectors in the economy. The sector provides livelihood to more than 30 percent of the total workforce and remains the world's leading exporter of rice, rubber, canned pineapple, sugar, fish, tuna, tapioca, and tiger prawns (Rayfuse and Weisfelt 2012). As such, the environmental risks that Thailand and this sector face do not only concern food security of its population but also of those relying on food from this country. The problem is that agriculture in general is both a victim of and a contributor to climate change. A substantial amount of greenhouse gas (GHG) is emitted in the production process and this greatly contributes to global warming and climate change.

Such inherent problem in agriculture becomes even more problematic in Thailand because of its extensive use of agricultural chemicals. Thailand has long been among the world's top users of agricultural chemicals despite the relatively small size of agricultural lands (Sanitsuda 2016). As of April 2017, Thailand ranked fourth in annual pesticide consumption after China, the US, and Argentina (Pariona 2017). The excessive use of agrochemicals in conventional agriculture has several harmful effects on the soil, ground, surface water, and even the atmosphere, ultimately resulting in low agricultural productivity (Panpluem et al. 2019). This explains the reason for the falling yield of agricultural products that in 2017, the GDP share of agriculture was only 6.3 percent (World Bank 2018).

The exposure to excessive use of pesticide is one of the major public health problems in this country. Between 2007–2013, there were about 49,000 to 61,000 reported cases of pesticide intoxication each year with morbidity rates ranging from 76.4 to 96.6 per 100,000 people (Tawatsin 2015). Most cases were found predominantly in the central region (31%–36%), followed by the northeastern region (27%–31%), and the southern region (18%–19%). The foregoing closely resembles the geographic distribution of farms in Thailand.

Thus, while the climate risks are alarming, the health risks posed by using agricultural chemicals are also pushing a public demand for chemical-free produce. Additionally, more and more people are realizing that shifting toward chemical-free farming is important for the environment and the safety of farmers and consumers.

In response, organic agriculture has been promoted in Thailand as a type of low-carbon and low-pesticide agriculture. Organic agriculture is not merely about polluting less in the food production. It has multiple benefits, including sequestering large amounts of carbon to the soil, enhancing the adaptive capacity of farmers through strengthening agro-ecosystem, diversifying crop and livestock production, and improving farmers' knowledge about sustainable farming practices, as well as developing good eating habits for both producers and consumers (Burlingame 2012; WHO 2012). In a future of unpredictable weather events, such robust and resilient food production will gain more competitiveness for permanent adaptation, food security, rural development, sustainable livelihoods, and positive human health.

While organic agriculture was initially practiced from the 1980s in Thailand, it began to really take off from the 1990s as enabling policies were formulated around the time to promote organic practices. As a result, the number of organic farmers increased from 2,500 in 2003 to 44,418 in 2019 (Willer and Yussefi 2006; Office of Agricultural Economics 2020). While this number represents such a small share (0.003%) of the total farmers in Thailand, the Thai government has set ambitious goals to further expand the area under organic farming. It aims to become the center of organic production and trading in the ASEAN region. Thus, it is critical to examine its potential in bringing positive impacts to farmers and the environment.

METHODOLOGY

This study collected various documents, journal articles, newspaper articles, and publications from government agencies and ministries and international organizations to amass information and data to describe the local organic sector. The author used GIS software to map the spatial location of key supporting organizations in agriculture.

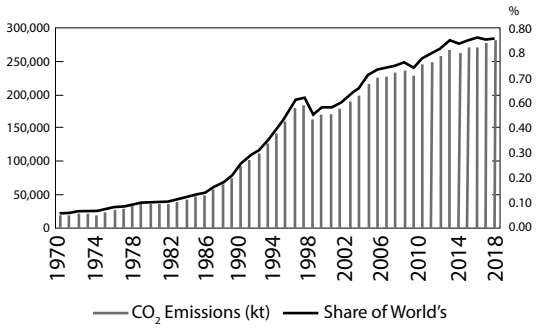
This study aims to examine whether organic agriculture is a sustainable approach to solving the problems encountered in conventional agriculture, as well as to assess its potential in building sustainable agriculture and climate resilience. Specifically, this study (1) reviews the development policies of organic agriculture; (2) identifies the key players who have committed to helping farmers go organic; (3) examines challenges and problems experienced in the conversion to organic agriculture; and (4) provides policy insights on how to further improve organic agriculture to strengthen community resilience to climate change and drive the country toward a sustainable development path.

Current Trends of Greenhouse Gas Emissions in Thailand

According to the Emissions Gap Report (UNEP 2019), the efforts of reducing GHG emissions in each country, in line with the Paris Agreement, are not enough to decrease the levels to a more sustainable level. Due to such a low level of commitment, it is projected that global carbon dioxide (CO_2) emissions will be over twice of what it should be by 2030. To prevent an even more dangerous level of climate change, there is a call for countries to shift to a low-carbon pathway.

The level of commitment demanded of Thailand in terms of GHG reduction is even greater than most countries. In 2017, Thailand ranked as the 20th largest GHG emitter in the world, generating 278,270 kiloton (kt) (Frohlich and Blossom 2020). As seen in Figure 1, Thailand's CO_2 emissions have more than tripled between 1990 and 2018, growing at an average annual rate of 4.79 percent. At the current rate, its GHG emissions would soar to 555 million tons of CO_2 in 2030 under a business-as-usual scenario, up from 230 million tons in 2000. Under the Paris Agreement, Thailand has pledged to keep its 2030 emissions at 20 percent below business-as-usual (or BAU) levels.

Figure 1: Thailand CO_2 emissions (metric tons)



Source: European Commission (n.d.)

According to the 2nd Biennial Update Report (SBUR) of Thailand (ONEP 2018), agriculture accounted for 21.9 percent of the country's net GHG emissions in 2013 and nearly 55 percent of it came from rice farming. The problem is the massive rice cultivation area in Thailand at 11.27 million hectares, accounting for approximately half of the Thailand's total agricultural area (USDA FAS 2019). These areas also produce methane (CH_4), a gas that is about 25 times more damaging to climate than CO_2 (NAMA Facility 2020). In 2012, methane emissions for Thailand was 106,499.2 kt of CO_2 equivalent, growing at an average annual rate of 1.2 percent (Knoema 2019).

Development of Organic Agriculture in Thailand

While organic agriculture was initially practiced from the 1980s, it began to really take off from the 1990s as an alternative strategy to foster sustainable agricultural development in Thailand. In 1997, the Organic Agriculture Certification Thailand or ACT was set up to commence organic farm inspection and certification (Panyakul 2003). By 2002, the Department of Agriculture established the Organic Crop Institute and promulgated "Organic Thailand" as a national logo. It was in response to depressed farm prices and declining productivity in conventional agriculture, a growing concern for the health risks of farmers and consumers, and the trend to protect the environment and biodiversity (Ellis et al. 2006). Yet, there were no specific policies and programs on organic agriculture until 2005.

In 2005, organic agriculture was included in the government plan for the first time as an innovative and sustainable approach to solve problems in conventional agriculture and develop sustainable agriculture. It has been included in every plan since then (Mingcha and Pradtana 2008).The organic agriculture policy was approved by the Cabinet as part of the national agenda and was later set up as the first National Strategic Plan for Organic Agriculture Development (2008–2012). The second plan (2013–2016) aimed to reduce chemical use by 50 percent in four years, increase areas for organic farming, and increase the market for organic products (NESDB 2008; OAE 2013). To fulfil these objectives, the government conducted a number of pilot projects including supporting 4.25 million farmers to use organic inputs instead of chemical fertilizers, covering 13.5 million ha (GreenNet 2016). However, the total budget allocated for organic agriculture development in the period 2013–2016 represented only around one percent of the total budget for the national plan (Bureau of Budget 2013).

In 2012, the Cabinet established the National Organic Agriculture Committee to guide, monitor, and oversee the implementation of policies and strategies for organic agriculture (The Government Public Relations Department 2014). As a "control tower", the committee created a more comprehensive program to promote organic agriculture by integrating all related plans and measures by all the relevant ministries. It brought on board the Ministry of Agriculture and Cooperatives, the Ministry of Commerce, and the Ministry of Science and Technology so they could work together to develop a productive plan. But only having government agencies on board, this top-down approach excluded the voices of all other major stakeholders from the grassroots communities and the private sector.

In 2017, the Cabinet set up a new five-year strategic plan on the development of organic farming for 2017–2021. Under this plan, a new program was launched with an aim to convert

160,000 ha of standard rice cultivation to organic and produce over one million *rai*[1] of organic rice (400,000 t of paddy/year) (NCOAD 2017). The Thai government invested about USD 25 million in 2018 to provide technical and financial support for the participating farmers. If successfully converted, such expansion will represent a 500 percent increase in the total organic rice cultivation area and a six-fold increase in the domestic supply of organic rice.

Despite such continuous support of the Cabinet for organic agriculture and various national-level projects and initiatives, organic agriculture in Thailand is yet to be considered a success because the lack of institutional capacity and support have not matched the ambitious policy goals. This led to such a slow annual growth rate of organic agriculture at 0.1 percent over the past decade (Pattanapant and Shivakoti 2013; Chinvarasopak 2015; Win 2017). In 2019, there were approximately 85,059 ha of certified organic land (up by 2,380% over just 3,429 ha in 2001), now constituting around 0.4 percent of total arable land in Thailand (Land Development Department 2019). Moreover, there has been lack of coordination and cooperation between relevant agencies. While the government has vowed to promote organic farming, the Ministry of Agriculture and Cooperatives, which is in charge of agriculture development, came up with contradictory policies such as promoting products like genetically modified organisms and purchasing agro-chemical inputs for farmers participating in government-funded projects (GreenNet 2016; Arunmas 2018). Thus, inconsistency in policies and little support from the government have tended to slow organic conversion resulting in its slow development.

Supporting Organizations

Shifting to organic farming is not as simple as just growing a different crop form. Even if the government succeeds in convincing farmers to turn low-carbon or organic, individual farmers cannot make this shift unless the government provides the necessary assistance and techniques on organic production of rice such as managing soil fertility and tackling weeds and insects without herbicides and insecticides (Pattanapant and Shivakoti 2013). Most farmers in Thailand are smallholders and they are often heavily indebted due to low commodity prices, among other reasons. Thus, they lack the money, knowledge, and training to produce organic rice and the network to access domestic and international markets. Moreover, during the first years of transitioning into organic practices, yields would normally drop after weaning from farm chemicals (Gillman 2008). With such uncertainty, it is nearly impossible, at least in the organic farming sector, for farmers to survive on their own.

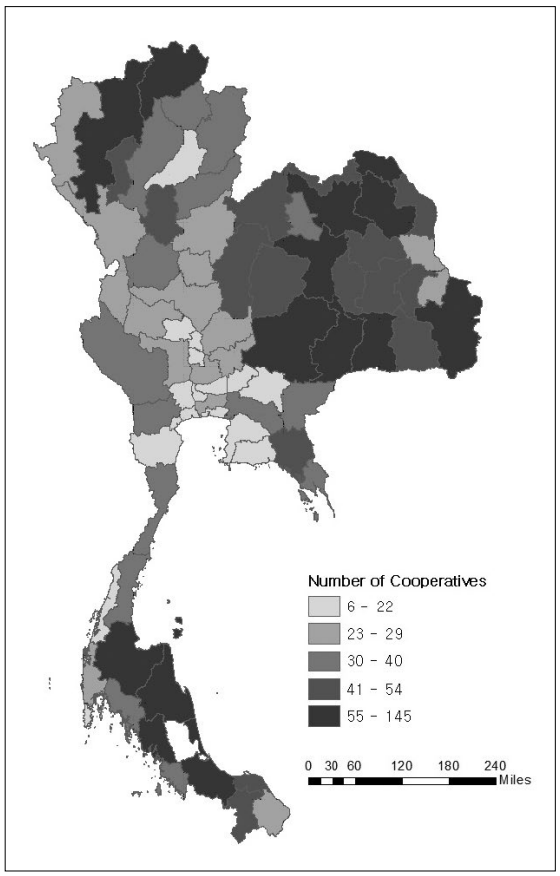
In Thailand, much of education and training in organic agriculture comes from private companies, cooperatives, NGOs and other grassroot support farmer groups. Among 44,418 organic farmers in total, some operate alone, but most are cooperative movements of which 7,110 are registered in Thailand as of March 2020 (CLT 2020). Of these, about 50.3 percent are agricultural cooperatives.

Figure 2 shows the geographic location of these cooperatives in 77 provinces; they are divided into five equal-sized sub-groups based on quintile. The largest number of agricultural cooperatives is found in the north-eastern, southern, and central regions, constituting 36.32 percent, 22.05 percent, and 15.87 percent, respectively. There is large-scale production of rice and rubber in these regions. More than 50 percent of the total rice lands are located in the northeastern and central regions, whereas the southern region hosts 68 percent of all rubber tapping areas in the country (Chainuvati and Athipanan 2000). Despite the rapid progress in organic production, the most recent available information and data is not comprehensive enough to map the location of organic farms and/or their corresponding cooperatives.

The country's extensive network of cooperatives has been helping farmers to shift to organic farming practices through knowledge-sharing and the provision of loans (Green Net Cooperative n.d.; Sanitsuda 2016). Their support

1 1 *rai* = 1,600 m^2

Figure 2. Geographic presence of agricultural cooperatives



Note: Author-generated map with data/information from CLT (2020)

comes in various forms, ranging from technology transfer, provision of farm inputs such as organic seeds, distribution of organic products into local and international markets, to setting fair and reasonable market prices based on the production and logistics costs to generate sufficient income for farmers (Pattanapant and Shivakoti 2013). Normally, when individual farmers lack the scale or capacity to contract directly with buyers, they have no choice but to accept community pricing. Cooperatives consisting of many farmers are empowered to negotiate and fill orders for large domestic and international buyers. Thus, farmers, especially smallholders, take advantage of economies of scale in the process of product procurement, sorting, storing, and delivering to the processor, among others, resulting in higher profits (Food and Fertilizer Technology Center 2017). Subsequently, organic produce in Thailand is sold to domestic supermarket chains and abroad mainly through local cooperatives and NGOs (Pattanapant and Shivakoti 2013). In 2017, the total market size for organic food and beverage went up to USD 15.6 million from USD 9.3 million in 2011, growing with an annual sales rate of seven percent (Statista 2018; EU Gateway 2019).

The northeast region has been particularly successful in converting to organic farming resulting from experiences in droughts and floods, with many of the standard rice seeds not surviving through the long-term climate change impacts. To cope, many farmers, particularly in the Surin and Yasothon provinces, turned to climate-resistant seeds and grew them organically with help from local cooperatives. Numerous cooperatives have supported its members in switching to organic production, especially for jasmine rice that is proven resistant to flash floods, drought, and salinity. These cooperatives include the Rice Fund Surin Organic Agriculture Cooperative, Bak Rua Farmer Organisation, Nature Care Society, Nong Yo Natural Organic Agriculture Cooperative, Organic Agriculture Cooperative Surin, Organic Jasmine Rice Produce Group, Loeng Nok Tha, Thai Caroen Organic Agriculture Cooperative, Than Lux Cooperative, Prasaat Agriculture Cooperative, Ban Um-sang Rice Community Enterprise, and Nong Yang Organic Rice Growers Group. Every year, these cooperatives collect around 200–3,000 t of rice from their farmer members (Makita and Tsuruta 2017). These farmers make more profits now using standard conventional rice seeds with larger market premiums and are exposed to less toxic chemicals.

The oldest cooperative, which is deemed to have started organic rice production, the Rice Fund Surin Organic Agriculture Cooperative Ltd, was established in 1992 with 100 farmers. They invested in research on better organic farming methods over the past decades and spread the benefits of organic farming across the nation (Mekong Common 2016). In tandem, Rice Fund Surin developed its own export business network,

eventually registering itself as an independent exporter and received Fair Trade certification in 2005. The cooperative also obtained additional organic certification from the EU and the US National Organic Program. Over the years, Rice Fund Surin has gradually decreased opportunities for wealthier farmers to join and use its services to preserve its original objective, to serve small farmers. By giving easier access to markets, Rice Fund Surin and other cooperatives in this region helped build the capacity of marginalized farmers and as a result, those farmers were able to earn a good income, revive their health, and restore their environment while contributing to thriving local communities.

Challenges to the Growth of Organic Farming

a. *Lack of consumer demand*

Constraints inherent to organic farming slowed the conversion to organic production and, to some extent, weakened the efforts to promote organic products (Wheeler 2008; Pattanapant and Shivakoti 2013; Kerdnoi 2014). These constraints include (1) lack of governmental and institutional support; (2) negative perceptions toward organic farming; (3) high costs of and complicated certification process; (4) inadequate information on the benefits of organic products and its labels; and (5) lack of domestic demand due to high prices. Many Thai consumers, including those living in urban areas, are unaware of the unique characteristics and benefits of organic products (Yiridoe, Bonti-Ankomah, and Martin 2005; Roitner-Schobesberger et al. 2008). Therefore, consumers are unable to distinguish organic from non-organic produce, thus weakening farmers' incentives and efforts to convert to organic farming.

Educating consumers in Thailand is quite difficult with a wide variety of competing "safe food" labels. The terms used on these labels include "safety food", "quality food", "non-toxic food", "health food", "chemical-free", "pesticide-free", "hydroponic", etc. (Haas et al. 2010; Roitner-Schobesberger et al. 2008). These numerous and varied labels confuse consumers and prevent them from choosing authentic "environmentally superior products".

Capital Rice Company and Green Net Cooperative dominate the organic food market in Thailand, with 45.1 percent and 16.5 percent market shares, respectively (EU Gateway 2019). Green Net Cooperative, the largest in the industry, began its business in 1993, and produces and distributes a variety of organic products including non-food items (e.g., clothing, toiletries, cosmetics). Rice Fund Surin used to export its produce through Green Net Cooperative until it became an independent exporter in 2005. Its membership in Green Net Cooperative served as a stepping stone to becoming an independent network. Green Net's sales reached approximately USD 2.5 million in 2015 with around 1,000 members. This is a huge achievement from just a few hundred US dollars in 1993 (Pattanapant and Shivakoti 2013; Tanrattanaphong 2015).

Regardless of this success, the organic market remains a niche sector in Thailand. About 0.3 percent of the country's agricultural land is certified as organic, compared to one percent worldwide (SCB Economic Intelligence Center 2017). Such a small share of organic land may be an outcome of low consumer demand for organic products, which appears to result from the lack of information and awareness on the benefits of organic products. Consumers are not unwilling to pay for the premium as evidenced in recent years by people's increasing interest in a healthy lifestyle. Table 1 shows that Thai people's consumption level of healthy foods and beverages has been on the rise even though these products are generally more expensive than their standard counterparts. This implies that if sufficient information about organic products' benefits were given, Thai consumers would be willing to pay more for them. Currently, the percentage of choosing organic foods over other healthy counterparts is nil with organic food sales constituting nearly zero percent of the total healthy food sales. The role of cooperatives therefore, particularly Green Net, is very important in promoting organic products in Thailand. Green Net, along with

Table 1. Organic food and beverage consumption trend (USD million)

	2014	2015	2016	2017	2018	2019
Health and wellness products consumption (a)	4,734.8	4,974.4	5,102.1	5,236.1	5,382.1	5,523.5
Organic packaged food and beverages consumption (b)	12.1	13.2	14.4	15.6	16.7	17.8
(b) as a % of (a)	0%	0%	0%	0%	0%	0%

Source: Global Organic Trade Guide (n.d.)

support from the Earth Net Foundation, has been trying to increase people's confidence in organic products. It informs consumers of the differences among various food safety labels in Thailand, the importance of consuming organic produce, and pursuing environmentally responsible lifestyles in general (Roitner-Schobesberger et al. 2008; Green Net Cooperative 2020).

b. *Farmers' reluctance to adopt organic agriculture*

Another major constraint to organic conversion is farmers' fear of dramatic decline in yields and income (Eyhorn 2007; Pattanapant and Shivakoti 2013; Makita and Tsuruta 2017; Pongsrihadulchai 2020). Revenues from crops are the main sources of income and low returns put the economic survival of the household at stake, especially for the smallholders. These include costs such as putting food on the table, sending children to school, and getting adequate healthcare. Many studies (Bertramsen and Dobbs 2002; Nieberg and Offermann 2003; OECD 2003; and Carambas 2005) compared organic agriculture to conventional farming with regard to their yield and return. It was found that yield from organic rice production is generally lower than the conventional rice production. But such decline in the yield is a temporary outcome in early stages of the conversion process. Once the transition period has passed—usually in three to five years—organic crop yields often catch up with conventional yields (Gillman 2008).

Pattanapant and Shivakoti (2013) conducted a survey of 72 farmers (37 organic farmers and 35 conventional farmers) in Chiang Mai province in 2007 and about 60 percent of the respondents reported that their yields are like those of conventional farmers. Moreover, they generated higher income and profits than for conventional agriculture due to the reduced input costs incurred in the organic system. We computed the benefit-cost ratios using the data provided by the farmers during the survey and found that in both types of agriculture, the ratio was less than one except for organic rice and vegetables, which came out nearly equal to one, greater than that of conventional agriculture. This finding is in line with the studies of Hanson (2003), Pacini et al. (2003), Brinton et al. (2004), Setboonsarng et al. (2006), and Pongsrihadulchai (2020). Conventional agriculture tends to entail higher costs due to the purchase of external inputs such as chemical fertilizers and pesticides, which are replaced in organic agriculture with on-farm inputs such as animal manure and crop wastes.

Producing equivalent yields should not necessarily be the goal for organic farmers because high yields do not always guarantee more profits. Prices charged for organic foods are typically higher in the marketplace so the net economic return per ha is often equal to or higher than that of crops produced in conventional farming (Pimentel et al. 2005). In 2015–2016, a pilot organic program was carried out jointly by the Thai Organic Agriculture Foundation (TOAF) and government agencies in five provinces with 456 households, covering a total area of 60 ha. With the end of the project survey, the TOAF found that price premiums for organic crops in addition to reduced production costs helped boost their income by 10–50 percent. In fact, when

the market price differential was factored in, the differences between the two types of agriculture become trivial and in most cases the returns on the organic produce became even greater, as observed in other studies (Brumfield, Rimal, and Reiners 2000; Bertramsen and Dobbs 2002; Nieberg and Offermann 2003; Pacini et al. 2003; Carambas 2005). In some cases, even without price premiums, organic systems bring more profits due to lower production costs (Brinton et al. 2004).

Yet, there is still a major debate over whether organic farming is more profitable for farmers given that the crop yield and economic return vary depending on the crops, regions, and technologies applied in the system. With such a small number of farmers in organic agriculture and limited research in this regard, it is too early to conclude that the organic system in this country would bring higher returns than the conventional system. Further research is needed to firmly establish this.

Contribution to Agricultural and Environmental Sustainability

The IPCC (2007) found that mitigation options to reduce agricultural GHG emissions are cost-competitive compared to non-agricultural options for achieving long-term climate objectives. Among the variety of options existing for GHG mitigation in agriculture, the most prominent options are improving crops, grazing land management, and restoring organic soils through improved agronomic practices, nutrient use, and residue management, among other things. However, even after the adoption of such mitigation measures, it still remains difficult to quantify the total amount of emissions reduced due to the lack of comprehensive data on organic agriculture, among others.

Against this backdrop, this study uses the government plan to convert 160,000 ha to organic rice farming by 2021 to estimate how much methane (CH_4) could be removed from the atmosphere. According to the NAMA Facility (2020), every hectare used to grow rice in Thailand releases up to 2.11 t of CO_2 equivalent into the atmosphere. This means that the conversion of 160,000 ha is estimated to have a potential of avoiding emissions of 337,600 t of CO_2 equivalent with an increasing annual mitigation potential.

The carbon market is one of the instruments to provide incentives for polluters to reduce emissions. To estimate the monetary value of the reduction from the conversion of 160,000 ha, we referred to the carbon price of EUR 23.17/t set by the EU Emission Trading System as of June 5, 2020. The economic value of the GHG reduction from the conversion amounts to EUR 7.8 million. Given that only the conversion areas of organic rice are considered in this calculation, converting the areas for other agricultural produce would increase the amount of the emission reduction and its economic value even more.

The 12th National Economic and Social Development Plan (2017–2021) calls for several mitigation measures, including the development of a domestic carbon market. The National Climate Change Master Plan (2015–2050) also refers to carbon markets as a potential mechanism to reduce GHG emissions in the private sector. Accordingly, the Thailand-Voluntary Emissions Trading Scheme (or Thailand-V-ETS) was established in 2015 (IEA 2020). If farmers were allocated carbon allowances and allowed to trade them in the ETS, then this may financially incentivize them to turn to low-carbon agriculture and reduce their own emissions.

Lastly, organic farming practices improve soil organic matter content, which is key to healthy and high-quality soil (Burlingame 2012; Bavec and Bavec 2015). Healthy soils with stable levels of soil organic matter are vital in preventing and fighting soil-borne diseases, and thus bringing direct benefits for agricultural production. In addition, the level of biodiversity in organic farms is found to be higher than in conventional farms in numerous studies (Pimentel et al. 2005; Rahmann 2011; Bavec and Bavec 2015; Rundlöf, Smith, and Birkhofer 2016). Indeed, it is possible to design an ecologically sustainable farming system that is equally productive and maintains the ecosystem, and thus contributing to agricultural resilience to climate change.

CONCLUSION

Organic farming has been promoted as an alternative to conventional farming in Thailand the past several years given its potential to mitigate climate change, reduce health risks, and secure agricultural livelihoods. Despite the ambitious plan to make Thailand the center of organic agriculture in the ASEAN region, there has been lack of institutional support for farmers in the conversion process. The organic sector has been driven by the private sector such as private companies, cooperatives, NGOs, and grassroots groups. This study identified the potential of agricultural cooperatives in promoting organic agriculture through their extensive network across the country, offering know-how and expertise with respect to the adoption of organic practices, financing inputs, and managing logistics and procurement to local and international markets.

Yet, constraints including inconsistent policies and limited support from the government remain. To some extent, these weaken the efforts to promote organic and sustainable agriculture.

One difficulty noted in the promotion of organic agriculture is the lack of information and awareness of the benefits of organic agriculture, which is an important consideration of farmers in turning to organic farming. Hence, an educational program should be established at the community level that fully explains the benefits and costs of organic versus conventional agriculture.

Currently, strong stakeholder engagement is inhibited by the top-down decision-making process that continues to dominate policymaking with respect to organic agriculture. To bring about better outcomes, the involvement of key stakeholders in government projects (i.e., agricultural cooperatives and NGOs) is crucial to facilitate the farmer-to-farmer spread of knowledge and skills in organic agriculture and quickly respond to the specific needs of an individual farm. Also, to secure coherence in policy design and implementation, stronger coordination and communication with stakeholders is necessary across all responsible ministries and agencies.

Lastly, critical issues regarding organic farming remain to be unresolved. It has been considerably difficult to collect and evaluate information about organic farming and its relevance to emission control, food quality, human and animal health, livelihoods, and poverty reduction. This is due to the lack of up-to-date and comprehensive/detailed data on organic farming. This poses a serious constraint for researchers on exploring opportunities and challenges of organic agriculture in Thailand. To widen recognition of the potential of organic agriculture, there is a need for more research based on more comprehensive data among bodies that currently promote organic agriculture. This, in turn, will raise awareness on the impacts of organic agriculture on the environment and the Sustainable Development Goals by identifying and addressing various challenges and opportunities on the way.

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