



Development of Agricultural E-commerce in Thailand

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ABSTRACT

As Thailand continues to move towards digital transformation, the e-commerce for the agriculture sector has gradually emerged. Digital platforms can enable farmers to overcome agricultural problems throughout the value chain from upstream to downstream. Smallholder farmers and SMEs can sell agricultural products directly to e-commerce service providers, retailers, and consumers, leading to increased efficiency of the agri-food supply chain and generating greater revenue, as well as a better connection between buyers and sellers. The B2C and C2C e-commerce platforms are prominent business models for agricultural products. The market value of agricultural e-commerce mainly contributed from small and medium enterprises (SMEs) where social commerce (i.e. Facebook, LINE, and Instagram) and e-marketplace were top preferred market channels. Agricultural e-commerce service providers can be a direct positive influence on driving digital adoption among farmers. The government pushed the shift in the agricultural sector toward digital channel with “Thailand 4.0” policy, and national digital economy and society development plan which provided support on the development of digital platform and digital marketing skills on SMEs and farmers, as well as, improved the digital infrastructure and built the digital network in the rural area. To shift traditional commerce toward e-commerce in agricultural market, building digital ecosystem and entrepreneurship environment, as well as enhancing farmers and SMEs to adopt digital channels are suggested.

Keywords: e-commerce, ecosystem, digital platform, agricultural products, SMEs, Thailand

INTRODUCTION

E-commerce in Thailand

E-commerce is defined as the transactions between buyer and seller via the internet (Fruhling & Digm, 2000; Mueller, 2000; OECD, 2019). With the highly urbanized population and hectic lifestyles, Thailand is one of the world's fastest growing e-commerce markets. Over the past five-year, e-commerce has become one of the drivers for Thailand's economic growth. The value of Thailand's e-commerce market amounted to US\$115.31 billion¹ in 2018 (ETDA, 2019). As shown in Figure 1, the annual growth rate of e-commerce market value was 36.4% in 2018 and the share of e-commerce to domestic market had increased. Many enterprises have adjusted their business strategies to multi-channel, which offers both offline and online channels to consumers. According to ETDA (2019), the total e-commerce enterprises in Thailand was 644,071 enterprises, which can be divided based on the market value into small and medium enterprises or SMEs (33.73%) and large enterprises (76.45%). E-commerce transactions involved three types of partners: consumers, business, and government with six combinations of platforms, of which four are considered important platforms in Thailand: business-to-business (B2B); business-to-consumers (B2C); consumer-to-consumer (C2C), and business-to-government (B2G) transactions².

¹ The exchange rate on 10 April 2020 is THB 32.67 = US\$1. Source: Bank of Thailand (2020).

² The definition of business-to-business (B2B) is a type of commerce transaction existing between businesses in the private sector, in which the private sector means e-commerce operators registered as juristic persons and intending to do businesses between one another. The business consists of small and medium enterprises (SMEs) (an annual revenue is less than US\$1.61 million) and large enterprises (an annual revenue is equal or more than US\$1.61 million).

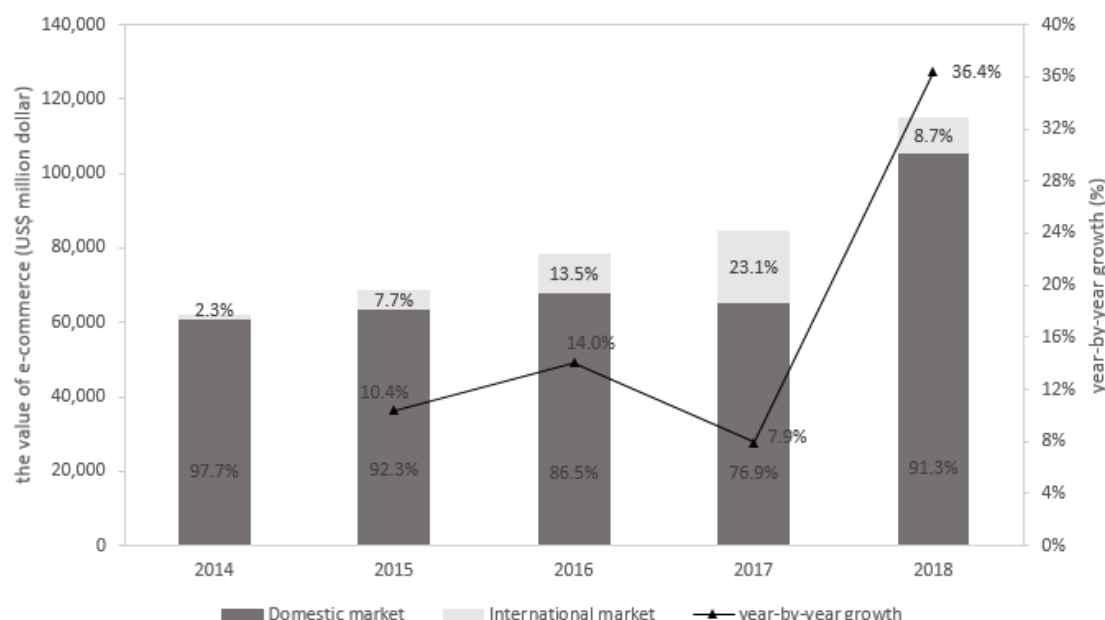


Figure 1. Thailand's total value of e-commerce (2014-2018)

Source: Electronic Transactions Development Agency (ETDA, 2019)

In 2018, the B2B platform carried the highest value of the e-commerce market (54.36%) followed by the B2C platform (27.47%)³, and the B2G platform (18.17%) (ETDA, 2019). The e-commerce market of B2B and B2C platforms can be divided into eight economic industries including wholesale and retail (31.84%), accommodation service (24.58%), manufacturing (20.89%), information and communication (16.15%), transportation (4.89%), art and entertainment (1.13%), other service business, (0.40%), and insurance (0.13%). In general, different e-commerce platforms in Thailand can be categorized into four channels as follows:

1. E-marketplace (i.e. *Lazada, Shopee, Alibaba, T-mall, Tarad, JD Central*) accounted for 35% of the total value of B2C e-commerce market. *Shopee* and *Lazada* are main e-commerce players for all businesses in Thailand, while *Alibaba* and *T-mall* are e-marketplaces to sell products of China.
2. Brand website (an online platform to tell stories of brands and communicate with consumers).
3. E-retailer (i.e. *Central online, J.I.B, Powerbuy, HomePro, Tesco Lotus, Big C, Tops* supermarket, *Makro click*) accounted for 25% (included brand website) of the total value of B2C e-commerce market. In Thailand, leading supermarkets and hypermarkets are *Tesco Lotus, Big C, Top* supermarket, *Gourmet Market & Home Fresh Mart, Villa market, and Maxvalu*. Many retailers have been forced to adjust grocery landscape to provide omni-channel experiences and capture digital customers. *Tesco Lotus* and *Big C* are leading e-retailer for grocery online in Thailand.
4. Social commerce (i.e. *Facebook, Google, YouTube, and LINE*) accounted for 40% of the total value of B2C e-commerce market.

According to ETDA (2020), the number of internet users in Thailand was reported at 47.5 million in 2018 with the growth rate of 5.1% as compared to the last year. The mobile penetration rate was found at 188% and time spent on the internet was about 10 hour per day. The shift of consumer lifestyle to digital society has generated various internet-based activities, including communication via social media (91.2%), listening music or watching movies (71.2%), surfing information (70.7%), messaging via e-mail (62.5%), online payment (60.6%), buying products and services (57%), ordering food delivery (26.5%), and online selling (15.9%) (ETDA, 2020). As the number of mobile users continues to grow year-by-year, top two highest growth rates of internet-based activities are ordering food delivery with 15.1% and online payment with 11.4%, indicating an increase in Thai consumer willingness to adopt

million). The definition of business-to-consumer (B2C) is a type of commerce transaction existing between businesses in the private/public sector and the private sector, in which the private sector means e-Commerce operators registered as individual or juristic persons and intending to do businesses between one another. The definition of consumer-to-consumer (C2C) is a type of commerce transaction existing between individuals. The definition of business-to-government (B2G) is a type of commerce transaction existing between the private and public sectors under two approaches: e-market and e-bidding (ETDA, 2019).

³ Note that the annual report by ETDA (2019) did not separate the data on C2C platform from B2C platform.

online transaction. Regarding internet-based activities on buying and selling of products and services, e-commerce businesses for SMEs emerged as a potential tool to sell their products via multi-channel and assess the new market, as well as develop social and economic activities (Sathirathai & Nakavachara, 2019).

Two e-commerce platforms that create potential to SMEs and to a new entrepreneur are e-marketplace and social commerce. The top five channels for internet users to sell their products and services are *facebook* (64%), *Shopee* (43.1%), *LINE* (39.5%), *Instagram* (26.6%), and *Lazada* (24.8%) (ETDA, 2020). With an affordable internet and devices, selling via *facebook* allows SMEs and new entrepreneurs to start their business at low cost investment, ease to use, and function to assess target groups. On the demand-side, most internet users are more likely to buy products and services via *Shopee* (75.6%), *Lazada* (65.5%), *facebook* (47.5%), and *LINE* (38.9%) (ETDA, 2020). The selection of buying channel by Thai internet users depends on ease to use, payment methods, trust in security of service providers, and promotional activities. One of the major concerns is personal data infringement, which varies among the behavior of each generation.

In Thailand, e-commerce has been applied in many business sectors, especially retail, service, and financial industries. According to the report by ETDA (2019), the leading e-commerce industry in 2018 was wholesale and retail, which was categorized into eight sectors as presented in Table 1. The market value of e-commerce wholesale and retail industry was generally relied on SMEs (69.9%), while the rest was belonged to large enterprises (30.1%). The market channel share of wholesale and retail industry was divided into B2C platform (83.04%) and B2B platform (16.96%). From Table 1, the e-commerce market value of food, processed food, beverages, agriculture and fishery sector was US\$ 5,564.13 million with the growth rate of 27%. The share of this agri-food sector was mainly generated by SMEs (94.7%) and large enterprises (5.31%), leading to the policy supports on SMEs to e-commerce adoption. For SMEs, the most preferred channels for e-commerce was social commerce (75.3%) followed by e-marketplace (23.9%) and brand websites (0.8%). As discussed above, *facebook*, *LINE*, *Instagram* are the top social commerce for SMEs. Key driving factors of the growth of social commerce were connectivity between SMEs and consumers, functionality of e-commerce to serve demands, creativity on high value services, affordable cost investments, user friendly platform, payment gateways, and digital logistic services (Fruhling & Digman, 2000; World Bank, 2019; ETDA, 2020). One of the key policies supports on SMEs was developing digital skills and literacy to ensure that opportunities and benefits from the digital technology can be addressed by everyone.

Table 1. The market value of e-commerce in wholesale and retail industry by sectors

Sectors	the market value (US\$ million)				Expected growth rate (%)
	2015	2016	2017	2018	
Shopping center	5,397.11	8,309.04	8,334.41	9,864.39	18.36
Fashions, clothing, and jewelry	1,115.30	1,437.37	1,496.05	1,950.15	30.35
Cosmetics, supplementary food, perfumes, and beauty products	3,735.29	4,346.35	2,818.69	3,730.52	32.25
Automotive products and parts	335.52	419.49	456.93	658.27	44.06
Computers, electric appliances, and telecommunications equipment	1,553.19	1,642.91	1,689.54	2,049.22	21.29
Household furniture and other household goods	802.68	950.96	1,036.63	1,197.01	15.47
Food, processed food products, beverages, agricultural and fishery products	3,295.29	4,879.14	4,381.44	5,564.13	26.99
Sporting equipment, toys, and collections	831.31	1,029.58	1,090.21	1,453.83	33.35

Source: Electronic Transactions Development Agency (ETDA, 2019)

Both internal and external factors play a prominent role in the rapid growth of e-commerce in Thailand (ETDA, 2019; World Bank, 2019). For internal factors, more digital platforms are available to

SMEs and new business with low cost of investment and easy to access. Some enterprises have skilled workers with digital platforms and digital marketing. The rise of the internet through mobile connectivity and increasing role of mobile networks have become a key in improving the e-commerce market. For external factors, the government policy on digital economy, “Thailand 4.0” provided support on the development of the digital infrastructure and connectivity, as well as promoted digital technology utilization by public and private sectors to drive the economic growth and better quality of life. Several external factors are an increase in digital consumers and society, reshaping lifestyle and demand for convenience, urban population growth, and healthy trends on sources of foods. Therefore, the growing popularity of e-commerce has created an opportunity for all types of businesses including SMEs and farmers to diversify their agribusiness and connect to new market. This paper aims to assess the development of agricultural e-commerce and review the national strategies and policies to identify benefits and challenges on digital transformations by the agriculture sector in Thailand.

The development of e-commerce in agriculture sector in Thailand

The Gross Domestic Production (GDP) of agriculture sector in Thailand accounted for 8% of the total GDP at US\$517 billion during 2019, while the rest was generated from non-agricultural sectors (NESDC, 2020). The value added by agriculture sector has been continuously decreasing, while the value addition by digital businesses (i.e. e-commerce and food service providers) has been increased. This contrasting trend is reflected in agricultural transformation and economic development such as employment, destruction, and rural economy. With the high growth trend on digital society, e-commerce has become a new emerging business in agriculture sector. Under the development for Digital Economy and Society Act (2017-2021), the government launched the National Digital Economy and Society Development Plan and Policy for 20 years (2018-2037) to transform the nation towards digital driven economy. One of the missions was to support the application of digital technology to apply in business, community, and society to improve the nation’s competitiveness. Regarding the National Digital Economy Plan, the Ministry of Agriculture and Cooperatives, Ministry of Commerce, and the Ministry of Digital Economy and Society have provided a development strategic plan for five years and supported programs to develop SMEs, cooperatives, community enterprises and smallholders to adopt digital technology and e-commerce, to promote Thai agricultural products in both the domestic and international markets. In China, *Alibaba* started to promote agricultural products from both domestic and international markets and exploit agricultural e-commerce in rural area (Zeng et al., 2017). In April 2018, Thai government and *Alibaba* have signed an agreement on promoting agricultural products, leading to a remarkable record of 60-seconds trading volume of 80,000 golden pillow durian by Chinese consumers after going online (The Nation Thailand, 2020).

Following Thai agriculture sectors, there are seven significant issues: labor intensives and aging farmers, economies of scale and low productivity, land ownership, water management, climate changes, lack of financial capability, and no negotiating power and lack of market access (Attavanich *et al.*, 2019; Sathirathai & Nakavachara, 2019; DEPA, 2020). These challenges have led to the development of agricultural technology and e-commerce. In the traditional agri-food supply chain, smallholder farmers sell agricultural products through four channels: 1) Direct marketing channel, 2) Farmer Groups, Community Enterprises, Agricultural Cooperatives, 3) SMEs, and 4) Middlemen or Collectors. Note that SMEs consists of the private/public enterprises registered as individual or juristic persons or community enterprises in which these enterprises operate under four economic activities: manufacturing, services, retail, and wholesale (OSMEP, 2018). Examples of direct marketing channels through offline are traditional markets or wet markets, flee market, wholesale market, and physical stores. In the rural area, lagging marketing skills and business system, no offline stores or marketplace, and inadequate infrastructures (i.e. irrigation) were the common problems in Thailand. Most Thai smallholder farmers have no negotiating power and market access, thus they were taken advantage by middleman or collectors and receive the price lower than market prices. These bring about increasing number of farmers seeking for alternative channels and solutions to improve their income. Furthermore, some farmers form a group started to sell directly to consumers or restaurants via online channel, or open a farmer store, or farmers’ market, without selling through the middlemen. The emergence of digital channel and technology has changed the way in which the agriculture sector generate revenue, improve performances, and boost profit growth (Mueller 2001, Canavari *et al.*, 2010; Carpio *et al.*, 2013; Zeng *et al.*, 2017). Along with the digital transformation in Thailand, each traditional channel has potential for developing digital technology and e-commerce and creating a new linkage between farmers and consumers to bypass intermediaries. Moreover, the establishment of rural and urban connectivity would enable growth in economic development of the society, and generate a new market opportunity outside the regions.

In the past five years, online channel has been developed and slightly used for buying and selling agricultural products in Thailand. New digital businesses and entrepreneurs relating to logistic and storage services, smart agriculture technology, digital platform providers, e-commerce learning, and e-payment services are one of the fastest growing industries. The government has encouraged various agricultural support programs on the application of digital technology to be adopted by smallholder farmers and related stakeholders, including young smart farm project, smart farm flagship, mega farm enterprise, public-private partnerships (PPP), innovation and capability voucher, and startup Thailand. The Ministry of Agriculture and Cooperatives plays a significant role in supporting farmers to shift from traditional agricultural system to e-agriculture system, as well as promoting digital technology adoption and developing farmer skills. This agenda also include the development of ecosystem for smart farmers consisting of support funds, training, hardware, software, and agricultural information and database system. More public institutions have been established to promote digitalized agriculture technology, digital training, and digital marketplace. In 2017, Digital Economy Promotion Agency (DEPA) was established to support the development of digital technology adoption in various sectors such as digital startup promotion, digital manpower, digital community, digital SMEs, and digital agriculture (DEPA, 2020). In 2020, Agritech and Innovation Center (AIC) has been agreed to establish in 77 provinces of Thailand under the collaboration among the Ministry of Agriculture and Cooperatives and Ministry of Education and several leading universities. AIC will be driven under three policy schemes: linking digital platform of both domestic and international market, operating by the digital experts, and coaching farmers to adopt e-commerce.

Despite several agricultural support programs have been implemented, the level of e-commerce adoption among Thai farmers and SMEs in the agricultural sector are quite slow, as compared to other sectors. Chieochan *et al.* (2003) showed that Thai agricultural cooperatives were slow in adopting e-commerce and seldom used information technology for commercial transactions. Even though selling agricultural products through online channels enables farmers to eliminate intermediaries and leads to more benefits, most Thai farmers still preferred offline channels in place of online channels. Some barriers from e-commerce adoption by farmers are digital divide, digital literacy and skills, as well as lack of motivation to use and prefer comfort zone (Wongsim *et al.*, 2018; Sathirathai & Nakavachara, 2019; DEPA, 2020). Farmers in rural area have limited access to information technology, so that they do not recognize the benefits of the usage of technology (Wongsim *et al.*, 2018). In contrast, trends in agricultural e-commerce has been developing rapidly in suburban areas of big cities, especially in Bangkok and Chiang Mai provinces. Only a few SMEs and smallholder farmers, especially young smart farmers and farmers of specialty products (i.e. organic, natural, pesticide free), applied to use digital channels. Wicha *et al.* (2017) presented the development of e-Community Supported Agriculture (e-CSA) system to promote local organic agricultural product in Chiang Rai province. Consequently, the agricultural e-commerce adoption required a long-term strategic plan to shift from traditional agriculture to e-agriculture.

E-commerce platforms in agri-food markets

Digital platform has enabled larger visibility into both domestic and international supply chain of agricultural products (Mueller, 2001; Hennessy *et al.*, 2016). The relationship between sellers (i.e. farmers, agricultural cooperatives, and SMEs) and buyers are closer and more easily connected (Sathirathai & Nakavachara, 2019). In Thailand, agricultural products are available in six different marketing channels under four e-commerce platforms (Table 2). Four e-commerce platforms consist of social media, agricultural e-marketplace platform, e-retailers, and e-fresh market. In general, a main supply chain in Thailand is farm products sold via collectors or middlemen and then sold via supermarkets and fresh markets. Supermarkets and fresh markets play major roles on distribution of agricultural products. During digital era, new digital platforms have emerged and connected farmers to end-users. Hence, supermarkets and fresh markets have to adopt new services (i.e ordering via applications, delivery, and chat box) and offer multi-channels on both offline and online. The role of players in agri-food supply chain includes smallholder farmers, agricultural cooperatives, collectors, e-commerce providers, retailers, traditional markets, and end-users. Another important player is logistic service providers, operating in two systems: on-demand delivery (i.e. *Skootar*, *Lalamove*, *LINE MAN*, *GRAB Express*, and *Deliveree*) and third-party logistics (i.e. *Kerry*, *Thailand post*, *SCG Yamato Express*, *FedEx*, and *DHL*). Financial service provider is also a key player in e-commerce platform. Two types of e-payments are payment gateway (i.e. *2C2P*, *PayPal*, *Omise*, *truemoney*, *AliPay*, and *WeChat pay*) and mobile payment (i.e. mobile banking).

Table 2. Marketing channels of e-commerce platforms for agricultural products

E-commerce platforms	Marketing channels	Description
Social media	Farmers → Consumers	The internet transaction has enabled the emergence of online channel via social commerce (i.e. <i>Facebook</i> , <i>LINE</i> , <i>Instagram</i>) that directly connect farmers to consumers. Most smart farmers or small farmers who sell specialty products (i.e. organic, natural products, local produce) prefer using this channel because of low cost and various service application tools such as improving consumer engagement, crating traffic, posting contents, monitoring the business, and communicating with customers.
	Farmers → Agricultural cooperatives → Consumers	Cooperatives can perform e-commerce for agricultural products to improve sales and access to consumers. Most Thai farmers are members of agricultural cooperatives, community enterprises, or farmer groups, who work together to improve production efficiency and sell products.
Agricultural e-marketplace platform	Farmers → E-commerce service providers → Consumers/HORECA	The most popular e-commerce platforms for agricultural products which connect farmers to consumers (i.e. <i>HealthMe</i> , <i>FarmKaidee</i> , <i>Get Kaset</i> , <i>Greenspace</i>). Most platforms started from start-up or SMEs, which require financial supports from venture capital (VC) or government.
	Farmers → Collectors → E-commerce service providers → HORECA	Agricultural producers can sell agricultural produce directly to e-commerce service providers (i.e. <i>Freshket</i> , <i>Farm Fresh</i>) or via collectors. These service providers usually require large amount of fresh products to sell to hotel, restaurants, and cafeteria (HORECA). This e-commerce platform also has benefits from the advanced logistics to reach consumers with fresh products.
E-retailer	Farmers → Collectors/middlemen/wholesale market → Retailer → Online channels	Retailers/ supermarkets/ specialty stores (i.e. <i>Tesco Lotus</i> , <i>Top supermarkets</i> , <i>Big C</i> , <i>Makro Click</i> , <i>Lemon farm</i>) have launched multi-channel strategies with its online

		delivery service to provide omni-channel customer experience. Example is a specialty store, names <i>Lemon farm</i> , selling organic and natural products from farmers.
E-fresh market	Farmers → Collectors/middlemen/wholesale market → Traditional market → Online store	Traditional/fresh markets have launched digital platforms and invested in developing logistics networks that are suitable for e-commerce. Examples: - <i>Ortokor</i> market launched <i>Ortokor express</i> . - <i>Ying Charoen</i> market launched <i>Songsod delivery</i> .

Source: Author's collection

In recent years, a number of agricultural e-commerce service providers under B2B, B2C, and C2C platforms have been launched in Thailand. These e-commerce service providers deliver farmers and SMEs by offering a new way of selling their produce and reaching a new market opportunity (Mueller, 2000; Sathirathai & Nakavachara, 2019). One important movement towards digital agricultural markets is implemented by the government institutions or public sector such as *DGT farm* offering the e-marketing platform to match between farmers and consumers. With a great potential to e-commerce in agricultural sector, many e-commerce service providers by private sector have been established; however, most e-commerce service providers are in the start-up phase, as well as require funding sources and building trust in security to internet users. The development of e-marketplace by the private sector is more diverse and creative, than the platform developed by the public sector. For example of success business, *Freshket* is the first B2B e-marketplace platform for fresh food suppliers and restaurants that provide trading services to farmers to have stable demands and restaurants to get fresh products. Many success cases on farmers adapting digital channels to strengthen farmer's bargaining power and avoid the middlemen. *Tankhun* organic farm sell organic chicken meats via multi-channels such as *Facebook*, *LINE*, *HealthMe* (e-marketplace), and *Lemon farm* (e-retailer). Another success case is *SookJai* farmer market in Nakhon pathom province, located close to Bangkok, which was established for a group of farmers who want to sell organic products. This farmer group uses *Facebook* to promote their market and connect directly to consumers. During the COVID-19 pandemic in Thailand, the lockdown restriction has caused serious damages to agriculture sector and the shortage in distribution of agricultural products. Thai consumers turned to home cooking and local farm products to ensure the safety and where the foods come from. Under the outbreak, Thai farmers have adapted the direct-to-consumer channel via *Facebook*, *LINE*, and e-marketplace to boost sales of unsold products. The growth of specific group e-marketplace platforms (i.e. *Chula* marketplace and *Kaset* marketplace) and online delivery service providers (i.e. *Kerry*) have boomed to cope with the lack of connection between farmers and consumers. In addition, the revenue shares between online and offline have become the potential business model for farmers and reduce market risks.

Policy on e-commerce in agricultural markets

Considering the broad ranges of aspects of agricultural e-commerce by World Bank (2019) coupled with risks in agricultural sectors by Attavanich *et al.* (2019) and Komarek *et al.* (2020), barriers and risks in agricultural sectors to adopt agricultural e-commerce and grow the digital economy can be divided into six categories: production risks, market risks, financial risks, institutional and policy risks, technology risks, and personal and labor risks. For production risks, unstable weather conditions such as drought or rainfall, lack of efficient equipment and machinery, and damage due to pests and diseases, cause an unpredicted productivity and reduced yields (Attavanich *et al.*, 2019). Agricultural digital technology (i.e., big data, internet of things, and sensor) and precision agriculture, would alleviate these risks. Market risks are the prominent issues among Thai farmers, which are resulting from price instability, lack of knowledge on product pricing, data analysis, and operation, high level of competition among similar products, low product and service quality, unattractive packaging, and ability to access to the market (Coble *et al.*, 2018; Fecke *et al.*, 2018). E-commerce platforms and training programs on marketing, business, and digital skills would help to cope with these marketing risks. Financial risks are specific to

limited access to financial institutions, funding sources, high input costs, and lack of adequate cash or credit.

Institutional and policy risks are associated with e-commerce tax uncertainty and the harmful effect by the changes in the policies. Other policies on cyber security, consumer protection and personal data privacy do not cover all business applications. The unpredictable changes and inconsistent policy implementation result in limited control by the farmers (Attavanich *et al.*, 2019). Challenges on e-commerce regulations would delay an investment decision on both domestic and cross-broader e-commerce. Technology risks result from less trust in security of service providers (i.e. e-payment system, personal information), as well as the accessibility to national pooled data and internet network. Another risk is the lack of awareness on the benefits to farmers, causing a slow adoption of agricultural e-commerce among farmers and SMEs. Personal and labor risks are related to the lack of skilled labor in information technology (IT), management, and negotiation as well as the aging society of farmers.

To cope up with barriers and risks in agricultural sectors, the government digitalized smallholder farmers and SMEs through the policies and support programs to the development of e-commerce and the growth of digital economy. Under Thailand 4.0 policy, the National Digital Economy and Society Development Plan and Policy for 20 years (2018-2037) was launched by the Ministry of Digital Economy and Society, to transform towards digital driven economy. More specifically, Thailand's priorities stand out the following aspects: building digital infrastructure, boosting the economy with digital technology, creating a knowledge-driven digital society, developing digital skills, and building trust in the use of digital technology.

1. Four national e-commerce strategies have been implemented in 2017 including: 1) enhance the entrepreneur by creating digital marketing skills and developing e-commerce products and standards; 2) strengthen ecosystem for e-commerce by supporting cashless society and improve logistic network; 3) improve the effectiveness of soft-infrastructure by making ease to access the pools of data; and 4) build trust in e-commerce market by ensuring consumer protection (ETDA, 2018).

2. "OTOP-SMEs Transformer 4.0" project have been implemented in 2019 and primarily focused to support the local communities and SMEs in agricultural sectors by enhancing market access and developing farmer's business, create a new business model, and digital skills.

3. To improve the financial risks, the Ministry of Finance introduced e-payment in 2016 such as prompt-pay policy and standardized QR code payment to encourage Thai consumers to use e-payment and to enable digital payments with mobile phone. This benefits SMEs and farmers to reduce their transaction costs and close to the sales.

4. The Office of SMEs Promotion (OSMEP) has collaborated work with the Department of Agriculture Extension and Bank of Agriculture and Agricultural Cooperatives (BAAC) launched "SMEs GO Online" campaign in 2019 to coach SMEs on online marketing skills and entrepreneurship.

5. "Net pracharat" project aimed to build the digital infrastructure and the availability of internet access over the country, especially providing free broadband internet to 24,700 villages in the rural area by 2020. This policy has focused on coping technology risks to ensure accessibility of internet network and the use of digital application.

6. "Young smart farmers" program was implemented by the Department of Agriculture Extension. This program aims to reduce marketing risks and personal and labor risks in agriculture sector by improving digital skills and agricultural capability to engage digital technology on smart farming system and commercial aspects.

As presented above, Thai Government is waking up to the opportunities and challenges brought by digital transformation. Many public sectors tend to focus on the development of digital platforms and SMEs, but pay less attention to serve the farmers' problems. Similarly, funding programs in China mainly provide supports to agribusiness and avoid other groups (Zeng *et al.*, 2017). Following the national roadmap, policies to promote the digital economy have been implemented by many public institutions and agencies. However, the implementations of policies mainly focus on short-term assistance, causing more risks to farmers and less incentives for them to participate in the government policies. Moreover, too many policies and training programs have been overlapped and implemented to the same target group. Some farmers, especially in rural areas, have a limited access to the support programs, giving obstacles to grow the digital economy. Therefore, the government should integrate public institutions and work with the private sector and stakeholders to develop policy framework for sustainable agriculture and self-sufficiency of farmers, as well as provide incentives to the farmers to adopt agricultural technology and the diversification of agribusiness. Specially, policies on short-term assistance must be reduced and focused more on long-term solutions.

Challenges of e-commerce in agriculture sector

Currently, the changes of agricultural technology and variety of digital platforms would enhance the farmers' income, profit growth, and welfare. The stakeholders in the agri-food chain would gain benefits from building the connectivity, improving the product quality and safety, enhancing competitiveness, and expanding the market to both domestic and international markets (Fruhling & Digman, 2000; Mueller, 2001; Hennessy *et al.*, 2016; Zapata *et al.*, 2016; Zeng *et al.*, 2017). Digital technology usage keeps growing, but remains unequally distributed across Thailand, as well as among enterprises and social groups (i.e. income class). Implementing on both online and offline channels require the alignment between channels to operate the success business. In Thailand, the agricultural e-commerce adoption is in an early stage, so several challenges must be considered.

1. The market structure of e-commerce for agricultural products in Thailand is considered as a monopolistic competition. A range of product differentiation is limited for agricultural products. New competitors are easy to enter the e-commerce market, but they need marketing skills and build trust in security of its business.

2. Internet accessibility and connectivity is an important factor on adopting agricultural e-commerce. Limitations in internet access and affordable mobile devices, especially in rural area, bring about lack of awareness on the use of digital technology.

3. Logistic infrastructure of Thailand ranked 41st in the world. The logistic infrastructure is described as a quality of trade and transport related infrastructure (i.e. poor road conditions, information technology) (World Bank, 2018). In Thailand, logistic system faced heavy traffic, low levels of critical infrastructure in rural area, and high costs in cold chain system, leading to the logistical challenges such as long delivery time and complex handling of fresh produce. High logistics costs bring about limited competition and cross-border e-commerce.

4. E-payment is one of the major challenges in the development of agricultural e-commerce. Even the number of e-commerce users were about 51.3% in 2018, but there were 42.7% who paid by using credit card (ETDA, 2019). Meanwhile, some Thai consumers (6.8%) preferred not to purchase product and services online due to a concern about frauds, online security, and privacy (ETDA, 2020). Lack of trust in digital payment has an impact on the adoption of e-commerce on agricultural products.

5. Challenges on policies and regulations for e-commerce including consumer protection, cyber security, trade policy, e-commerce tax, and environmental policy are unpredictable changes. A lack of information causes economic loss, less opportunity for investments, and risks to smallholder farmers and SMEs.

6. Lack of digital skills affects the digital divide and unequal opportunities. A small number of Thai farmers and SMEs can adapt to digital channels. The government should encourage farmers and SMEs by training courses (i.e. e-commerce marketing, entrepreneurship, smart farmers, and technology application) and implementing a long term project (more than 2 years) to ensure that the online business of farmers or SMEs are well established. Moreover, the availability of funding sources, the development of co-creation among parties, and competition for new business model would create an innovative start-ups and potential e-commerce businesses.

As discussed above, various challenges cause the long-term shift of tradition transaction to digital transaction in agricultural market. The majority of Thai population is engaged in agricultural activities, thus agriculture will remain as the major economic sector in Thailand. Some individual farmers and cooperatives are active in starting digital channels, which lead to the competition among online sellers. Policy framework on the development of digital economy should emphasize based on five main issues, including connectivity, payments, digital skills, logistics, and digital regulation (World Bank, 2019). In general, Thai consumers focus on healthy, convenience, and supporting local farmers. Some consumers prefer to buy agricultural products via offline channel due to freshness. However, Thai consumers mostly relied on information (i.e. reviews) on social media and intended to increase buying online (Euromonitor International, 2018). After COVID-19 outbreak, consumer lifestyle has changed to new normal. Thai consumers tend to seek out how the food is produced, where the food comes from, and how food is distributed, thus farmers may need partners to fulfill consumer demand on digital services such as the self-scan, ordering online, and mobile payment. Moreover, agribusiness and farmers must lift the safety measures, hygiene standard, and product information to make consumers feel safe and secure. Therefore, the way forward on the development of agricultural e-commerce in Thailand must be focused on building digital ecosystem to connect chain activities among partners through digital platforms. Boosting digital ecosystem and giving farmers and consumers a more convenient way to make digital transactions would shift traditional commerce towards e-commerce.

CONCLUSION

As the digital platform has emerged, the agricultural e-commerce has developed and slowly adapted to smallholder farmers and SMEs. The digital economy policies under Thailand 4.0 cover not only information technology implementation but also the development of economic and social aspects of digital technologies. Agricultural e-commerce markets have created an opportunity of value addition in the agri-food chain, eliminate intermediaries, empower the competitiveness, and help farmers to boost profit growth. In Thailand, B2C and C2C e-commerce platforms have played a major role in agri-food market. Major contribution to agricultural e-commerce is generated by SMEs, wherein social commerce (i.e. facebook, LINE, and Instagram) and e-marketplace were the top market channels for agricultural products. The development of e-marketplace by the private sector has become increasingly dynamic and creative. For the agriculture sector in Thailand, six marketing channels from farmers to end users were discussed under four e-commerce platforms (social media, e-marketplace, e-retail, and e-fresh market). An increase in internet connectivity and digital logistics has positively influenced the development of e-commerce in the agriculture sector. Even though some challenges to e-commerce for agricultural products have been improved (i.e. the digital infrastructure in the rural area), both current and new issues (i.e. long delivery time and complex handling of fresh produce) need to be addressed. The logistical challenges of fresh produce and small number of farmers' adaption toward digital platform are significant issues. To succeed, agricultural e-commerce enterprises require a scalable economy and sustainable agribusiness. The government should provide projects and funding to motivate the new farmers and SMEs to develop a new agribusiness model and promote the use of digital technology and digital payment to consumers. Moreover, creating the e-commerce ecosystem and building entrepreneurship environment would create a new opportunity and employment in agriculture sector.

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