

# ECONOMICS WORKING PAPER

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## **Determinants of E-Commerce Adoption and Utilisation by SMEs in Thailand**

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### **Abstract**

This study empirically investigates the factors and barriers which hinder e-commerce adoption and utilisation levels by Thai SMEs in the food and beverage and retail industries. Older SMEs are likely to have lower levels of e-commerce utilisation. Larger SMEs are more likely to adopt e-commerce. Social media and website are significantly drivers of e-commerce utilisation levels. Food delivery platforms are crucial in enhancing higher e-commerce utilisation levels in the food and beverage industry. Smartphones are found to be a cost-effective tools for e-commerce transactions. The most significant barriers which can hinder the e-commerce adoption are customers' knowledge of e-commerce and internet security.

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# Determinants of E-Commerce Adoption and Utilisation by SMEs in Thailand

Yot Amornkitvikai and Cassey Lee

## 1. Introduction

Electronic commerce (e-commerce) is an essential driver of economic growth in developing countries.<sup>1</sup> It supports international value chains, improves market access and market efficiency, and reduces operating costs (Humphrey et al, 2003; Lawrence and Tar, 2010; UNCTAD, 2015). Generally, developing countries can gain the benefits of e-commerce adoption by exploiting competitive advantages that were not usable in the “*old economy*” where traditional marketing and export channels are inefficient and dominated by multiple off-line intermediaries (UNCTAD, 2002, 2010). More importantly, e-commerce can stimulate growth in developing countries by enhancing the transparency and efficiency of its market operations and public institutions.

E-commerce can be an extremely beneficial tool in developing countries provided that the barriers of e-commerce adoption are removed (Lawrence and Tar, 2010). It is particularly important to ensure that such barriers are minimised for small and medium-sized enterprises (SMEs). The reason is that the adoption of e-commerce is restricted mostly to large enterprises (UNCTAD, 2010, 2015). These barriers of e-commerce adoption might be due to some of the firm and entrepreneurial-specific factors. According to Kshetri (2007), the barriers to e-commerce adoption can be classified into three groups as follows: i) economic barriers related to unreliable and costly power supply, inadequate ICT infrastructure and use, limited adoption of credit cards, lack of purchasing power, and weak financial systems; ii) sociopolitical barriers related to weak legal and regulatory frameworks, cultural preferences for face-to-face interaction and reliance on cash in society; and iii) cognitive barriers related to poor ICT literacy, awareness and knowledge related to e-commerce among both consumers and enterprises.

There have been a number of empirical studies on e-commerce adoption in Thailand. Lertwongsatien and Wongpinunwatana (2014) used ANOVA analysis to investigate factors affecting a firm’s decision on e-commerce adoption by Thai SMEs. They found that the e-commerce adoption rate was still low. E-commerce adopters also differed significantly from laggards in terms of organisational, technological, and environmental factors. In another study,

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<sup>1</sup> In this paper, e-commerce is defined as the sale or purchase of goods or services which are conducted over computer networks designed to obtain or place of orders (OECD, 2011).

Changchit et. al. (2018) examined factors that encouraged or discouraged consumers in Thailand from shopping online. The results from their study suggested that the success of online businesses relied heavily upon their ability to attract buyers to purchase goods and services on their websites. More specifically, perceived ease of use of online shopping and past experiences of online shopping were important factors. Perceived security of online shopping were significantly and positively related to the attitude of Thai customers toward online shopping.

None of the above studies has investigated the barriers to both e-commerce adoption and utilization in Thailand. This study fills this research gap by examining factors affecting the e-commerce adoption and utilisation by Thai SMEs, particularly in the food and beverage and trading industries. The empirical analysis in this study uses primary data covering 310 SMEs from the food and beverage service and retail industries in Thailand.<sup>2</sup> The outline for the rest of the paper is as follows. Section 2 provides an overview of Thailand's e-commerce. Section 3 reviews the literature on e-commerce adoption. Section 4 discusses the methodology and empirical models. Section 5 shows the empirical results of this study. Policy implications are given in Section 6. Section 7 concludes the paper.

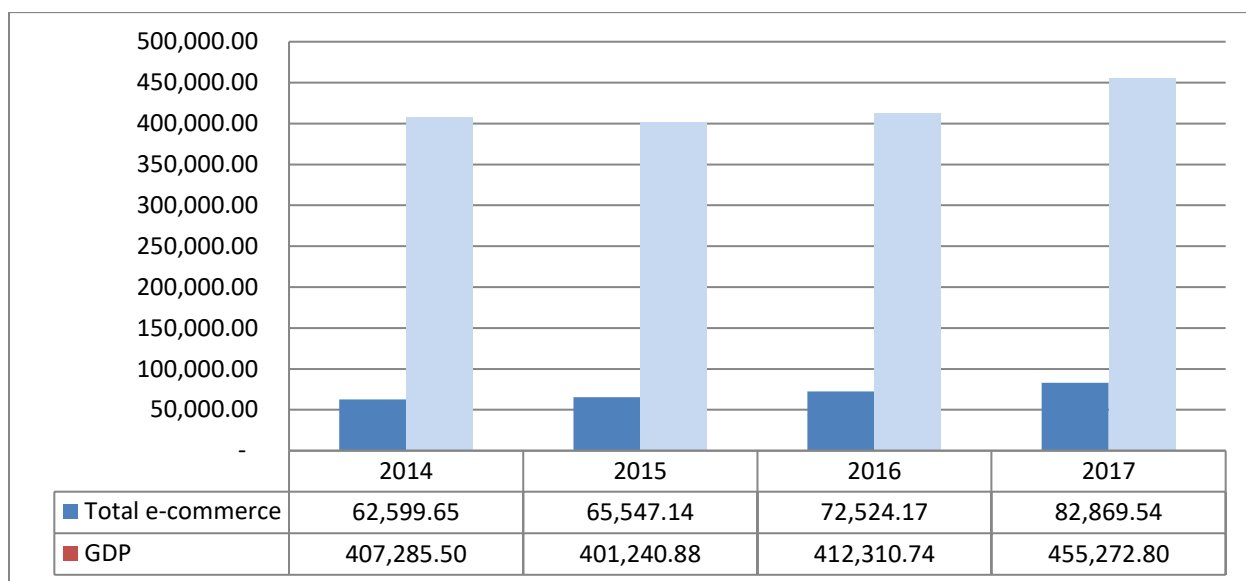
## **2. An Overview of Thailand's E-Commerce**

E-commerce has become increasingly important in Thailand. According the ETDA (2017) and NESDC (2017), the value of e-commerce trading in Thailand increased from 62.6 USD billion in 2014 (or 15.37 per cent of Thailand's GDP) to 82.87 USD billion in 2017 (18.20 per cent of its GDP) (see **Figure 1**). The number of e-commerce entrepreneurs, as measured by the number of establishments engaged in e-commerce, has also increased from 502,676 in 2014 to 592,996 in 2017. This figure indicates that entrepreneurs have shifted their preference to more on-line sales in response to changes in consumer behaviour in the digital age and in line with the Thai government's policies of promoting the digital economy.

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<sup>2</sup> Thailand's survey was funded by the ISEAS – Yusof Ishak Institute, Singapore.

**Figure 1: Value of Thailand’s E-Commerce, 2014 – 2016 (USD Million)**

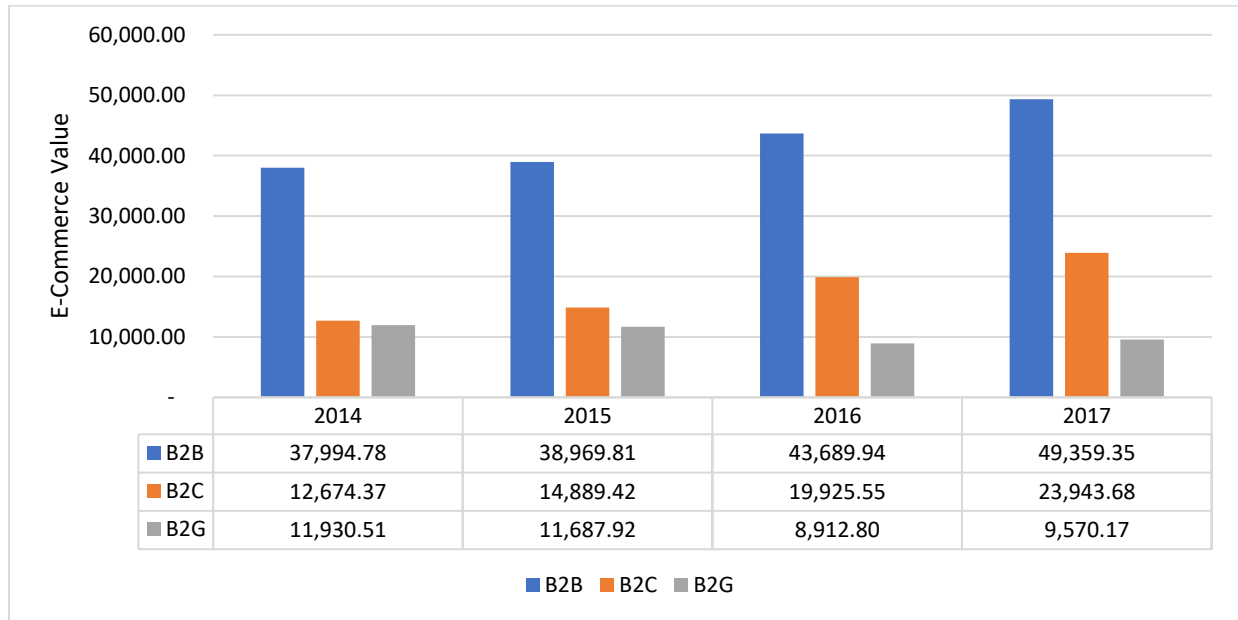


Source: The Electronic Transactions Development Agency (ETDA) and the Office of National Economic and Social Development Council (2017)

The breakdown of the three main types of e-commerce in Thailand are indicated in **Figure 2**. Business to business (B2B), which refers to sales of the goods and services of the business marketed to other business, had the highest e-commerce value among other types of e-commerce<sup>3</sup>. The B2B e-commerce value increased from 37.99 billion USD in 2014 to 49.36 billion USD in 2017. It accounted for 60.69 per cent of total e-commerce value in 2014 to 59.56 per cent of total e-commerce value in 2017. This figure implies that B2B e-commerce transactions involving upstream supply chain has increased in importance. Even though the value of B2C e-commerce is still lower than the value of B2B e-commerce, B2C e-commerce also became more critical. The B2C’s share of total e-commerce value increased from 20.25 per cent in 2014 to 28.89 per cent in 2017.

<sup>3</sup> B2C only refers to sales of the finished product to the end customer and B2G refers to sales of e-auction and non-e-auction transactions to the government.

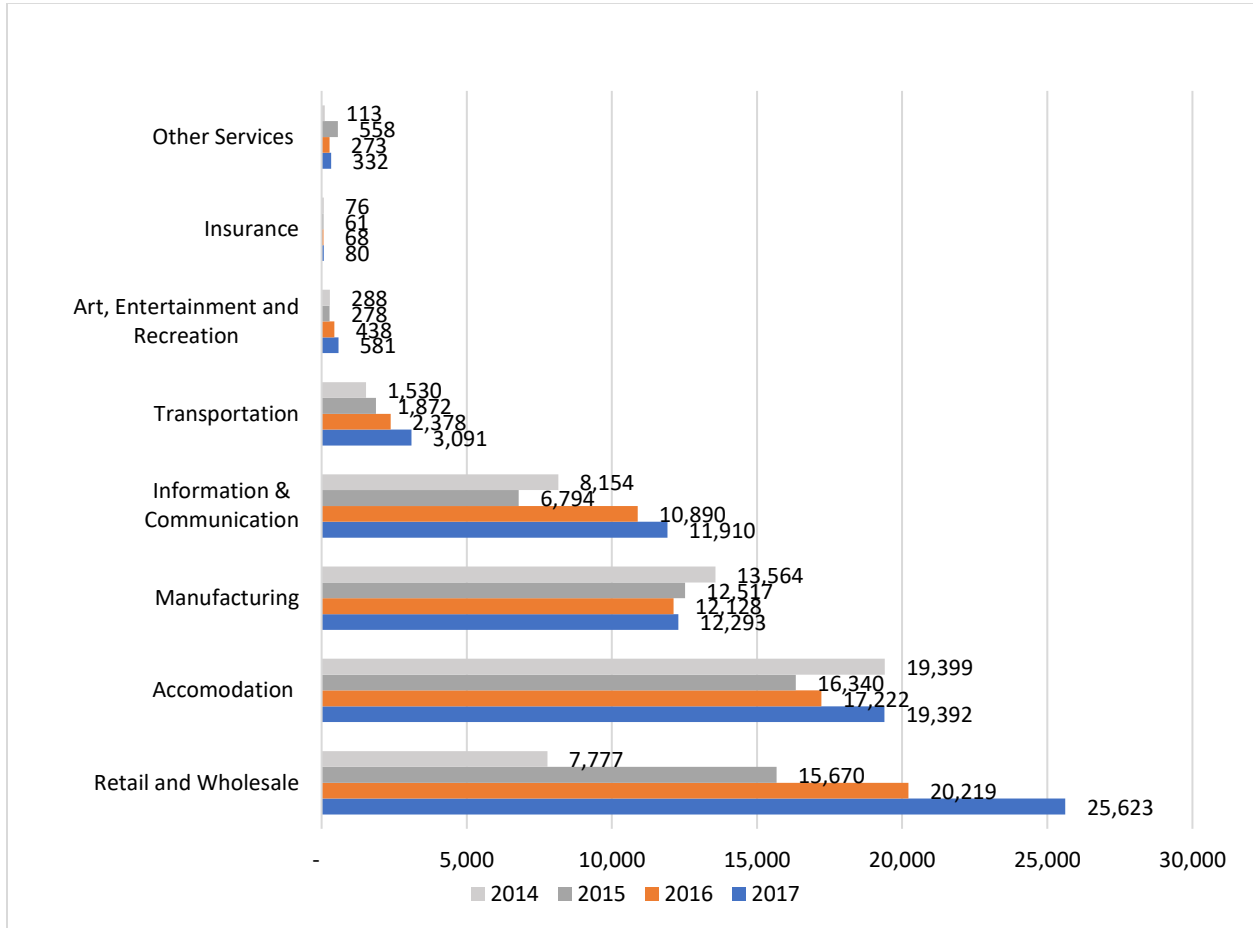
**Figure 2: Thailand’s E-Commerce Value Classified by Type, 2014 – 2016 (million USD)**



Source: The ETDA (2017)

In terms of industries, accommodation was the most critical industry for Thailand’s e-commerce. The industry accounted for 38.11 and 30.35 per cent of total e-commerce value in 2014 and 2015, respectively (**Figure 3**). Similar trends can be observed for the retail and wholesale sector, where their share of total e-commerce value has increased from 31.78 in 2016 to 40.28 per cent of in 2017. The above trends indicate that Thai consumers have increasingly shifted their preference to more on-line purchase of goods. The reason is that they can save their searching time for goods, and therefore reduce their transaction costs. Similarly, entrepreneurs have increasingly preferred more on-line sales which can be made through social media and e-marketplaces. With these e-commerce platforms, they can reduce their inventory and renting costs. According to the ETDA (2017), the majority of products and services are sold via social media, followed by e-marketplaces and websites in the retail and wholesale industry. Currently, drop-ship enterprises, which are the intermediaries between foreign producers and domestic customers, have become very popular in Thailand. Typically, these firms will ask foreign producers to produce goods based on their domestic customers’ designs (ETDA, 2017).

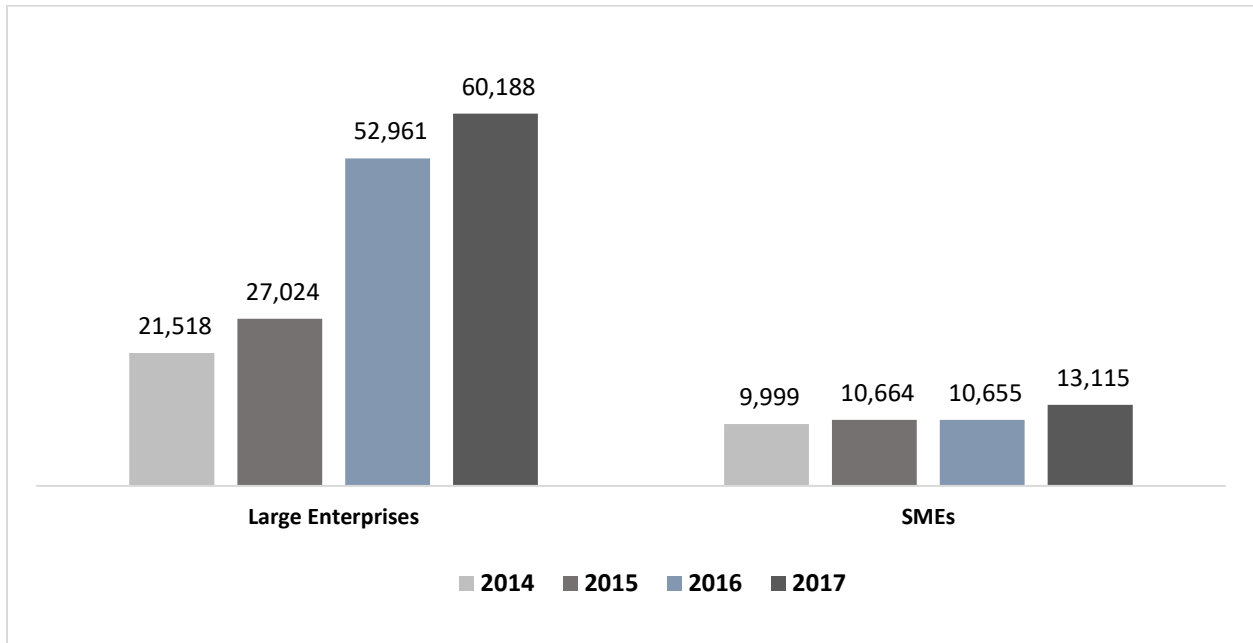
**Figure 3: E-Commerce Value Classified by Industry (Million USD)**



Source: The ETDA (2017)

In terms of size of enterprises, Thailand’s e-commerce market is dominated by large enterprises. The total value of their e-commerce transactions increased from 21.518 USD billion in 2014 (68.27 per cent of total e-commerce) to 60.188 USD billion in 2017 (71.70 per cent) (**Figure 4**). In contrast, the share of the e-commerce value of SMEs decreased from 31.73 per cent in 2014 to 17.89 per cent in 2017. However, the value of SME’s e-commerce transactions increased from 9.999 USD billion in 2014 to 13.115 USD billion in 2017. These figures imply that Thai SMEs may encounter problems identified by OECD (2001) in terms of lack of their awareness and ability in adopting information and communication technology (ICT) for their commercial and production-related purposes

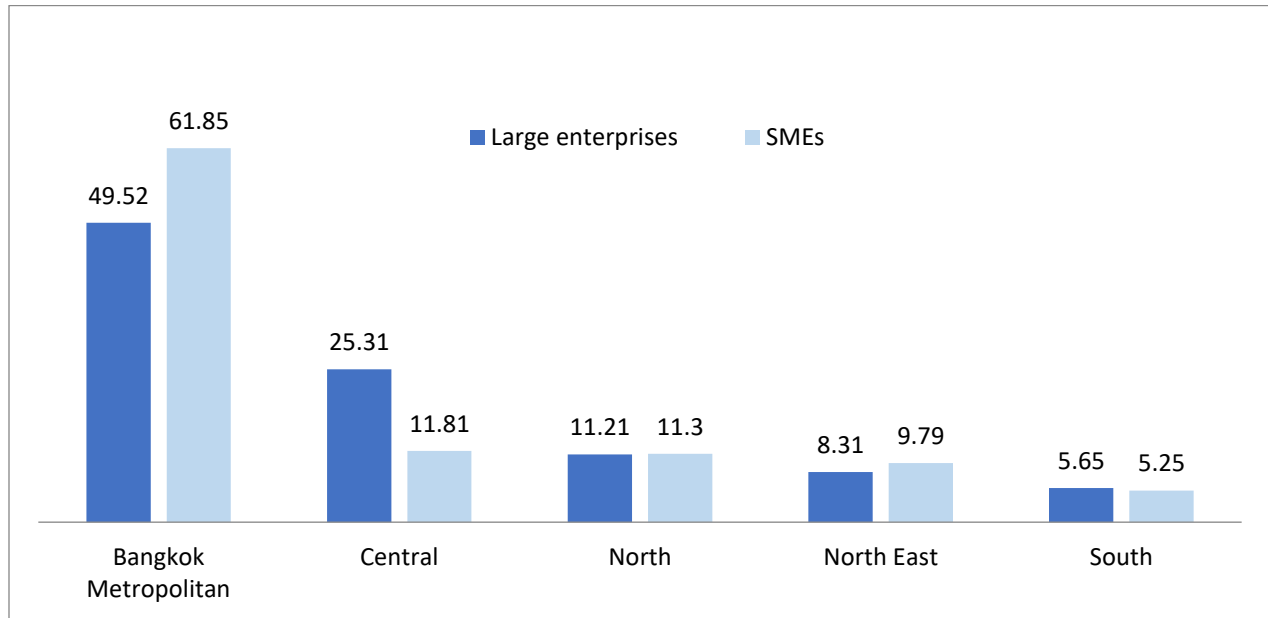
**Figure 4: E-Commerce Value of Large Enterprises and SMEs (Million USD)**



Source: The ETDA (2017)

In terms of location, 49.52 per cent of large enterprises and 61.85 per cent of SMEs in Thailand are located in the Bangkok Metropolitan region, followed by the Central, Northern, North Eastern, and Southern regions (**Figure 5**). The Bangkok Metropolitan region is a major provincial area for economic and business activities in Thailand where enterprises can access better infrastructure, logistics, financial sources, high internet speed, more advanced ICT, and secure payment systems.

**Figure 5: E-Commerce by Region and Firm Size (Percentage)**



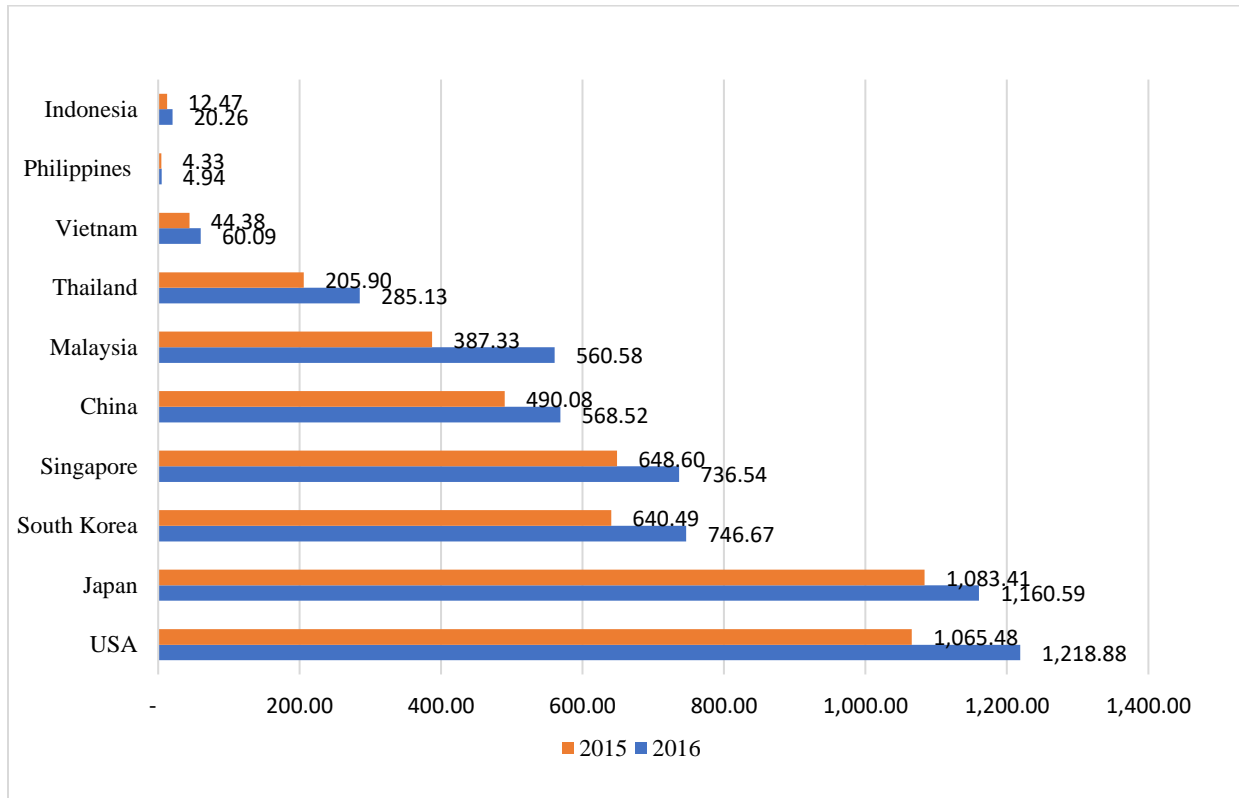
Source: The ETDA (2017)

Thailand’s B2C e-commerce value per capita increased from 205.90 USD in 2015 to 285.13 USD in 2017 (**Figure 6**). The country’s B2C e-commerce value per capita is still less than some countries such as USA, Japan, South Korea, Singapore, China, and Malaysia. However, its e-commerce value per capita is still higher than Vietnam, the Philippines, and Indonesia. This evidence is consistent with the UNCTAD’s B2C e-commerce index in 2014 that ranked Thailand 70<sup>th</sup> country<sup>4</sup>. Thailand is ranked below South Korea (8<sup>th</sup>), Japan (12<sup>th</sup>), USA (15<sup>th</sup>), Singapore (26<sup>th</sup>), Malaysia (45<sup>th</sup>), and China (65<sup>th</sup>), but Thailand is ranked higher than Indonesia (88<sup>th</sup>), Vietnam (90<sup>th</sup>), and the Philippines (no ranking) (UNCTAD, 2015).

<sup>4</sup>. The ranking is based on some criteria as follows: i) the share of population having mail delivered at home, ii) the share of individuals with credit card, iii) the share of individuals using the internet, and iv) the secure servers per 1 million people (UNCTAD, 2015).



**Figure 6: B2C E-Commerce Value Per Capita for Selected Countries (US Dollar)**



Source: The ETDA (2017)

### 3. Literature Review

Lawrence and Tar (2010) identified four key barriers to the adoption of e-commerce in developing countries. These barriers include: i) specific infrastructure barriers including technology, telecommunication (network), high access cost, and access to computer equipment, ii) socio-cultural barriers including transactional trust (payment will be made when ordered goods are received), shopping as a social place, limitation on personal contact, language and content, iii) socioeconomic barriers including economic condition, educational system, payment system, and logistics, iv) political, and v) government barriers.

Some country studies have also investigated the barriers to e-commerce adoption by SMEs (Abualrob and Kang, 2016; Chang and Dasgupta, 2015; Changchit et al., 2018; Hong and Zhu, 2006; Lertwongsatien and Wongpinunwatana, 2014; MacGregor and Vrazalic, 2005; Rahayu and Day, 2015; Saif-Ur-Rehman and Alam, 2016; Scupola and Dwivedi, 2009; Simpson and Docherty,

2004; Wymer and Regan, 2005). Saif-Ur-Rehman and Alam (2016) employed a sample of 91 small and medium-sized enterprises in Malaysia to investigate the barriers of Malaysian SMEs. E-commerce barriers are classified into five categories as follows: i) organisational barriers, ii) financial barriers, iii) technical barriers, and iv) legal and regulatory barriers and v) behavioural barriers. They found that all of these e-commerce barriers influence e-commerce adoption on average. Legal and regulatory barriers are the most crucial barrier to e-commerce adoption among Malaysian SMEs, followed by technical barriers, financial barriers, behavioural barriers, and organisational barriers, respectively. Also, they revealed that the lack of internet securities, the requirement to undertake additional training and skill development are the essential items which hinder their e-commerce adoption.

MacGregor and Vrazalic (2005) used correlation matrices and factor analysis to identify e-commerce barriers for 477 small businesses in Sweden and Australia. They found that e-commerce adoption barriers can be generally grouped into two main categories depending on whether e-commerce is either “too difficult” or “unsuitable” for the business. “Too difficult” barriers include i) lack of technical knowledge in the organisation, ii) e-commerce too complex to implement, iii) financial investment required too high, iv) lack of time to implement e-commerce, and v) difficulty of choosing between different e-commerce options. “Unsuitable” barriers refer to factors such as i) not suited to products and services, ii) not suited to way of doing business, iii) not suited to clients’ way of doing business, and iv) no advantages from e-commerce.

Simpson and Docherty (2004) also reviewed the benefits and barriers of e-commerce adoption from the literature and conducted interviews with SMEs’ owner-managers and a UK online business advisor. They found from the interviews that internal pressure from family and friends rather than external competitive pressures are the main factor in adopting e-commerce. Also, e-commerce adoption could help rescue struggling businesses. Managers-owners could gain social benefits through reduced working hours as this can provide more time for reflective thought.

Wymer and Regan (2005) also investigated a list of incentives and barriers to the adoption and use of e-business and e-commerce information technology (EEIT) by SMEs. They also consolidated these factors and determined their significance at different levels of e-commerce adoption for SMEs, such as i) SMEs which have adopted a business website, ii) SMEs which will intend to adopt a business website, and iii) SMEs which have no intention to adopt a business

website. A total of 26 factors, including incentives and barriers, were grouped into four main factors such as i) environmental factor, ii) knowledge factor, iii) organisation factor, and iv) technology factor. According to their study, six factors considered as barriers are also statistically significant for their EEIT adoption decision, such as i) setup and maintenance costs, ii) priority relative to other projects which need existing resources and time, iii) security issues, iv) access to capital for start-up, v) viable market, and partners/vendors. They also found that factors are perceived differently according to different levels of EEIT adoption decision for SMEs. However, the only consistent factor across all groups of EEIT adoption decision was the set-up and maintenance costs.

Focusing on the impacts of globalisation on the use of e-commerce and firm performance, Kraemer et al. (2005) found that globalisation, as indicated by the degree to which firms conduct business internationally and face international competition, leads to a more enormous scope of e-commerce and the improvement of firm performance as measured by efficiency, coordination, and commerce (sales and market position). The research covered ten countries, namely, Brazil, China, Denmark, France, Germany, Japan, Mexico, Singapore, Taiwan, and the United States. Furthermore, e-commerce adoption leads to better firm performance. This empirical result implies that firms with highly global experience are likely to gain benefits from e-commerce because they can enjoy economies of scale and global reach. They can use resources and capabilities received from their global experience and operations in order to enhance their e-commerce operations and technologies.

Further, firm size as measured by total employees has a significant and positive relationship with its scope of e-commerce use as well as its performance as measured by its coordination which includes both lower procurement and inventory costs and proved coordination with suppliers. However, there is no significant evidence for other firm-performance dimensions as measured by its efficiency and market. Kraemer, Gibbs, and Dedrick (2005) also compared a scope of e-commerce use and firm performance across industries such as manufacturing, distribution and finance. They found that service-based industries, such as distribution and finance, which are likely to adopt more B2C e-commerce than the manufacturing industry. Furthermore, the finance industry is likely to make more intensified scope of e-commerce use than the manufacturing industry. The finding implies that the distribution and finance industries are involved with downstream activities which require relatively more interaction with consumers. However, the

manufacturing industry focuses more interaction with business partners.

Hong and Zhu (2006) also studied that factors affecting e-commerce adoption and migration at the firm level for 1,036 US and Canadian firms. Their study revealed that firm size is found to be negatively related to e-commerce adoption and especially to e-commerce migration from traditional physical channels to the internet. Moreover, they found that firms in the service sector are likely to have higher migration level. Scupola and Dwivedi (2009) examined the factors affecting business-to-business (B2B) e-commerce adoption and implementation in Danish and Australian SMEs. Face-to-face interviews focusing on a theoretical model of technological, environmental, and organisational factors influencing e-commerce adoption and implementation were conducted in their study. They concluded that the availability of e-commerce related technologies could either be a significant facilitator or inhibitor of e-commerce adoption and implementation both in Danish and Australian SMEs. For organisational context, they found that the firm's resource constraints (human and financial resources) can be a significant factor in influencing e-commerce adoption and implementation in Denmark and Australia.

Moreover, they found that top management support and CEOs characteristics are the most vital organisational factors in the adoption and implementation of e-commerce. For environmental context, they found that the pressure from competitors and suppliers is not very significant for both Danish and Australian SMEs. However, only one Australian firm and two Danish firms accepted that competitive pressure is a significant factor for e-commerce adoption by firms. The government's role is found to be significant for the perception among Australian firms, but this evidence is not found for the case of Denmark.

Chang and Dasgupta (2015) used a qualitative method which involves in-depth interviews of seven SMEs in investigating their barriers to e-business implementation. They, however, found no association between firm age and e-business implementation. Older SMEs with more elderly employees may not be able to utilise some of the e-technologies, but older SMEs can resolve this problem by hiring younger workers who have a right level of IT skills required for that job. Rahayu and Day (2015) surveyed 292 Indonesian SMEs to investigate determinant factors of e-commerce adoption by SMEs in Indonesia. Their study is based on the Technology-Organization-Environment (TOE) framework, which groups these factors into four main categories, namely, technological context, organisational context, environmental context and specific context. In their

study, the technological factor refers to perceived benefits, compatibility, and cost that influence the adoption of e-commerce technology. The organisational factor refers to the firm characteristics that might influence the adoption of e-commerce technology. The environmental factor refers to external influences such as pressure from customers, suppliers, competitors, and external support that influence e-commerce adoption. Lastly, the individual factor refers to a strategic decision initiated by managers and owners. Their results revealed that perceived benefits, technology readiness, owners' innovativeness, owners' IT ability, and owners' IT experience are the significant factors that influence the e-commerce adoption by Indonesian SMEs.

Abualrob and Kang (2016) surveyed 161 business owners in Palestine and used structural equation modelling to investigate barriers to e-commerce adoption. In their study, these barriers can be classified into two main groups of barriers as follows: i) external barriers which cover government instability, occupation restrictions, and logistic obstacles and ii) internal barriers which include perceived losses, perceived uncertainty, and perceived complexity. Their study revealed that occupation restrictions and political factors are the significant barriers that hinder e-commerce adoption by business owners in Palestine. Also, some barriers weakly affected or did not influence their e-commerce adoption, such as perceived financial losses.

#### **4. Methodology and Empirical Models**

This study empirically examines the determinants of e-commerce adoption and utilisation by Thai SMEs. More importantly, one of the significant concerns of previous studies on e-commerce is that a firm's e-commerce adoption is mostly viewed as a binary outcome which can be either "*a firm adopts e-commerce*" or "*a firm does not adopt e-commerce*". The disadvantage of a binary outcome (the adoption vs non-adoption approach) does not fully capture the issue of technology adoption (Daniel and Wilson, 2002; Hovav, Patnayakuni, and Schuff, 2004). Therefore, the dependent variable as identified by the percentage of e-commerce adoption relative to total sales is employed in this study, which shows relatively large numbers of observations at the zero per cent of the possible range of e-commerce adoption values.

Applying the method of ordinary least squares (OLS) will lead to biased and inconsistent estimators since OLS regression will treat the zero as the actual values and not as the lower limit of the e-commerce adoption. A limitation of this approach is that when the dependent variable indicating either "adoption in e-commerce" or "none adoption in e-commerce" is censored, OLS

regression provides inconsistent estimates of the parameters, indicating that the coefficients from the OLS analysis will not necessarily approach the actual population parameters as the sample size increases (Long, 1997). Therefore, the maximum likelihood estimation for a left-censored Tobit model is well-suited to the data of this study, since the values of the dependent variable are found to be zero. This left-censored Tobit model can be expressed as follows:

$$y_i^* = \beta_0 + \sum_{j=1}^{j=n} \beta_j x_i + \varepsilon_i \quad (1)$$

$$y_i = \begin{cases} y_i^* & \text{if } c < y_i^* \\ c & \text{if } c \geq y_i^* \end{cases} \quad (2)$$

where  $y_i^*$  = Unobserved dependent variables of firm i which is distributed with stochastic component ( $y_i^* \sim Normal(\varepsilon_i, \sigma^2)$ ); where  $\varepsilon_i$  is a vector means and  $\sigma^2$  is a scalar variance parameter.

$y_i$  = Observed dependent variables of firm i

$c$  = The lower limit of the censored distribution

$\beta_i$  = Unknown parameter to be estimated for each independent variable of firm i

$x_i$  = Independent variables of firm i

$\varepsilon_i$  = Random error ( $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$ )

Applying the maximum likelihood estimation of a left-censored Tobit model for a firm's e-commerce adoption as measured by the percentage of e-commerce adoption relative to total sales, the MLE for a left-censored Tobit model is given as follows:

$$y_i^* = (\text{firm\_size}_i, \text{firm\_age}_i, \text{owner\_degree}_i, \text{owner\_education}_i, \text{owner\_age}_i, \text{computer}_i, \text{smart phone}_i, \text{web-site}_i, \text{e-market place}_i, \text{social media}_i, \text{food delivery platform}_i, \text{retail}_i, \text{government\_support}_i, \text{export}_i, \text{e-commerce\_year}_i, \text{environmental\_barrier}_i, \text{ceo\_barrier}_i, \text{organizational\_barrier}_i) \quad (3)$$

$$y_i = \begin{cases} y_i^* & \text{if } 0 < y_i^* \\ 0 & \text{if } 0 \geq y_i^* \end{cases} \quad (4)$$

where  $y_i^*$  = unobserved dependent variables, representing the percentage of e-commerce adoption relative to total sales of firm<sub>i</sub>

The analysis of e-commerce adoption uses the Probit model that can be derived from an underlying latent variable model. Let  $y^*$  be an observed or latent variable as follows:

$$y_i^* = \beta_0 + \sum_{j=1}^n \beta_j x_i + u_i \quad (5)$$

$$y_i = \begin{cases} 1 & \text{if } y_i^* = x_i\beta + u_i > 0 \\ 0 & \text{if } y_i^* = x_i\beta + u_i \leq 0 \end{cases} \quad (6)$$

where  $y_i^*$  = Unobserved dependent variables of firm i, representing the e-commerce/non e-commerce adoption of firm i

$y_i$  = Observed dependent variables of firm i

$\beta_i$  = Unknown parameter to be estimated for each independent variable of firm i

$x_i$  = Independent variables of firm i

$u_i$  = Random error which has the standard normal distribution ( $u_i \sim N(0,1)$ )

Applying the maximum likelihood estimation of a Probit model for a firm's e-commerce adoption as measured by a binary outcome is given as follows:

$$y_i^* = (\text{firm\_size}_i, \text{firm\_age}_i, \text{owner\_degree}_i, \text{owner\_education}_i, \text{owner\_age}_i, \text{computer}_i, \text{smart phone}_i, \text{environmental\_barrier}_i, \text{ceo\_barrier}_i, \text{organizational\_barrier}_i) \quad (7)$$

## 5. Data Source and Data Classification

The primary data employed in the econometric analysis in this study comes from a survey of 310 SME firms in both the retail as well as food and beverage service industries. Unlike the Thai government's survey on e-commerce conducted by the Electronic Transactions Development Agency (Public Organization) (ETDA), which covers only SMEs which use e-commerce, this surveys adopters and non-adopters of e-commerce. The number of e-commerce barriers is also identified in this survey. More importantly, one of the major criticisms of previous studies on e-commerce is that a firm's e-commerce adoption is mostly viewed as a binary outcome (either adopted or not adopted). The drawback of a binary outcome (the adoption vs non-adoption approach) does not adequately state the issue of technology adoption (Ahmad, Abu Bakar, Faziharudean, and Zaki, 2014; Daniel and Wilson, 2002; Hovav et al., 2004). Hence, a continuous dependent variable indicating the percentage of e-commerce adoption relative to total sales is adopted in this study so that this can fully capture the full coverage of technology and e-commerce adoption. According to the empirical model, as indicated in Section 4, descriptive data statistics for all variables used in this study are provided in **Table 1** and **Table 2**.

**Table 1: Variables and Summary Statistics (continuous variables)**

Variable	Definition	N	Mean	S.D	Min	Max
firm size <sub>i</sub>	Firm size of firm i as measured by total employees.	305	15.227	24.182	0	100
firm age <sub>i</sub>	Firm age of firm i as measured by the number of operating years.	307	7.557	8.104	1	49
owner age <sub>i</sub>	Age of CEO/owner/senior manager in firm i	300	40.403	11.332	17	67
export <sub>i</sub>	E-commerce exports of firm i as measured by the percentage of e-commerce exports relative to total e-commerce sales	307	0.827	6.812	0	90
e-commerce_year <sub>i</sub>	The number of years which a firm engages in e-commerce	306	1.775	2.943	0	27
B2B_e-commerce <sub>i</sub>	Business to business (B2B) e-commerce of firm i as measured by the percentage of B2B e-commerce sales relative to total e-commerce sales.	307	8.014	16.971	0	95
B2C_e-commerce <sub>i</sub>	Business to customer (B2C) e-commerce of firm i as measured by the percentage of B2C e-commerce sales relative to total e-commerce sales.	307	45.092	44.832	0	100

Source: Author's calculation



**Table 2: Variable Definitions and Summary Statistics (categorical variables)**

Variable	Definition	N	No. of "1"	No. of "0"	Min	Max
owner_degree <sub>i</sub>	Dummy variable takes a value of 1 for a firm's CEO/owner/senior's manager obtaining at least a university degree in economics, accounting, business administration, and other social science & humanities and related fields, or 0 otherwise (such as science, information technology (IT), and engineering)	307	279	28	0	1
owner_education <sub>i</sub>	Dummy variable takes a value of 1 for a firm's CEO/owner/senior manager obtaining at least a bachelor's degree, or 0 otherwise	307	221	86	0	1
computer <sub>i</sub>	Dummy variable takes a value of 1 for a firm having computers (PC/laptops/tablets), or 0 otherwise	307	135	172	0	1
smart phone <sub>i</sub>	Dummy variable takes a value of 1 for a firm having smartphones, or 0 otherwise	307	181	126	0	1
website <sub>i</sub>	Dummy variable takes a value of 1 for a firm having websites or company applications, or 0 otherwise	307	51	256	0	1
e-marketplaces <sub>i</sub>	Dummy variable takes a value of 1 for a firm using e-marketplaces (i.e. Lazada and Shopee) as one of its e-commerce platform, or 0 otherwise	307	50	257	0	1
social media <sub>i</sub>	Dummy variable takes a value of 1 for a firm using social media (i.e. Facebook, Instagram, Line, Whatapps) as one of its e-commerce platform, or 0 otherwise	307	252	55	0	1
food delivery platforms <sub>i</sub>	Dummy variable takes a value of 1 for a firm using social media (i.e. Grabfood, Foodpanda, Lineman, Lalamove) as one of its e-commerce platform, or 0 otherwise	307	76	231	0	1
retail <sub>i</sub>	Dummy variable takes a value of 1 for a firm being in the retail industry, or 0 otherwise (food & beverage)	307	177	130	0	1
government_support <sub>i</sub>	Dummy variable takes a value of 1 for a firm requiring the government supports for its e-commerce enhancement, or 0 otherwise	307	66	241	0	1
environmental_barrier <sub>i</sub>	Dummy variable takes a value of 1 for a firm that the environmental factors ranks as the most critical barrier in hindering its e-commerce implementation, or 0 otherwise	302	94	208	0	1
CEO_barrier <sub>i</sub>	Dummy variable takes a value of 1 for a firm that ranks CEO/owner/senior manager's management views as the most critical barrier in hindering its e-commerce implementation, or 0 otherwise	302	75	227	0	1
organizational_barrier <sub>i</sub>	Dummy variable takes a value of 1 for a firm that ranks the organisational factor as the most critical barrier in hindering its e-commerce implementation, or 0 otherwise	302	76	226	0	1
technological_barrier <sub>i</sub>	Dummy variable takes a value of 1 for a firm that ranks the technological factor ranks as the most critical barrier in hindering its e-commerce implementation, or 0 otherwise	302	56	246	0	1

Source: Author's calculation

## 5. Empirical Results

The empirical results are reported for both food and beverage and retail industries, separately for the food and beverage industry, and the retail industry<sup>5</sup>.

### 5.1 Food and Beverage and Retail Industries

The empirical evidence shows that firm age has a significant and negative association with e-commerce utilisation levels of Thai SMEs in the food and beverage and retail industries (**Table 3**). This result implies that older firms are less likely to adopt lower e-commerce utilisation levels relative to younger ones. This result contradicts to the findings of Chang and Dasgupta (2017), which found mixed results between e-commerce adoption and firm age. Their finding from in-depth interviews suggests that older firms might recruit workers with the right level of IT skills required for the job. From Table 3, the significant and negative association between firm age and e-commerce utilisation levels are also found for the case of B2C e-commerce for Thai SMEs.

In this study, the age of the owners/CEOs/senior managers are also found to be significantly and negatively related to e-commerce utilisation levels by Thai SMEs. This evidence also suggests that older owners/CEOs/senior managers are likely to have lower e-commerce utilisation levels. This study also investigated the impact of owners/CEOs/senior managers' education attainment level as well as their educational background on e-commerce utilisation level. There is no statistically significant result to conclude that their educational attainment level and education background will help promote e-commerce utilisation levels for Thai SMEs in aggregate, as indicated in **Table 3**. Nevertheless, education attainment level and educational background in economics, accounting, business administration, and other social science and humanities and related fields can help enhance higher business-to-business (B2B) e-commerce utilisation levels by Thai SMEs.

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<sup>5</sup> Heckman's selection model was employed to analyze the problem of selection bias in this study since non-randomly selected samples can lead to inaccurate conclusions. According to Thai SMEs in the survey, the Wald test of independent equations is approximately 2.37. The estimated p-value is 0.1238, and greater than 0.05. Therefore, it failed to reject the null hypothesis of no sample selection bias ( $\rho = 0$ ). In other words, e-commerce utilization is unrelated to the decision to adopt e-commerce. Hence, the Tobit and Probit models can be analyzed separately.

**Table 3: Factors Affecting E-Commerce Utilisation by Thai SMEs  
in the Retail and Food and Beverage Industries**

Independent Variable:	E-Commerce Utilisation		B2B Utilisation		B2C Utilisation	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Firm size <sub>i</sub>	0.0356	(0.0947)	-0.0548	(0.1048)	0.1964	(0.2142)
Firm age <sub>i</sub>	-0.7808*	(0.2821)	0.1325	(0.3954)	-0.9195***	(0.5127)
Owner degree <sub>i</sub>	5.4726	(6.0213)	16.9009**	(7.2973)	-0.3336	(12.7921)
Owner education <sub>i</sub>	-5.1622	(5.6297)	6.9814	(6.1853)	-7.0833	(9.5188)
Owner age <sub>i</sub>	-0.4836**	(0.2220)	-0.2266	(0.2608)	-0.5155	(0.3781)
Computer <sub>i</sub>	5.6579	(4.6929)	14.3600*	(5.5251)	18.4286**	(8.5909)
Smart phone <sub>i</sub>	18.3341*	(4.9519)	16.3951*	(6.3322)	46.6469*	(9.6767)
Website <sub>i</sub>	15.0961**	(6.1149)	6.6443	(5.9899)	12.4514	(9.0395)
E-market place <sub>i</sub>	9.3896***	(5.6661)	-4.0893	(6.1615)	21.3183**	(8.5428)
Social media <sub>i</sub>	30.4574*	(7.2767)	55.4974*	(15.7973)	50.5681*	(13.7124)
Food delivery platform <sub>i</sub>	18.2319*	(6.3815)	5.1198	(8.4424)	42.8170*	(12.6617)
Retail <sub>i</sub>	22.9097*	(6.0247)	27.9492*	(7.1825)	28.3275**	(11.7415)
Government support	6.3664	(4.6002)	-2.4009	(6.6669)	12.6526	(8.9820)
Export <sub>i</sub>	0.6585*	(0.1805)	0.4712***	(0.2477)	0.4968	(0.3562)
E-commerce year <sub>i</sub>	4.3085*	0.9240	4.0127*	(0.8986)	7.1258*	(1.3734)
Environmental barrier <sub>i</sub>	-10.0487***	(5.9320)	-12.3266	(7.7525)	-28.3820*	(10.5589)
CEO barrier <sub>i</sub>	-7.7560	(6.3615)	-20.9521**	(8.1460)	-16.3228	(11.2189)
Organizational barrier <sub>i</sub>	-10.8998***	(6.1845)	-11.2260	(7.5740)	-15.9089	(11.1213)
Constant	-39.3882*	(14.3873)	-114.5730*	(23.6672)	-56.5518**	(26.7611)
/sigma	27.7037	(1.7687)	29.1519	(2.6274)	52.7722	(2.6774)
Left-censored obs. (<=0)	135		200		132	
Uncensored obs.	156		92		160	
Right-censored obs.	0		0		0	
Number of obs.	291		292		292	
F statistics	8.63		4.79		14.12	
Prob>F	0.00*		0.00*		0.00*	
Pseudo R2	0.1116		0.1277		0.0926	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance.

In this study, firm size is not a significant role in e-commerce utilisation for Thai SMEs. This study is different from the studies of Kraemer et al. (2005) and Kuan and Chau (2001) which suggested that larger firms tend to adopt greater ICTs than smaller ones due to their more considerable resources and IT knowledge. The reason is that this study only focusses on SMEs in services such as food and beverage and retail which need fewer workers compared with those in

the manufacturing sector. In this study, most of the firms are very small, and therefore they are likely to hire fewer workers. Focusing on technological devices for e-commerce utilisation among Thai SMEs, it is found that smartphones are a crucial technological device in promoting e-commerce utilisation levels among Thai SMEs, including both B2B and B2C e-commerce utilisations. They can use smartphones together with social media to update their products' information. On the contrary, desktop PCs are not statistically related to e-commerce utilisation levels by Thai SMEs. The reason is that desktop PCs may have become less used compared to smartphones and tablets.

For e-commerce platforms, it is found that social media usage (Facebook, Instagram, Line, and WhatsApp's) is found to be statistically and positively related to e-commerce utilisation levels by Thai SMEs, including both B2B and B2C e-commerce utilisations. It is because social media is a cost-effective marketing tool which can reach massive online customers without a large amount of payments on advertising their products and services. This paper finds that social media has the significant and greatest impact on e-commerce utilisation levels due to the most considerable magnitude of estimated coefficient, followed by food delivery platform, website, and e-marketplaces. Food delivery platforms also significantly contribute to higher e-commerce utilisation levels by Thai SMEs. Moreover, the usage of e-marketplaces (i.e. Lazada and Shopee) is related to e-commerce utilisation levels by Thai SMEs. E-marketplaces enable Thai SMEs to advertise their products and services targeted for a considerable number of online customers, reduce their operation costs, and increase trust and transparency between Thai SMEs and customers as well as opportunities for oversea sales. However, e-marketplaces are found to be the least efficient e-commerce platform in promoting e-commerce utilisation levels by Thai SMEs. The reason why e-marketplaces have the least significant impact on e-commerce utilisation levels by Thai SMEs is that online sellers have pay for sales commission for the provider in such e-marketplace.

This study also found that Thai SMEs in the retail industry are likely to have higher e-commerce utilisation levels compared to those SMEs in the food and beverage industry. The reason is that the retailers have shifted their preference to more online sales due to changes in customers' preferences. Unlike the retail industry, it is more challenging to sell food and beverage products because these products must be delivered on time in order to maintain the highest quality. This study also found that Thai SMEs exporting their products to foreign markets are likely to have higher e-commerce utilisation levels, and this applies to B2B e-commerce utilisation. This evidence is consistent with the finding of Kraemer et al. (2005), indicating that firms which have tremendous international experience tend to use resources and capabilities learned from their global business experience to develop their domestic business operations and technologies for e-commerce activities. More interestingly, Thai SMEs, which have more years of e-commerce experience, are likely to have higher e-commerce utilisation levels. More e-commerce experience positively contributes to higher B2B and B2C e-commerce utilisation levels by Thai SMEs.

This study also investigated which type of barriers significantly hinder e-commerce adoption. Organisational, environmental, and technical barriers are found to hinder the e-commerce adoption.<sup>6</sup> This result is consistent with the finding of Scupola (2009). Environmental factors are also found to be significantly crucial in hindering e-commerce utilisation by Thai SMEs<sup>7</sup>. The barriers from CEOs do not have a significant impact on the e-commerce utilisation levels by Thai SMEs. However, it has a more significant impact on B2B e-commerce utilisation levels by Thai SMEs relative to the technological barrier<sup>8</sup>. Organisational and environmental barriers are not found to be a significant factor in hindering B2B e-commerce utilisation levels by Thai SMEs. The reason is that dealing with B2B e-commerce requires more CEOs' technology readiness, innovativeness, and IT ability and experience required for upstream activities in their businesses, as stated in Rahayu and Day (2015). Focusing on B2C e-commerce adoption, it is found that the environmental barrier is found to be the most significant factor in hindering B2C e-commerce

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<sup>6</sup> In this study, organizational factors refer the following organizational barriers such as i) firms' products and services are not suitable for e-commerce transaction, ii) there is a lack of firms' technical knowledge, iii) firm size is too small to support e-commerce activities, and iv) firms are constrained by financial and human resources to invest in e-commerce activities.

<sup>7</sup>This is due to the second-largest magnitude of its estimated coefficient which is slightly close to the size of the estimated coefficient for the organizational barrier as shown in Table 3.

<sup>8</sup> CEO barriers cover the followings: i) uncertainty over e-commerce benefits compared to costs, ii) still learning about e-commerce transactions and markets, iii) concern about managing disruptive e-commerce technologies. The technological barrier is the base category for types of barriers in this study.

utilisation levels by Thai SMEs compared to technological barrier. According to the ETDA's survey in 2017, many SMEs have suggested that the government should revise the laws for e-commerce business and impose harsher punishments as well as disciplinary actions on those who engage in deceitful online trading, credit or debit card fraud, exaggerated commercial ads, deceitful promotional campaigns, and identity theft (ETDA, 2017). Legal and regulatory factors are also the most critical barriers to e-commerce adoption by Malaysian SMEs, as suggested by Rehman and Alam (2016).

Besides the factors affecting e-commerce utilisation levels by Thai SMEs, this study also investigates factors affecting e-commerce adoption by Thai SMEs. Unlike irrelevant results between larger firms and e-commerce utilisation levels, the results found in **Table 4** and **Table 5** suggested that larger firms are likely to adopt their e-commerce, including B2C e-commerce. It implies that firm size matters for being an e-commerce adopter since most of them are brick-and-mortar firms that need more workers to handle goods ordered online while selling goods at their physical stores. However, once they become e-commerce firms, firm size does not matter for higher utilisation levels in this study. Firm age is not found to be significant for the case of e-commerce adoption by Thai SMEs. Owners/CEOs/senior managers' education attainment level and their educational background are not found to help promote e-commerce adoption by Thai SMEs in aggregate, including B2B and B2C e-commerce adoptions.

Concerning technological devices for e-commerce adoption among Thai SMEs, smartphones and desktop PCs are crucial technological devices in promoting e-commerce adoption by Thai SMEs, including both B2B and B2C e-commerce adoptions. They can use smartphones and desktop PCs, together with social media, to update their products' information. Nevertheless, smartphones have a more significant impact on e-commerce adoption by Thai SMEs, including their B2B and B2C e-commerce adoptions due to more significant estimated coefficients found in Tables 4 and 5. For the case of e-commerce adoption by Thai SMEs, Thai SMEs in the retail industry are likely to e-commerce adoption more than those SMEs in the food and beverage industry, including both B2B and B2C e-commerce adoptions. Environmental, CEO, and organisational barriers are not found to be a vital factor in hindering B2B e-commerce adoptions by Thai SMEs.

**Table 4: Factors Affecting E-Commerce Adoption for Thai SMEs in the Retail and Food and Beverage Industries**

Independent Variable:	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.
Firm size <sub>i</sub>	0.0341**	(0.0153)	0.0032	(0.0048)	0.0341**	(0.0153)
Firm age <sub>i</sub>	-0.0170	(0.0145)	0.0020	(0.0155)	-0.0170	(0.0145)
Owner degree <sub>i</sub>	0.0683	(0.3043)	0.4385	(0.2970)	0.0683	(0.3043)
Owner education <sub>i</sub>	-0.0769	(0.2073)	0.3175	(0.2123)	-0.0769	(0.2073)
Owner age <sub>i</sub>	-0.0217**	(0.0085)	-0.0143	(0.0100)	-0.0217**	(0.0085)
Computer <sub>i</sub>	0.6640*	(0.2010)	0.5129**	(0.2076)	0.6640*	(0.2010)
Smart phone <sub>i</sub>	1.3624*	(0.2021)	1.0197*	(0.2249)	1.3624*	(0.2021)
Retail <sub>i</sub>	0.9059*	(0.1915)	1.1650*	(0.2058)	0.9059*	(0.1915)
Government support <sub>i</sub>	0.4781**	(0.2173)	-0.0187	(0.2215)	0.4781**	(0.2173)
Environmental barrier <sub>i</sub>	-0.7723*	(0.2739)	-0.3962	(0.2613)	-0.7723*	(0.2739)
CEO barrier <sub>i</sub>	-0.7674*	(0.2839)	-0.6129**	(0.2863)	-0.7674*	(0.2839)
Organizational barrier <sub>i</sub>	-0.6416**	(0.2739)	-0.2576	(0.2671)	-0.6416**	(0.2739)
Constant	-0.1869	(0.5451)	-1.9549*	(0.5868)	-0.1869	(0.5451)
Wald Chi2(12)	101.74		86.38		101.74	
Prob > chi2	0.0000*		0.0000*		0.0000*	
Number of obs.	293		293		293	
Pseudo R2	0.3623		0.2944		0.3623	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance.

**Table 5: Factors Affecting E-Commerce Adoption for Thai SMEs  
in the Retail and Food and Beverage industries**

Independent Variable:	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Firm size <sub>i</sub>	0.0084**	(0.0036)	0.0008	(0.0012)	0.0084**	(0.0036)
Firm age <sub>i</sub>	-0.0042	(0.0036)	0.0005	(0.0038)	-0.0042	(0.0036)
Owner degree <sub>i</sub>	0.0168	(0.0748)	0.1083	(0.0731)	0.0168	(0.0748)
Owner education <sub>i</sub>	-0.0189	(0.0510)	0.0784	(0.0528)	-0.0189	(0.0510)
Owner age <sub>i</sub>	-0.0053*	(0.0021)	-0.0035	(0.0025)	-0.0053*	(0.0021)
Computer <sub>i</sub>	0.1634*	(0.0472)	0.1267**	(0.0502)	0.1634*	(0.0472)
Smart phone <sub>i</sub>	0.3352*	(0.0366)	0.2519*	(0.0495)	0.3352*	(0.0366)
Retail <sub>i</sub>	0.2229*	(0.0427)	0.2878*	(0.0409)	0.2229*	(0.0427)
Government support <sub>i</sub>	0.1176**	(0.0524)	-0.0046	(0.0547)	0.1176**	(0.0524)
Environmental barrier <sub>i</sub>	-0.1900*	(0.0654)	-0.0979	(0.0640)	-0.1900*	(0.0654)
CEO barrier <sub>i</sub>	-0.1888*	(0.0690)	-0.1514*	(0.0689)	-0.1888*	(0.0690)
Organizational barrier <sub>i</sub>	-0.1579**	(0.0662)	-0.0636	(0.0658)	-0.1579**	(0.0662)

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance.

This paper also employs the average marginal effects for all covariates affecting e-commerce adoption by Thai SMEs, as indicated in Table 5. Marginal effects are an informative tool for summarising how change in the dependent variable is related to change in an independent variable. For continuous covariates, the marginal effect measures the instantaneous rate of change. For instance, the average marginal effect for owner age is -0.0053. In other words, as owner/CEO/senior manager's age increases by one year, the predicted probability of adopting e-commerce decreases by 0.0053 (or 0.53%), holding other covariates fixed.

For categorical covariates, the marginal effects for categorical variables indicate how probability (Y=1) is predicted to alter as the independent variable changes from 0 to 1, holding all covariates fixed. For instance, the average marginal effect for the independent variable (retail) is 0.2229 for Thai SMEs in the retail industry. It shows that the predicted probability of adopting e-commerce is higher than those SMEs in the food and beverage industry by 0.2229 (22.29 per cent), holding other independent variables constant.



## 5.2 Food and Beverage Industry

Focusing on the food and beverage industry, as indicated in **Table 6**, it is found that firm size has a significant and positive correlation to e-commerce utilisation levels. Unlike Thai SMEs in the retail industry, larger SMEs in the food and beverage industry are likely to have higher levels of e-commerce adoption. The empirical evidence on firm size is consistent with those of Kraemer et al. (2005) and Kuan and Chau (2001). The reason is that larger firms are more likely to have advanced IT knowledge and resources. Larger enterprises are also more likely to have higher B2C e-commerce utilisation levels. However, there is no evidence that this applies to the case of B2B e-commerce utilisation by larger SMEs. For the food and beverage industry, this implies that larger restaurants are more likely to have higher B2C e-commerce utilisation levels. Such businesses are involved with downstream business activities that accept online orders from household customers via food delivery platforms. This evidence follows Kenneth et al. (2005) finding that firms which focus on more local or multi-domestic businesses are more likely to do B2C but less likely to do B2B. Based on estimated coefficients, website is the most significant e-commerce platform in the food and beverage industry, followed by social media and food delivery platform. Unlike the retail industry, e-marketplaces are not statistically significant for the case of Thai SMEs in this industry. Social media and food delivery platform are also found to be statistically significant for the case of B2C e-commerce adoption, but such insignificant evidence is found for B2B e-commerce adoption.

Thai SMEs which engage in exports are likely to have higher e-commerce utilisation levels. More years in adopting e-commerce also promote higher e-commerce utilisation levels by Thai SMEs in this industry, indicating the significance of learning-by-doing hypothesis. This finding also contributes to higher B2C e-commerce utilisation levels by Thai SMEs. Owners/CEOs/senior managers' education attainment levels and educational background are not found to influence e-commerce utilisation levels by Thai SMEs, except that education attainment levels of owners/CEOs/senior managers play an essential role in promoting higher B2B e-commerce utilisation levels. This implies that B2B e-commerce focus more upstream business activities which need more skills and knowledge of entrepreneurs.

**Table 6: Factors Affecting E-Commerce Utilisation for Thai SMEs  
in the Food and Beverage Industry**

Independent Variable:	E-Commerce Utilisation		B2B Utilisation		B2C Utilisation	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Firm size <sub>i</sub>	0.2030**	(0.0959)	-0.1832	(0.2177)	0.9360*	(0.3558)
Firm age <sub>i</sub>	-0.4190	(0.4499)	1.1518	(0.9349)	-1.6137	(1.2582)
Owner degree <sub>i</sub>	17.7814	(12.1197)	46.0851**	(18.0621)	14.0999	(30.3881)
Owner education <sub>i</sub>	-7.3815	(7.4012)	46.5120*	(17.6653)	-20.9354	(17.8240)
Owner age <sub>i</sub>	-0.3091	(0.2570)	-0.9387	(0.6502)	-1.0958	(0.7345)
Computer <sub>i</sub>	8.5959	(5.8353)	25.6562	(19.1751)	46.6607*	(17.7755)
Smart phone <sub>i</sub>	9.3129	(5.6312)	15.5732	(14.1643)	5.7134	(18.0373)
Website <sub>i</sub>	18.7952**	(7.8575)	6.6446	(12.2161)	23.3125	(16.8632)
E-market place <sub>i</sub>	-2.9653	(6.4982)	-16.9735	(22.7611)	21.2020	(20.0802)
Social media <sub>i</sub>	17.0958**	(7.4505)	89.8791	(80.5068)	54.1292**	(24.3276)
Food delivery platform <sub>i</sub>	15.3929*	(5.6041)	10.8140	(13.1530)	64.4468*	(15.6106)
Government Support <sub>i</sub>	12.7390**	(5.8362)	6.7619	(18.6840)	37.0620**	(16.3595)
Export <sub>i</sub>	1.8920*	(0.6265)	0.5229	(1.4455)	2.9592	(2.1869)
E-commerce year <sub>i</sub>	2.2026**	(0.9172)	3.8195	(3.4791)	9.1262*	(3.0009)
Environmental barrier <sub>i</sub>	-21.7938*	(6.7839)	-37.4590**	(16.1378)	-67.3450*	(22.6547)
CEO barrier <sub>i</sub>	-19.5808**	(7.5262)	-56.8452**	(27.3739)	-39.6626	(26.4367)
Organizational barrier <sub>i</sub>	-17.9604**	(8.3130)	-38.5042**	(18.3854)	-56.8927**	(24.9179)
Constant	-29.7457***	(15.7908)	-185.4401***	(97.4026)	-39.4695	(42.0018)
/sigma	20.3299	(3.0684)	32.4650	(6.3045)	63.4032	(5.5724)
Left-censored obs. (<=0)	74		109		73	
Uncensored obs.	50		16		52	
Right-censored obs.	0		0		0	
Number of obs.	124		125		125	
F statistics	10.16		2.00		7.57	
Prob>F	0.00*		0.017**		0.00*	
Pseudo R2	0.1293		0.1671		0.1086	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance.

In this industry, this study found that Thai SMEs which need government supports for their e-commerce activities are more likely to have higher e-commerce utilisation levels. This finding also applies to higher B2C e-commerce utilisation levels by Thai SMEs. Regarding four different types of barriers, environmental barrier is found to be the most significant factor which can hinder the e-commerce utilisation by Thai SMEs, followed by environmental barrier, CEO barrier, and organisational barrier, and technological barrier.

Focusing on the factors affecting e-commerce adoption by Thai SMEs in the food and beverage industry, the age of owners/CEOs/senior managers is likely to have a significant and negative association with e-commerce adoption by Thai SMEs, as indicated in **Table 7** and **Table 8**. In other words, older owners/CEOs/senior managers are not likely to adopt e-commerce. If they become e-commerce adopters, their older age does not cause higher levels of e-commerce utilisation. Firm size and firm age are not statistically related to e-commerce adoption by Thai SMEs, including B2B and B2C e-commerce adoptions. Owners/CEOs/senior managers' education attainment level and their educational background do not help e-commerce adoption by Thai SMEs in the food and beverage industry, including B2B and B2C e-commerce adoptions.

**Table 7: Factors Affecting E-Commerce Adoption for Thai SMEs  
in the Food and Beverage Industry**

Independent Variable:	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.
Firm size <sub>i</sub>	0.0242	(0.0187)	-0.0058	(0.0067)	0.0242	(0.0187)
Firm age <sub>i</sub>	0.0041	(0.0204)	0.0480	(0.0293)	0.0041	(0.0204)
Owner degree <sub>i</sub>	0.4933	(0.6605)	0.9321	(0.6106)	0.4933	(0.6605)
Owner education <sub>i</sub>	-0.2075	(0.3015)	1.2264**	(0.4844)	-0.2075	(0.3015)
Owner age <sub>i</sub>	-0.0220***	(0.0120)	-0.0294	(0.0185)	-0.0220***	(0.0120)
Computer <sub>i</sub>	1.0498*	(0.3064)	0.9484***	(0.5063)	1.0498*	(0.3064)
Smart phone <sub>i</sub>	0.6117**	(0.3097)	0.5973	(0.4541)	0.6117**	(0.3097)
Government Support <sub>i</sub>	0.7040**	(0.3084)	0.1846	(0.4111)	0.7040**	(0.3084)
Environmental barrier <sub>i</sub>	-1.1144*	(0.3489)	-1.3603*	(0.4744)	-1.1144*	(0.3489)
CEO barrier <sub>i</sub>	-1.1056*	(0.3975)	-1.8593*	(0.7103)	-1.1056*	(0.3975)
Organizational barrier <sub>i</sub>	-1.1041*	(0.4064)	-1.2059**	(0.5144)	-1.1041*	(0.4064)
Constant	-0.0571	(0.8190)	-2.1543**	(0.8747)	-0.0571	(0.8190)
Wald Chi2(12)	37.79		26.72		37.79	
Prob > chi2	0.0001*		0.0051*		0.0001*	
Number of obs.	125		125		125	
Pseudo R2	0.2902		0.3209		0.2902	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance

Smartphones and desktop PCs are found to be critical technological devices for e-commerce adoption by Thai SMEs, including both B2B and B2C e-commerce adoptions. Smartphones can be used to promote e-commerce adoption by Thai SMEs compared with desktop PCs, including B2B and B2C e-commerce adoptions due to a larger size of estimated coefficients found in **Table 7** and **Table 8**. Thai SMEs requiring government supports in the future are likely to adopt e-commerce compared with those SMEs requiring no government supports. Since these SMEs that require government supports, realise e-commerce benefits. Environmental, CEO, and organisational barriers are found to be significantly necessary (and higher than technological barriers as a base group) for e-commerce adoption by Thai SMEs in this industry, including B2B and B2C e-commerce adoptions.

**Table 8: Factors Affecting E-Commerce Adoption for Thai SMEs  
in the Food and Beverage Industry, Marginal Effects**

Independent Variable	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Firm size <sub>i</sub>	0.0066	(0.0049)	-0.0009	(0.0010)	0.0066	(0.0049)
Firm age <sub>i</sub>	0.0011	(0.0055)	0.0070***	(0.0040)	0.0011	(0.0055)
Owner degree <sub>i</sub>	0.1349	(0.1778)	0.1368	(0.0919)	0.1349	(0.1778)
Owner education <sub>i</sub>	-0.0567	(0.0821)	0.1800**	(0.0776)	-0.0567	(0.0821)
Owner age <sub>i</sub>	-0.0060***	(0.0031)	-0.0043***	(0.0025)	-0.0060***	(0.0031)
Computer <sub>i</sub>	0.2871*	(0.0724)	0.1392***	(0.0718)	0.2871*	(0.0724)
Smart phone <sub>i</sub>	0.1673**	(0.0814)	0.0876	(0.0651)	0.1673**	(0.0814)
Follow up <sub>i</sub>	0.1925**	(0.0783)	0.0271	(0.0591)	0.1925**	(0.0783)
Environmental barrier <sub>i</sub>	-0.3048*	(0.0877)	-0.1996*	(0.0643)	-0.3048*	(0.0877)
CEO barrier <sub>i</sub>	-0.3024*	(0.1024)	-0.2729*	(0.0863)	-0.3024*	(0.1024)
Organizational barrier <sub>i</sub>	-0.3020*	(0.1013)	-0.1770*	(0.0671)	-0.3020*	(0.1013)

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance

Concerning the barrier factors in the food and beverage industry, as indicated in **Table 9**, the alpha coefficient for eighteen barrier items in this industry is 0.816, suggesting that the barrier items have relatively high internal consistency for the case of Thai SMEs in the food and beverage industry. The average score of all eighteen barrier items is about 3.34, indicating that Thai SMEs neither disagree nor agree for all eighteen barrier items in this industry. One-sample test is used to test the statistical difference of each barrier item relative to the mean score of all eighteen barrier items. It is found that the barrier item, “insufficient security to prevent hacking and malware” and “large segment of consumers that are still not literate in using e-commerce” are found to be the most significant barrier, which can hinder the e-commerce adoption by Thai SMEs, followed by the barrier items such as “*government incentives are not sufficient.*”, “*still learning about e-commerce transactions and markets.*”, and “*lack of standards/regulations from government on e-commerce activities*”. However, the significant barrier item which has the least impact in hindering e-commerce is “*technological infrastructure (including website) of firm does not support e-commerce activities*”, followed by “*telecommunication and other logistics infrastructure are not adequate in my country*”, “*not enough pressure from competitors*”, “*telecommunication and other logistics infrastructure are not adequate in my country*”, and “*my product/service is not suitable for e-commerce transaction*”. The rest of the barrier items, which are not addressed, are not found to be statistically different from the hypothesised mean score of all eighteen barrier items for the food and beverage industry.

**Table 9: Factors Hindering E-Commerce Adoption of Thai SMEs in the Food and Beverage Industry: Reliability Test and One-Sample Test**

Barrier Factors	Reliability Test	One-Sample Test (Test Value = 3.34)					
	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation	t	Df	Sig. (2-tailed)	Mean Difference
TechI: Technological infrastructure (including Website) of firm does not support e-commerce activities	.809	2.92	.981	-4.937	129	.000*	-.425
TechII: E-commerce activities (e.g. marketing, payment, logistics) are still segmented.	.806	3.21	.929	-1.623	129	.107	-.132
TechIII: Insufficient security for on-line payment and transactions	.803	3.29	1.045	-.520	129	.604	-.048
TechIV: Insufficient security to prevent hacking and malware	.802	3.65	.955	3.654	129	.000*	.306
OrgI:The product/service is not suitable for an e-commerce transaction.	.811	3.09	1.030	-2.742	129	.007*	-.248
OrgII: Lack of technical knowledge/awareness of available training for e-commerce adoption.	.802	3.45	.924	1.310	129	.193	.106
OrgIII: Firm size is too small to support e-commerce activities.	.801	3.42	.995	.952	129	.343	.083
OrgIV: Constrained by financial/human resources to invest in e-commerce activities	.801	3.27	1.002	-.805	129	.422	-.071
EnvironI: Telecommunication and other logistics infrastructure are not adequate in my country.	.802	3.07	.942	-3.279	129	.001*	-.271
EnvironII: Government incentives are not sufficient.	.804	3.57	.853	3.064	129	.003*	.229
EnvironIII: Insufficient qualified vendors for developing and maintaining websites.	.800	3.35	.922	.171	129	.864	.014
EnvironIV: lack of standards/regulations from government on e-commerce activities.	.799	3.46	.799	1.735	129	.085***	.122
EnvironV: Large segment of consumers that are still not literate in using e-commerce.	.801	3.65	1.076	3.325	129	.001*	.314
EnvironVI: The additional costs of e-payment (e.g., commissions, bank charges, etc.) and logistics are high.	.800	3.47	.942	1.565	129	.120	.129
EnvironVII: Not enough pressure from competitors	.816	3.02	.968	-3.732	129	.000*	-.317
CEOI: Uncertainty over e-commerce benefits compared to costs.	.801	3.35	.860	.082	129	.935	.006
CEOII: Still learning about e-commerce transactions and markets.	.811	3.49	.865	2.008	129	.047**	.152
CEOIII: Concern about managing disruptive e-commerce technologies	.817	3.35	.922	.171	129	.864	.014

Remarks: \* \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance; The average score of 18 barrier factors is 3.34 for Thai SMEs in the food and beverage industry;

Cronbach's Alpha is 0.816

### 5.3 Retail Industry

For the retail industry, a firm's age has a significant and negative correlation with e-commerce utilisation level by Thai SMEs (**Table 10**). This result indicates that older firms have more difficulties in adopting e-commerce relative to younger ones. This study also found that owners/CEOs/senior managers with a bachelor's degree are more likely to have higher B2B e-commerce utilisation levels compared to those who do not have at least a bachelor's degree. Similarly, older owners/CEOs/senior managers are less likely to have higher e-commerce utilisation levels. They also tend to have a higher preference for traditional offline sales. Smartphones are found to be the critical and vital tool in promoting a higher level of e-commerce utilisation in this industry, but computers (desktops) are not found to be statistically significant to promote the levels of e-commerce adoption, including both B2B and B2C e-commerce utilisations. The reason is that most sellers are likely to use their smartphones to update and sell their products online through their social media and website.

More specifically, social media is also found to be a significant e-commerce platform in promoting higher B2B and B2C e-commerce utilisation levels. This evidence is consistent with the finding of the ETDA (2017), suggesting that the retail and wholesale industry distributed its products via social media. This evidence implies that social media via Facebook, Instagram, and Whatsapp is a cost-effective marketing tool for Thai SMEs in the retail industry. Also, the use of e-marketplaces are also found to significantly correlated to higher B2C e-commerce utilisation levels. The reason is that household customers are more likely to buy products via e-marketplaces compare with business customers. Firms which export their products online to foreign markets are likely to have higher e-commerce utilisation levels. The reason is that foreign customers are likely to order Thai SMEs' products online. The empirical evidence implies that exports can help increase e-commerce utilisation levels in the retail industry. Unlike the food and beverage industry, this study found no evidence that all barriers are statistically significant.

Concerning the factors affecting e-commerce adoption by Thai SMEs in the retail industry, firm size and firm age are found to statistically correlate with e-commerce adoption by Thai SMEs, including B2C e-commerce adoption (**Table 11**). These results imply that larger SMEs are likely to adopt e-commerce, but older SMEs are less likely to adopt e-commerce. However, when they become e-commerce adopters, larger SMEs do not statistically contribute to higher levels of e-commerce utilisation, as shown in Table 10. Older SMEs are less likely to have higher e-commerce

utilisation levels. Older owners/CEOs/senior managers are less likely to adopt e-commerce, including B2C e-commerce adoption. For the retail industry, smartphones are essential to promote e-commerce adoption, but computers (desktops) are not statistically significant to promote e-commerce adoption, including B2C e-commerce adoptions. Desktops are found to be statistically significant in promoting B2B e-commerce adoption. Desktops are essential for workers to do their jobs, especially for B2B e-commerce. **Table 12** indicates the marginal effects.

**Table 10: Factors Affecting E-commerce Utilisation for Thai SMEs in the Retail Industry**

Independent Variable:	E-Commerce Utilization		B2B Utilization		B2C Utilization	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Firm size <sub>i</sub>	-0.1345	(0.0858)	-0.0046	(0.1040)	-0.0278	(0.1255)
Firm age <sub>i</sub>	-0.8869*	(0.2686)	-0.2147	(0.3871)	-0.5422	(0.4136)
Owner degree <sub>i</sub>	1.5935	(7.2597)	15.2731***	(8.0344)	-12.8747	(13.4727)
Owner education <sub>i</sub>	-3.1984	(8.1045)	-1.6374	(6.8699)	0.0084	(10.0814)
Owner age <sub>i</sub>	-0.5819***	(0.3147)	-0.0683	(0.3039)	-0.3563	(0.3886)
Computer <sub>i</sub>	3.9211	(6.0901)	13.9221**	(6.0997)	0.4178	(7.9731)
Smart phone <sub>i</sub>	25.7631*	(7.7436)	18.4260**	(7.2089)	72.2569 *	(10.4798)
Website <sub>i</sub>	15.6976***	(8.4660)	8.7954	(6.3646)	6.9472	(10.5076)
E-market place <sub>i</sub>	10.8803	(7.2128)	-6.4059	(6.7104)	19.8377**	(8.4128)
Social media <sub>i</sub>	31.6060*	(11.1434)	42.2657*	(13.8882)	31.4679**	(15.0779)
Government support <sub>i</sub>	7.8664	(7.0821)	-3.6494	(7.2977)	10.2912	(9.7207)
Export <sub>i</sub>	0.6050**	(0.2378)	0.4101	(0.2670)	0.1697	(0.3224)
E-commerce year <sub>i</sub>	5.0162*	(1.1886)	4.3137*	(1.1390)	5.2022*	(1.2824)
Environmental barrier <sub>i</sub>	0.2515	(8.7598)	-5.2747	(9.9302)	-7.8344	(10.2475)
CEO barrier <sub>i</sub>	-0.5790	(9.4899)	-15.0533	(9.7312)	-0.8594	(10.3453)
Organizational barrier <sub>i</sub>	-5.1119	(9.1231)	-3.6350	(9.6427)	2.9562	(10.0750)
Constant	-24.3038	(22.0684)	-75.7712*	(25.0832)	-26.0212	(28.8902)
/sigma	29.0134	(2.2078)	27.2237	(2.9161)	39.8726	(3.0550)
Left-censored obs. (<=0)	61		91		59	
Uncensored obs.	109		76		108	
Right-censored obs.	0		0		0	
Number of obs.	167		167		167	
F statistics	8.04		4.60		13.04	
Prob>F	0.00*		0.00*		0.00*	
Pseudo R2	0.1037		0.0986		0.1119	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance.



**Table 11: Factors Affecting E-Commerce Adoption for Thai SMEs in the Retail industry**

Independent Variable:	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.
Firm size <sub>i</sub>	0.0422***	(0.0233)	0.0083	(0.0063)	0.0422***	(0.0233)
Firm age <sub>i</sub>	-0.0324***	(0.0187)	-0.0192	(0.0148)	-0.0324***	(0.0187)
Owner degree <sub>i</sub>	-0.6370	(0.4246)	0.4009	(0.3801)	-0.6370	(0.4246)
Owner education <sub>i</sub>	-0.0827	(0.3179)	0.0628	(0.2591)	-0.0827	(0.3179)
Owner age <sub>i</sub>	-0.0209***	(0.0118)	-0.0069	(0.0114)	-0.0209***	(0.0118)
Computer <sub>i</sub>	0.4141	(0.3329)	0.4954**	(0.2542)	0.4141	(0.3329)
Smart phone <sub>i</sub>	2.1743*	(0.3018)	1.2441*	(0.2722)	2.1743*	(0.3018)
Government support <sub>i</sub>	0.3241	(0.2715)	-0.1564	(0.2874)	0.3241	(0.2715)
Environmental barrier <sub>i</sub>	-0.4486	(0.4104)	-0.0627	(0.3203)	-0.4486	(0.4104)
CEO barrier <sub>i</sub>	-0.4758	(0.4011)	-0.2919	(0.3324)	-0.4758	(0.4011)
Organizational barrier <sub>i</sub>	-0.0710	(0.3461)	0.0975	(0.3324)	-0.0710	(0.3461)
Constant	0.7249	(0.7614)	-1.1227	(0.7486)	0.7249	(0.7614)
Wald Chi2(12)	81.27		55.24		81.27	
Prob > chi2	0.0000*		0.0000*		0.0000*	
Number of obs.	168		168		168	
Pseudo R2	0.4916		0.2394		0.4916	

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance

**Table 12: Factors Affecting E-Commerce Adoption for Thai SMEs  
in the Retail Industry, marginal effects**

Independent Variable	E-Commerce Adoption		B2B Adoption		B2C Adoption	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Firm size <sub>i</sub>	0.0076***	(0.0042)	0.0024	(0.0018)	0.0076***	(0.0042)
Firm age <sub>i</sub>	-0.0058***	(0.0034)	-0.0057	(0.0043)	-0.0058***	(0.0034)
Owner degree <sub>i</sub>	-0.1148	(0.0771)	0.1183	(0.1107)	-0.1148	(0.0771)
Owner education <sub>i</sub>	-0.0149	(0.0575)	0.0185	(0.0765)	-0.0149	(0.0575)
Owner age <sub>i</sub>	-0.0038***	(0.0021)	-0.0020	(0.0034)	-0.0038***	(0.0021)
Computer <sub>i</sub>	0.0747	(0.0590)	0.1461**	(0.0726)	0.0747	(0.0590)
Smart phone <sub>i</sub>	0.3920*	(0.0338)	0.3671*	(0.0665)	0.3920*	(0.0338)
Government support <sub>i</sub>	0.0584	(0.0494)	-0.0461	(0.0845)	0.0584	(0.0494)
Environmental barrier <sub>i</sub>	-0.0809	(0.0738)	-0.0185	(0.0945)	-0.0809	(0.0738)
CEO barrier <sub>i</sub>	-0.0858	(0.0736)	-0.0861	(0.0980)	-0.0858	(0.0736)
Organizational barrier <sub>i</sub>	-0.0128	(0.0623)	0.0288	(0.0978)	-0.0128	(0.0623)

Source: Authors' estimation

Note: Robust standard errors are in parentheses; \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance, \*\*\* indicates the 10% level of significance

For the retail industry, the alpha coefficient for all eighteen barrier items in this industry is 0.804, suggesting that the barrier items have relatively high internal consistency for the case of Thai SMEs in this industry (**Table 13**). The average score of all eighteen barrier items is about 3.19, indicating neither disagree nor agree for all of the eighteen barrier items. It is found that the barrier items, such as "*insufficient security to prevent hacking and malware*" and "*large segment of consumers that are still not literate in using e-commerce*" are the most significant factors that hinder the levels of e-commerce adoption, followed by significant barrier items, such as "*lack of standards/regulations from government on e-commerce activities*", "*still learning about e-commerce transactions and markets*", "*government incentives are not sufficient*", "*the additional costs of e-payment (i.e. commissions, bank charges) and logistics are high*", "*insufficient security for on-line payment and transactions*", and "*concern about managing disruptive e-commerce technologies*". On the other hand, the significant barrier factor which has the least impact in hindering e-commerce found in this industry is "*my product/service is not suitable for e-commerce transaction*", followed by "*technological infrastructure (including Website) of firm does not support e-commerce activities*", "*not enough pressure from competitors*", "*telecommunication and other logistics infrastructure are not adequate in my country*", "*constrained by financial/human resources to invest in e-commerce activities*", and "*firm size is too small to support e-commerce activities*". The rest of the barrier items are not statistically different from the hypothesised mean score of all barriers.

**Table 13: Barrier factors which hinder the levels of e-commerce adoption of Thai SMEs in the retail industry: Reliability Test and One-Sample Test**

Barrier Factors	Reliability Test	One-Sample Test (Test Value = 3.19)					
	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation	t	Df	Sig. (2-tailed)	Mean Difference
TechI: Technological infrastructure (including Website) of firm does not support e-commerce activities	.801	2.83	.901	-5.308	176	.000*	-.359
TechII: E-commerce activities (e.g. marketing, payment, logistics) are still segmented.	.799	3.24	.769	.818	176	.414	.047
TechIII: Insufficient security for on-line payment and transactions	.796	3.37	1.015	2.397	176	.018*	.183
TechIV: Insufficient security to prevent hacking and malware	.794	3.55	.929	5.128	176	.000*	.358
OrgI: The product/service is not suitable for an e-commerce transaction.	.800	2.60	1.007	-7.809	176	.000*	-.591
OrgII: Lack of technical knowledge/awareness of available training for e-commerce adoption.	.796	3.17	.914	-.299	176	.766	-.021
OrgIII: Firm size is too small to support e-commerce activities.	.790	2.98	1.069	-2.577	176	.011	-.207
OrgIV: Constrained by financial/human resources to invest in e-commerce activities	.797	2.97	1.005	-2.964	176	.003*	-.224
EnvironI: Telecommunication and other logistics infrastructure are not adequate in the country.	.789	2.85	.932	-4.890	176	.000*	-.343
EnvironII: Government incentives are not sufficient.	.793	3.40	.861	3.262	176	.001*	.211
EnvironIII: Insufficient qualified vendors for developing and maintaining websites.	.789	3.21	.866	.380	176	.705	.025
EnvironIV: lack of standards/regulations from government on e-commerce activities.	.791	3.43	.830	3.835	176	.000*	.239
EnvironV: Large segment of consumers that are still not literate in using e-commerce.	.792	3.55	.941	5.062	176	.000*	.358
EnvironVI: The additional costs of e-payment (e.g., commissions, bank charges, etc.) and logistics are high.	.793	3.39	.899	2.959	176	.004*	.200
EnvironVII: Not enough pressure from competitors	.791	2.85	.954	-4.698	176	.000*	-.337
CEOI: Uncertainty over e-commerce benefits compared to costs.	.792	3.28	.921	1.254	176	.212	.087
CEOII: Still learning about e-commerce transactions and markets.	.804	3.42	.843	3.600	176	.000*	.228
CEOIII: Concern about managing disruptive e-commerce technologies	.798	3.36	.869	2.627	176	.009*	.172

Notes: \* indicates the 1 % level of significance; \*\* indicates the 5 % level of significance The average score of 18 barrier factors is 3.19 for Thai SMEs in the retail industry; Cronbach's Alpha is

0.8

## **6. Policy Implications**

According to the empirical results of this study, training programmes on e-commerce should be conducted more regularly, especially for older SMEs and entrepreneurs. The ETDA (2017) suggested that the government should provide regular training programmes on e-commerce for SMEs from all regions throughout Thailand. The reason is that some of Thai SMEs are not aware of the list of relevant state organisations which are responsible for e-commerce promotion. This recommendation can ensure that local and older SMEs and entrepreneurs can receive the highest benefit from utilising all the government programmes across the country. Training programmes are also very crucial, especially for entrepreneurs without tertiary education.

More importantly, this study found that firms believe that a large segment of consumers that are still not literate in using e-commerce, and the security in preventing hacking and malware is insufficient. Therefore, training programmes on how to start a safe online purchase on the internet should be offered to customers as this can boost the buyers' confidence and trust in purchasing Thai SMEs' products traded on online channels. There is a difference between belief in goods and trust in purchasing on-line products. More accessible, affordable, and secured e-commerce platforms should be offered to Thai SMEs. According to the ETDA (2017), Thai SMEs have also preferred the government to solve some urgent problems relating to trading via social media, such as deceitful online trading, credit or debit card fraud, and identify theft. More specifically, social media, website, and food delivery platforms are found to increase Thai SME' e-commerce engagement. Therefore, the security and trust of these e-commerce platforms, especially for social media, should be provided to increase the confidence of e-commerce transactions for both sellers and buyers. The government should enforce strict laws related to e-commerce businesses to increase the security and trust in e-commerce so that e-commerce transactions will be more efficient, as suggested by the ETDA (2017). The UNCTAD (2015) also stated that relevant laws such as e-transaction laws, consumer protection laws, privacy and data protection laws, and cybercrime laws are inadequate in developing countries. Hence, the government should impose harsher punishments and disciplinary actions for those who operate their fraud and deceptive e-commerce businesses against the country's e-commerce laws. For instance, the government must monitor exaggerated commercial advertisements and deceitful promotional campaigns. The ETDA (2017) also suggested that the government should enhance the security of financial transactions such as making payment via Prompt Pay and the state-sponsored financial system.

Focusing on the food and beverage industry, food delivery platform has become very popular among consumers in the Bangkok Metropolitan Region. This study found that food delivery platform can help increase e-commerce utilisation levels by Thai SMEs. However, such food delivery services are still limited to the Bangkok Metropolitan region and other big provinces or cities such as Chiang Mai, Kon Kaen, Pattaya, and Hat Yai. To promote higher e-commerce utilisation levels in this industry, the government should promote online food delivery services, especially for the second-tier tourism-oriented provinces. However, the development of ICT infrastructure, especially the internet quality and coverage in the population, should be promoted in the second-tier tourism-oriented provinces as announced by the government. As a result, the government policies, which aim to promote adequate internet service coverage, fast internet service, and internet security and privacy for online customers, especially for the second-tier tourism-oriented provinces, should be targeted as suggested by the CIMB ASEAN Research Institute (2017)

Also, the development of skilled human capital should be considered for Thai SMEs. The ETDA (2017) also suggested that Thai SMEs lack of specialised officers in the fields related to e-commerce, such as online marketing and development, information technology, and computer graphics. Consequently, Thai SMEs are unable to compete with large enterprises in the competitive e-commerce market due to a lack of these specialised workforces. The government policies focusing on promoting the quality of excellent delivery and reducing the costs of transportation should be implemented for Thai SMEs To promote higher e-commerce utilisation levels in the retail industry, especially for Thailand Post which is a government-owned enterprise. The reason is that 84.38 per cent of Thai SMEs preferred to use delivery services provided by Thailand Post, as revealed by the ETDA (2017). As a result, the service quality of Thailand Post and private transportation providers should be promoted for Thai SMEs throughout the country.

## **7. Conclusions**

This paper aims to examine factors and barriers which hinder e-commerce utilisation and adoption by Thai SMEs in the food and beverage and retail industries. Older SMEs and entrepreneurs are likely to have lower e-commerce utilisation levels, implying that they have more difficulties than younger SMEs and entrepreneurs to cope with new technologies for their e-commerce adoption. Besides, they have a higher preference for traditional offline sales where

their businesses are conducted at their physical stores. Similarly, evidence is also found for the case of those SMEs and entrepreneurs in the retail industry. Larger SMEs are likely to adopt e-commerce. Nevertheless, when they become e-commerce adopters, the size of their firms does not significantly contribute to higher e-commerce utilisation levels. Similar evidence is also found in the retail industry. Entrepreneurs with at least a bachelor's degree are likely to have higher B2B e-commerce utilisation levels. The finding implies that education attainment level for entrepreneurs matters for upstream business activities. Smartphones have been factor for online stores to promote e-commerce adoption and higher e-commerce utilisation levels. These smartphones can be used to link with several e-commerce platforms such as social media, e-marketplace, website, and food delivery platform. In this study, the most crucial e-commerce platform is social media (via Facebook, Instagram, Line, and WhatsApp), especially for B2C e-commerce sales, followed by website. Food delivery platforms (i.e. Grabfood, Foodpanda, Lalamove, and Lineman) contribute to higher e-commerce utilisation levels by Thai SMEs in the food and beverage industry. For these two industries, SMEs in the retail industry are likely to have higher e-commerce utilisation levels than that of SMEs in the food and beverage industry. Thai SMEs exporting to foreign markets are likely to have higher e-commerce utilisation levels. Those SMEs which have more e-commerce experience tend to have higher e-commerce utilisation levels.

Comparing the importance of different types of barriers in both food and beverage and retail industries, organisational and environmental barrier is the key factor that can significantly hinder the e-commerce adoption by Thai SMEs compared with technological barrier. For the food and beverage industry, environmental barrier is the most significant factor hindering the e-commerce adoption by Thai SMEs, followed by CEO barrier, organisational barrier, and technological barrier. However, such insignificant evidence is not statistically found for the case of Thai SMEs in the retail industry. More specifically, this study found that a large segment of consumers has not adopted e-commerce due to concerns about internet security. These are the most critical barriers that hinder the e-commerce adoption by Thai SMEs in the food and beverage and retail industries. The significant barrier which has the least impact in hindering e-commerce adoption for the food and beverage industry is technological infrastructure (including Website). For the retail industry, the barrier which has the least impact in hindering e-commerce adoption is suitability of a firm's product/service for e-commerce transaction.

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