



# The adoption of sustainable supply chain management practices on performance and quality assurance of food companies

John K.M. Kuwornu<sup>a,b,c,\*</sup>, Janati Khaipetch<sup>c</sup>, Endro Gunawan<sup>d,c</sup>, Richard Kwasi Bannor<sup>a</sup>, Tien D.N. Ho<sup>b,e</sup>

<sup>a</sup> Department of Agribusiness Management and Consumer Studies, University of Energy and Natural Resources, P. O. Box 214, Sunyani, Ghana

<sup>b</sup> Department of Agricultural and Resource Economics, University of Energy and Natural Resources, P. O. Box 214, Sunyani, Ghana

<sup>c</sup> Department of Food, Agriculture and Bioresources, School of Environment, Resources and Development, Asian Institute of Technology (AIT), Thailand

<sup>d</sup> Indonesian Center for Agriculture Socio-Economic & Policy Studies, Ministry of Agriculture, Indonesia

<sup>e</sup> Faculty of Economics and Law, Tien Giang University, My Tho, Viet Nam

## ARTICLE INFO

### Keywords:

Sustainable supply chain management  
Food companies  
Sustainable performances  
Food quality assurance  
Thailand

## ABSTRACT

This study examined the effect of adopting sustainable supply chain management (SSCM) practices on food companies' sustainable performance and food quality assurance in Bangkok, Thailand. Primary data were collected through questionnaires administered to 126 food companies in Bangkok. The Seemingly Unrelated Regression (SUR) was used to examine the effect of internal and external sustainable supply chain management practices on sustainable performances. The Ordinary Least Squares (OLS) was employed to examine the effect of sustainable performances on the food company's quality assurance. The study's empirical result revealed that internal and external SSCM techniques positively influence the companies' financial, environmental, and social performances. The sustainable performance indicators (i.e. environmental, financial, and social) positively influence quality assurance. This study provides recommendations for adopting SSCM practices by food companies in Thailand.

## 1. Introduction

Currently, the world's population is more than three times larger than it was in the mid-twentieth century, and is estimated at 8.0 billion in mid-November 2022 from an estimated 2.5 billion people in 1950 ([1], p.3). Due to increases in the global population, food has become a crucial issue as demand for different and more quality food becomes eminent ([2]; Yamada Consulting Group [[3], 2018; [4]]. As a result, the global food supply will reach 60% by 2050 to meet the expected population growth [5]. However, consumers are beginning to be circumspect about food origin, production methods, and whether foods are eco-friendly or not [6,7].

Globally, food supply chains (FSC) are expanding to match the production of seasonal food with the increasing demands of consumers around the world in terms of safety, sustainability, and environmental impacts that may, in turn, affect human societies and well-being [3,7,8]. Therefore, in recent times, the issue of sustainability in the food supply chain (FSC) has also been a major concern among stakeholders, leading

to the development of a unique field of sustainable supply chain management (SSCM) [7,9]. Out of several sectors, such as manufacturing and energy, the food industry is one of the most critical sectors that faces multiple environmental, economic, and social challenges. All three are otherwise known as the triple bottom line (TBL), contributing to a company's adoption of sustainability strategy [7]. The management of a firm's activities such that it does not affect the environment negatively, or the negative environmental impact arising from the firms' activities, is the environmental domain of the SSCM [7,10,11].

Thailand is one of the primary leading producers and exporters of many processed foods, owing to its approximately 9,000 food processing companies. Major food exports include rice, canned tuna, sugar, meat, cassava products, and canned pineapple. Thailand's food and beverage industry contributes 25% of the country's gross domestic product. The value of Thai food exports was \$34.6 billion in 2021, an increase of 11.8% from 2020 [12,13].

Given this, the Thai food industry has become an entire sector for the added value of agricultural products and distributes technological

\* Corresponding author at: Department of Agribusiness Management and Consumer Studies, University of Energy and Natural Resources, P. O. Box 214, Sunyani, Ghana.

E-mail address: [john.kuwornu@uenr.edu.gh](mailto:john.kuwornu@uenr.edu.gh) (J.K.M. Kuwornu).

<https://doi.org/10.1016/j.sfr.2022.100103>

Received 22 July 2022; Received in revised form 29 November 2022; Accepted 12 December 2022

Available online 13 December 2022

2666-1888/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

advancement and development into rural areas faster than other sectors. Additionally, it provides income to more than 10 million people in small agricultural households living in rural areas of Thailand [14]. Generally, a food firm's practices are related to sustainable supply chain management, either internal or external, and can exist in various forms. The practices could be seen as planning, organisational, operational, and communication-based approaches [7]. Indeed, SSCM practices could influence food quality because of an act on social responsibility and the environmental management that require the company to place food safety assurance before a sustainable performance [15].

According to Wang et al. [16], food companies have adopted some sustainability standards, such as ISO 9001 as a quality management system standard, ISO 14001 as an environmental management standard, and ISO 22000 as a food safety management standard. However, these standards are not mentioned as codes of conduct for Thailand's food companies to operate as sustainable companies, and the objectives and outcomes of adopting these standards are also in doubt. Additionally, many small to medium companies also found that the cost of changing the entire operating process to achieve the SSCM standards is high and worthless [7,17]. For this reason, the adoption of SSCM practices by Thai food companies is still at the early stages as each company has its understanding and concept of sustainable production practices. In general, small food companies have less or no concern regarding sustainability and the benefits of being sustained. Apart from this, most studies in Thailand have focused on Green Supply Chain Management [18,19], with few studies on SSCM practices in the FSC [20,21].

Further, globally and most importantly in Asia, several studies have investigated SSCM in various industries, particularly the manufacturing industry (see [16,22,23]; Zeng et al., 2013), with few studies in the FSC [24].

Notwithstanding these fundamental challenges and the wealth of research on SSCM practices in manufacturing industries, little work has been conducted on the effect of both internal and external SSCM practices on the environmental, financial, social, and quality assurance performances in the food industry in Thailand. Hence, this study is an attempt to investigate SSCM practices in Thailand, examine the effect of both internal and external SSCM practices' adoption on sustainable performance of food companies and food quality assurance in Thailand. The results from this study will enhance the knowledge of food companies on the effects of SSCM on enterprise performance to aid in improving their sustainability and competitive advantage. This study attempts to answer the following two questions:

- 1 Does the adoption of internal and external SSCM practices influence sustainable performance of food companies in Thailand?
- 2 What is the effect of the adoption of SSCM practices on food quality assurance by food companies in Thailand?

The rest of the paper is structured as follows: [Section 2](#) presents the literature review; [Section 3](#) presents the materials and methods; [Section 4](#) presents the results and discussions; and [Section 5](#) provides the conclusions and recommendations.

## 2. Literature review

### 2.1. Sustainable supply and food chains

Supply chain (SC) includes the movement and storage of raw materials, inventory, and the transportation of goods from production, processing, distribution, and consumption. Supply chain management (SCM) is the management of the flow of goods and services from production, harvesting, storage, transportation and processing of many actors in the supply chain (i.e. producers, manufacturers, wholesalers, distributors, and retailers) [15]. The SCM uses management theories to design, collect, preserve, distribute, and trace products from the beginning to the end of the supply chain [25,26]. Perdana et al. [25] state that

the food supply chain (FSC) is a set of activities to provide food for society and maintain food security. From the production to consumption stages, economic, social, environmental, and political factors are major challenges in achieving sustainable development of the food sector. The SCM is crucial in the food processing industry because timing plays an important role for high quality, low cost and effective raw material use [27].

Food supply chain management (FSCM) concerns production, distribution, and consumption to maintain the quality and safety of different foods with an effective and efficient modus operandi. FSCM is very important, given its fundamental role in meeting the needs of human beings [28]. Previous studies have emphasised the short FSC effects and explained the processes by which these effects could enhance the benefits for the producer, consumer, and community [7,29–32].

Wang et al. [16] advocated that the FSC can be more sustainable by ensuring food safety, particularly high food quality, technology use, increased efficiency of resources, education for employees, and a greater understanding of consumer demand. For instance, stored harvested foods should be distributed and retailed for ultimate consumer satisfaction; however, globally, over 30% of food is lost or wasted yearly because of poor FSC [15,33]. Globally, about 14% of food produced is lost in the harvest and retail stages, and about 17% of total global food production is wasted (11% in households, 5% in the food service and 2% in retail) [33]. Hence, effective strategies are needed to reduce food losses and waste to feed a growing population without increasing the environmental footprints of agriculture [15].

According to Mastos and Gotzamani [7], sustainable supply chain management (SSCM) operates under the three dimensions of sustainable development goals: environmental, economic, and social sustainability. For sustainable supply chain performance, there is a need to measure economic, environmental, operational and social parameters [34]. SSCM practices continue to influence supply chain performance (SCP) in emerging countries, especially Thailand, South Korea, India, Malaysia, Indonesia, China, and Taiwan. Implementing SSCM practices could help companies increase market shares and profits. In addition to financial benefits, SSCM practices also help enterprises satisfy their responsibilities to society, the environment, and other stakeholders in the FSC [15,35].

According to Wang et al. (2017) and Mastos and Gotzamani [7], quality assurance (QA) is compulsory for the development of food safety in FSC. To implement quality assurance in food, standards such as total quality management (TQM), continuous improvement, and ISO 9000 standards are appropriate. QA systems (QAS) would enhance the satisfaction of customers' implicit and explicit expectations and the competitiveness for companies in the food industry. The continuous interaction of agribusiness with competitive markets increasingly requires the efficiency and reliability of their products and services as crucial aspects of competitiveness. The QAS, such as the International Standard Organization 9000 (ISO), Total Quality Management, Hazard Analysis and Critical Control Point (HACCP), and Good Manufacturing Practice (GAP) codes are implemented by companies to achieve effective quality assurance (Wang et al., 2017; [15]). This is because quality encourages more customer attraction and lower operating costs. While quality assurance (QA) schemes build up expenses, they also bring benefits and reinforce a company's competitive position.

In Thailand, the spread of supermarkets and modern retailing started in the 1990s due to huge foreign investments [15,36] and an increase in per capita incomes and economic development in the main cities – such as Bangkok – which led to a change in diet of the residents. People require more high-quality food products, inducing many changes in food systems and closer coordination among actors in the food supply chains [15,37]. These social changes require social and technological innovations coupled with understanding of consumer preferences, if food companies are to remain competitive. Thus, both internal and external factors are relevant and could significantly influence the performance of food companies. For instance, a food company can reduce waste by

introducing advanced technological and food-quality standards.

Meanwhile, from previous studies, the quality evaluation’s foundation for food is generally subjective, with various characteristics of food – such as nutritional and safety attributes of food or its appearance, smell, texture, and flavour – which are generally judged by human inspectors [7,15]. Nevertheless, there are limited studies on the qualitative and quantitative insights into the impact of internal and external factors on the performance of companies, one of the key stakeholders in food supply chains [15]. Likewise, strategies for enhancing environmental, financial, and social performances and food quality assurance are under-represented in the literature, while the emphasis on such issues is often not reflected in guidelines and policies [15].

On the other hand, when a firm’s activities improve the community and individual employees’ livelihoods, it is deemed to have fulfilled the social domain of the SSCM [11,22,38]. The economic domain of the SSCM is concerned with improving the firm’s financial benefits, such as market share, cost reduction, and profits accruing to the firm [7,11,39]. SSCM practices can be either internal or external. Focusing on each or both positively impacts firm performance [11, 16]. Food companies are focusing on advancing sustainable supply chain management practices (SSCM) [40]. Through SSCM, food companies would benefit from sustaining economic viability (profit), with no grave implications for the environment (plant) and social systems (people) [41,42]. In effect, the environmental and social practices of SSCM have a positive effect on performance by reducing significant costs (replacing non-compliant suppliers) and operational (delivery delays by labour) affairs concerning suppliers [7,43]. To this end, the performance of the triple bottom line (TBL), if not mandatory, is gaining significance [44], and food companies adopting the TBL approach could be utilised as a yardstick to confirm sustainable efforts [34]. Several studies have investigated SSCM in various industries, particularly in the manufacturing industry, with few studies in the FSC [24]. For example, Mitra and Datta [45] analysed the diversity influencing sustainable supply chains; and Glover [41] explored the dark side of supermarket-driven sustainable dairy supply chains. Das [46] examined sustainable practices in SCM and their impact on firm performance (i.e. social and environmental practices in SCM and SSCM performance). Phan et al. [23] analysed the effect of SSCM practices on the performance of Vietnamese manufacturing companies. Likewise, several studies have analysed the influence of SSCM practices on a firm’s performance at different levels in different countries [16,22]. Recently, Kitsis and Chen [44] analysed motives for driving SSCM. In Thailand, most studies have focused on green supply chain management [18,19], with few studies on SSCM practices in the FSC [20,21].

In terms of quality assurance, SSCM practices could influence food quality because of an act of social responsibility and the environmental management aspects that require the company to place food safety assurance before sustainable performance [15].

A review of the literature [15,47] of SSCM suggests that few studies simultaneously consider all aspects of sustainability (financial, social, and environmental perspectives). While many researchers have examined the food supply chain area and its sustainability, little research has been done on the effects of internal and external SSCM practices on sustainable performance and food quality assurance. Besides, the previous studies focussed on the economic and environmental performance aspects, whereas the social dimension and the integration of the three sustainability dimensions were not examined [7,22]. Meanwhile, since companies are taking responsibility for compliance with food quality requirements, finding options for tackling environmental footprints while achieving financial performance, social performance and food quality assurance is critical for the sustenance of food supply chains. Therefore, this paper examines the effect of the adoption of internal and external SSCM practices on sustainable performance and food quality assurance of food companies in Thailand.

**Table 1**  
Variables, description and a priori expectation.

Variable	Description	Expected sign
<b>Dependent Variables</b>		
EP	Environmental Performances	
FP	Financial Performance	
SP	Social Performance	
FQA	Food Quality Assurance	
<b>Independent Variables</b>		
FQA1	Concerns on Specification of Products	+
FQA2	Target fulfilment on specified quality criteria or standards	+
FQA3	Records on recall products	+
FQA4	Effects of quality on increase in market share and sale performance	+
FQA5	Effect of customer feedback on product quality improvement	+
EM	The environmental management	
GPM	General practices of environmental management	+
GFP	Green food production	+
SUP	Sustainable Packaging	+
EPM	Environmental Protection Management	+
SM	The social responsible management	+
SM1	Food Safety Management	+
SM2	Social Service and Philanthropy	+
SM3	Employees Right Protection	+
SMA	The supply chain member monitoring and assessment	+
SMA1	The engagement in supplier qualification and selection process management	+
SMA2	Strategic performance measures with suppliers	+
SMA3	Concern about organisational factors of suppliers	+
SMA4	Concern about environmental factors in supplier selection decision	+
SMA5	The adoption of supplier performance evaluation processes	+
SMA6	Dependency on management or expert opinion and previous supplier performance and decisions	+
SMA7	Monitoring of individual supplier	+
SCC	The supply chain member collaboration	+
SCC1	Adoption of the technological integration	+
SCC2	Adoption of the logistical integration	+
SCC3	Emphasis of enhanced communication	+
SCC4	Concern about quality of shared information along the supply chain	+
SCC5	Concern about transparency among individuals	+
SCC6	Joint Development with partners in the supply chain	+
SCC7	Engagement in long-term relationship with suppliers	+

2.2. Theoretical framework

The dominant theories employed to explain SSCM include the Resource-Based View (RBV) theory, Transaction-Cost theory, Institutional theory and Stakeholder theory [48]. However, given that this study investigated the influence of external and internal practices on SSCM performance indicators, the Resource-Based View theory and Stakeholder theory were used to underpin this study. The RBV theory was adopted to explain the effect of internal supply chain practices on supply chain performance, while the Stakeholder theory was used to explain the effect of external supply chain practices on supply chain performance. The Resource-Based View (RBV) is based on the idea that the resources available to a business impact its success. These resources allow the company to function and provide a distinct competitive advantage. The RBV contends that utilising existing resources effectively and efficiently enhances the ability of a company to take advantage of external possibilities [49]. Thus, the available resources at a firm’s disposal augment the adoption of environmental management (EM) and social responsibility management (SM) practices such as green food production, sustainable packaging, environmental protection

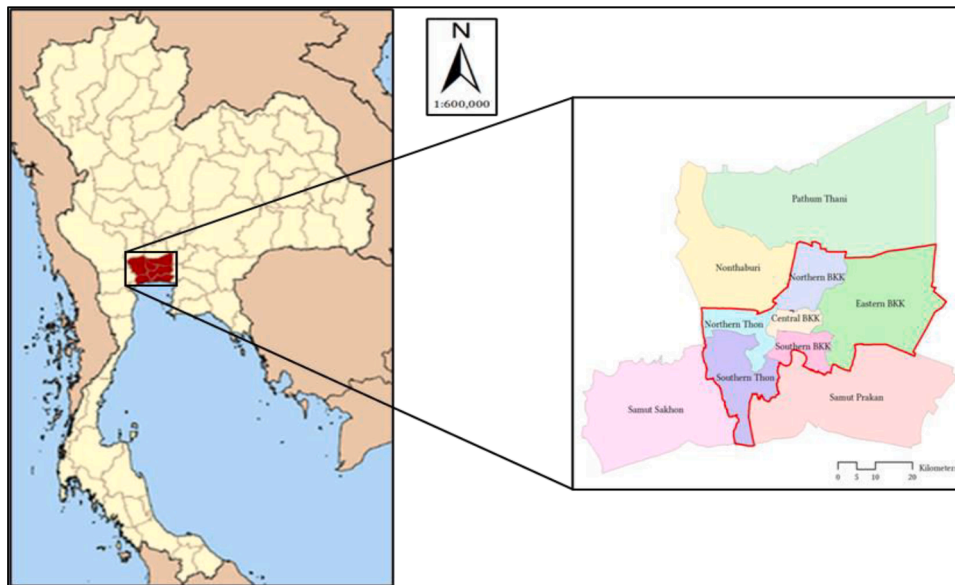


Fig. 1. Map of the study area in Bangkok, Thailand.  
Source: Adapted from Peungnumchai et al. [52].

management, food safety management, social service and philanthropy, and employee's right protection (refer to Table 1). Therefore, it is expected that environmental management and social responsibility management practices – which form the RBV theory construct in this study – would significantly affect sustainable supply chain performance. In contrast, the Stakeholder theory espoused that the activities of companies affect both internal and external parties [48]. A company's obligation to live up to its stakeholders' expectations is known as corporate social responsibility [50]. By integrating the vast network of players into their strategy, businesses may ensure their long-term survival and maintain their right to operate. This study considers that firms do not focus solely on their internal processes to improve their performance. Thus, they ensure a proper relationship between their suppliers and other stakeholders to maintain long-term relationships with these players. Hence, external activities such as supply chain member monitoring and assessment (SMA) and supply chain member collaboration (SCC) (refer to Table 1 for specific practices on each) are considered crucial to improving supply chain performance. Consequently, it is expected that supply chain member monitoring and assessment (SMA) and supply chain member collaboration (SCC) practices which form the Stakeholder Theory construct in this study would significantly affect sustainable supply chain performance.

### 3. Material and method

#### 3.1. Study area

This study was conducted in the Bangkok metropolitan area, known as the capital city of Thailand (Fig. 1). It is located at  $13^{\circ} 44' 12.1812''$  N and  $100^{\circ} 31' 23.4696''$  E. Bangkok has a total area of approximately 156,900 hectares (ha) and its population is about 5.59 million people (8.5% of the total population in Thailand) [51]. An increase in the population, economic development, living and consumption lifestyle, and transport system induced the expansion of the food market in Bangkok compared to other regions in Thailand [3]. Bangkok's citizens contribute the most to the remarkable growth of dining-out expenditure since families and individuals in urban areas have long working hours and limited time for homemade cooking. Rising incomes and a wide variety of available products in urban areas also encourage them to eat out frequently. Consequently, these factors increase the demand for quality food products with good taste, safety, and trustworthiness [3].

#### 3.2. Sample size, sampling technique and data collection

This study's primary data was collected from Thai food companies registered in Bangkok Metropolis, Thailand. According to the National Food Institute-NFI [53], the number of Thai food companies registered in Bangkok Metropolis, Thailand, was 1,967. Adopting Yamane's formula [54], the sample size was calculated as follows:

$$n = \frac{N}{1 + N(e^2)} = \frac{1967}{1 + 1,967(0.1^2)} = 95.2 \approx 95 \text{ companies} \quad (1)$$

where  $N$  denotes the total population,  $e$  denotes the margin of error from the selection sample (0.10), and  $n$  denotes the sample size.

Therefore, this study's sample size was, at least, 95 processed food companies in Bangkok, Thailand.

A multistage sampling technique was used to collect data from food companies in Bangkok Metropolis, Thailand, from June to August 2019. First, adequate Thai food companies in Bangkok Metropolis were purposively selected. Second, a stratified method was employed to categorise the population of 1976 food companies into six groups based on the annual revenues in 2017. Third, the proportional sampling method was employed to calculate the sample size of each group (refer to Table 3 for details). Later, a simple random technique was employed for data collection. In total, a sample size of 126 companies was used to improve the accuracy of the study results, thereby reducing the margin of error to 0.0862 (confidence level of 91.38%).

To ensure the quality of the responses, each respondent was interviewed for approximately one hour. The Thai language was used for easy discussion, and the result was then converted into English for the final report.

In this study, a structured questionnaire was used for data collection. In the questionnaire, seven-point Likert scale was used as follows: 1 = extremely disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, and 7 = strongly agree. The respondents were asked about the demographic characteristics (i.e. total revenue and type of products). Based on the main objective of this study, data on the firms' performances (i.e. Environmental performance, Financial Performance, and Social performance), and quality assurance were first collected.

The SSCM practices were grouped into internal and external practices. In this study, the internal SSCM practices included two main



factors: environmental management (including general practices of environmental management, green food production, sustainable packaging, and environmental protection management) and socially responsible management (including food safety management, social service and philanthropy, and employee rights protection). Alternatively, the external SSCM practices consisted of two main sections: supply chain member monitoring and assessment; and supply chain member collaboration. Supply Chain Member Monitoring and Assessment included engagement in supplier qualification and selection process management, strategic performance measures with suppliers, concern about suppliers' organisational factors, concern about environmental factors in supplier selection decisions, the adoption of supplier performance evaluation processes, dependency on management or expert opinion and previous supplier performance and decisions, and monitoring of the individual supplier.

### 3.3. Method of analysis

Descriptive statistics, including frequency and percentage, were employed to explore the data on the food companies. For the econometric analyses, first, Seemingly Unrelated Regression (SUR) was used to determine the effect of internal and external SSCM practices on sustainable performance. The SUR was used to analyse the equations regarding the effect of internal and external SSCM practices on food companies' sustainable performance indicators (i.e. environmental, financial, and social). SUR is a system estimation procedure composed of multiple regression equations, with dependent variables and widely different sets of independent variables. This approach accounts for contemporaneous correlations of errors across equations. Second, the ordinary least squares (OLS) method was employed to determine the effect of sustainable performance of food companies on quality assurance.

First, the index values were calculated as representative for each group of questions as one variable. For instance, sustainable performance was measured using financial, environmental, and social performance constructs. Following Zhu et al. [55], measures of financial performance included six variables that were measured using a Likert scale. Likewise, financial performance, social performance, and quality assurance included eight, four, and five variables on a Likert scale, respectively.

To calculate the index value, the total score of each group of questions was calculated and divided by the total number of questions in each particular group, as shown in Eq. (2):

$$i = \frac{\sum_{j=0}^n S_n}{\sum n} \tag{2}$$

where  $i$  denotes the index value,  $S$  denotes the score of each group of questions, and  $n$  denotes the number of questions in the group (Please refer to Table 1 for further details).

After all the index values were calculated for the variables, they were used for the regressions (i.e. SUR and OLS).

Table 1 shows the independent variables, including both internal SSCM practices and external SSCM practices. Internal SSCM practices consist of two key factors: environmental management (EM) and social responsibility management (SM). External SSCM practices were defined by two major factors: supply chain member monitoring and assessment (SMA), and supply chain member collaboration (SCC). Each of these major factors consist of several sub-factors (as shown in Table 1), and Table 1a in the Appendix presents the reliability tests of all the scales used in this study. All the constructs under sustainable performance, internal and external SSCM practices, and quality assurance are internally consistent with Cronbach's alpha values that were more than 0.8, indicating the reliability or internal consistency of the set of scales used in this study. In this study, the Microsoft Excel package and STATA version 17 were employed for the data analysis.

#### 3.3.1. Internal SSCM practices on sustainable performance

First, to examine the effect of internal SSCM practices on sustainable performance, three equations are specified as follows.

The empirical model of the effect of internal SSCM practices on environmental performance is specified in Eq. (3):

$$EP = \alpha_0 + \alpha_1 GPM + \alpha_2 GFP + \alpha_3 SUP + \alpha_4 EPM + \alpha_5 SM_1 + \alpha_6 SM_2 + \alpha_7 SM_3 + e \tag{3}$$

where  $EP$  denotes environmental performance,  $\alpha_i$  denotes the parameters to be estimated, and  $e$  denotes the error term, and the rest of the variables are as defined in Table 1.

The empirical model of the effect of internal SSCM practices on financial performance is specified in Eq. (4):

$$FP = \beta_0 + \beta_1 GPM + \beta_2 GFP + \beta_3 SUP + \beta_4 EPM + \beta_5 SM_1 + \beta_6 SM_2 + \beta_7 SM_3 + \mu \tag{4}$$

where  $FP$  denotes financial performance,  $\beta_i$  denotes the parameters to be estimated, and  $\mu$  denotes the error term, and the rest of the variables are as defined in Table 1.

The empirical model of the effect of internal SSCM practices on social performance is given in Eq. (5):

$$SP = \gamma_0 + \gamma_1 GPM + \gamma_2 GFP + \gamma_3 SUP + \gamma_4 EPM + \gamma_5 SM_1 + \gamma_6 SM_2 + \gamma_7 SM_3 + \nu \tag{5}$$

where  $SP$  denotes social performance,  $\gamma_i$  denotes the parameters to be estimated, and  $\nu$  denotes the error term, and the rest of the variables are as defined in Table 1.

#### 3.3.2. The external SSCM practices on sustainable performance

Second, to examine the effect of external SSCM practices on sustainable performance, another set of three equations is specified as follows.

The empirical model of the effect of external SSCM practices on environmental performance is specified in Eq. (6):

$$EP_1 = \varphi_0 + \varphi_1 SMA_1 + \varphi_2 SMA_2 + \varphi_3 SMA_3 + \varphi_4 SMA_4 + \varphi_5 SMA_5 + \varphi_6 SMA_6 + \varphi_7 SMA_7 + \varphi_8 SCC_1 + \varphi_9 SCC_2 + \varphi_{10} SCC_3 + \varphi_{11} SCC_4 + \varphi_{12} SCC_5 + \varphi_{13} SCC_6 + \varphi_{14} SCC_7 + k \tag{6}$$

where  $EP_1$  denotes environmental performance,  $\varphi_i$  denotes the parameters to be estimated, and  $k$  denotes the error term, and the rest of the variables are as defined in Table 1.

The empirical model of the effect of external SSCM practices on financial performance is specified in Eq. (7):

$$FP_1 = \omega_0 + \omega_1 SMA_1 + \omega_2 SMA_2 + \omega_3 SMA_3 + \omega_4 SMA_4 + \omega_5 SMA_5 + \omega_6 SMA_6 + \omega_7 SMA_7 + \omega_8 SCC_1 + \omega_9 SCC_2 + \omega_{10} SCC_3 + \omega_{11} SCC_4 + \omega_{12} SCC_5 + \omega_{13} SCC_6 + \omega_{14} SCC_7 + n \tag{7}$$

where  $FP_1$  denotes financial performance,  $\omega_n$  denotes the parameters to be estimated, and  $n$  denotes the error term, and the rest of the variables are as defined in Table 1.

The empirical model of the effect of external SSCM practices on social performance is given in Eq. (8):

$$SP_1 = l_0 + l_1 SMA_1 + l_2 SMA_2 + l_3 SMA_3 + l_4 SMA_4 + l_5 SMA_5 + l_6 SMA_6 + l_7 SMA_7 + l_8 SCC_1 + l_9 SCC_2 + l_{10} SCC_3 + l_{11} SCC_4 + l_{12} SCC_5 + l_{13} SCC_6 + l_{14} SCC_7 + m \tag{8}$$

where  $SP_1$  denotes social performance,  $l_n$  denotes the parameters to be estimated, and  $m$  denotes the error term, and the rest of the variables are as defined in Table 1.

**Table 2**

Demographic information of the companies categorised by year of establishment.

Year of establishment	Frequency	Percentage (%)
1925 - 1949	5	3.97%
1950 - 1974	22	17.46%
1975 - 1999	60	47.62%
2000 - 2018	39	30.95%
Total	126	100.00%

Source: Authors' survey (2019).

**Table 3**

Demographic information of the companies categorised by total revenue in 2017.

Revenue in 2017 (1,000 THB)	Frequency	Percentage (%)
less than 1,000	7	5.56%
1,000 - 9,999	29	23.02%
10,000 - 99,999	38	30.16%
100,000 - 999,999	25	19.84%
1,000,000 - 9,999,999	19	15.08%
10,000,000 and above	8	6.35%
Total	126	100.00%

Source: Authors' survey (2019). Note: 1 THB= 0.0322 USD.

**Table 4**

Demographic information of the companies categorised by the major type of products.

Type of products	Frequency	Percentage
Poultry Products	32	25.40%
Snack food	15	11.90%
Processed seafood	15	11.90%
Processed food	13	10.32%
Seafood	9	7.14%
Fresh and processed food	7	5.56%
Sausage	7	5.56%
Canned fruits	6	4.76%
Cooking oil	5	3.97%
Noodle	5	3.97%
Frozen fruits and vegetable	3	2.38%
Sugar Products	3	2.38%
Bakery food	2	1.59%
Canned food	2	1.59%
Chicken egg	1	0.79%
Fresh and processed beef	1	0.79%
Total	126	100.00%

Source: Authors' survey (2019).

3.3.3. The sustainable performances on quality assurance

The study also examined the effect of sustainable performance on food quality assurance. Eq. (9) is the empirical model of the effect of sustainable performance on food quality assurance.

$$QA = M_0 + M_1EP + M_2FP + M_3SP + q \tag{9}$$

where QA denotes quality assurance; EP, FP, and SP denote environmental performance, financial performance, and social performance, respectively;  $M_i$  denotes the parameters to be estimated; and q denotes the error term.

4. Results and discussion

4.1. Socio-demographic characteristics of the food companies

Table 2 shows the demographic characteristics of the sampled 126 companies in Bangkok, Thailand. The results indicated that almost half of the companies in this study started their businesses during the period 1975-1999 (47.62%), followed by companies established during 2000-

**Table 5**

Results of the effect of internal SSCM practices on sustainable performance.

No.	Variables	Coefficient	Std. Error	t-Statistic	p-value
1	General practices of environmental management	0.235	0.049	4.795	0.000***
2	Green food production	0.048	0.040	1.198	0.231
3	Sustainable Packaging	-0.333	0.059	-5.633	0.000***
4	Environmental Protection Management	0.329	0.068	4.871	0.000***
5	Food Safety Management	0.208	0.063	3.312	0.001***
6	Social Service and Philanthropy	0.023	0.043	0.530	0.596
7	Employees Right Protection	0.049	0.072	0.678	0.498
8	General practices of environmental management	0.292	0.058	5.024	0.000***
9	Green food production	0.072	0.047	1.524	0.128
10	Sustainable Packaging	-0.397	0.070	-5.634	0.000***
11	Environmental Protection Management	0.396	0.078	5.054	0.000***
12	Food Safety Management	0.259	0.072	3.602	0.000***
13	Social Service and Philanthropy	0.094	0.050	1.881	0.060*
14	Employees Right Protection	0.011	0.084	0.135	0.893
15	General practices of environmental management	0.205	0.040	5.125	0.000***
16	Green food production	0.049	0.033	1.503	0.133
17	Sustainable Packaging	-0.295	0.048	-6.086	0.000***
18	Environmental Protection Management	0.294	0.054	5.430	0.000***
19	Food Safety Management	0.204	0.050	4.091	0.000***
20	Social Service and Philanthropy	0.069	0.035	2.001	0.046**
21	Employees Right Protection	-0.013	0.058	-0.228	0.820

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

$$R_1^2 = 0.7711, R_2^2 = 0.8460, R_3^2 = 0.8077, R_4^2 = 0.8077, R_5^2 = 0.7549, R_6^2 = 0.8504.$$

2018 (30.95%). From 1950 to 1974, 22 companies launched their businesses (17.46%), whereas only five were established during 1925-1949 (3.97%).

Based on the total revenue of 126 companies in 2017, this study divided the revenue range into six groups (Table 3). The data showed that, in 2017, 6.35% of the companies obtained the highest revenue of more than 1 trillion THB of net revenue, whereas only 5.56% had less than 1 million THB of net revenue in 2017. Most companies (30.16%) had a net revenue of between 10 million Thai baht (THB) and less than 100 million THB, followed by 23.02% of companies that achieved net revenue between 1 million baht and 10 million baht.

There were 16 different types of major products sold by each company (Table 4). Approximately 25% of the companies in this study participated in poultry products. Snack and processed seafood shared the same value of 11.9% of the total companies. Other products shows lower values of less than 11%. Only one (1) company engaged in chicken eggs, fresh and processed beef (0.79%).

Since the year 2000s, Thai people have consumed more poultry products due to the affordable price and good protein, compared to other kinds of meat, such as pork, beef, and goat. Chicken meat, poultry ready-to-cook meals, and chicken nuggets are examples of poultry products which are always available in supermarkets, convenience stores, fast-food restaurants, and wet markets. In particular, fast-food restaurants offer different menus for poultry meals and significantly expand their networks as a leader in the domestic chain [3,56]. It is the

**Table 6**  
Results of the effect of external SSCM practices on sustainable performance.

No.	Variables	Coefficient	Std. Error	t-Statistic	p-value
22	The engagement in supplier qualification and selection process management	-0.012	0.029	-0.397	0.692
23	Strategic performance measures with suppliers	0.176	0.036	4.906	0.000***
24	Concern about organisational factors of suppliers	0.035	0.031	1.136	0.256
25	Concern about environmental factors in supplier selection decision	0.008	0.042	0.189	0.850
26	The adoption of supplier performance evaluation processes	0.032	0.041	0.796	0.427
27	Dependency on management or expert opinion and previous supplier performance and decisions	0.125	0.040	3.147	0.002***
28	Monitoring of individual supplier	-0.081	0.044	-1.848	0.065*
29	Adoption of the technological integration	0.066	0.025	2.632	0.009***
30	Adoption of the logistical integration	0.046	0.035	1.336	0.182
31	Emphasis of enhanced communication	-0.028	0.046	-0.602	0.547
32	Concern about quality of shared information along the supply chain	0.048	0.044	1.099	0.272
33	Concern about transparency among individuals	0.004	0.045	0.087	0.931
34	Joint development with partners in the supply chain	-0.077	0.045	-1.708	0.088*
35	Engagement in long-term relationship with suppliers	0.075	0.036	2.115	0.035**
36	The engagement in supplier qualification and selection process management	0.059	0.032	1.844	0.066*
37	Strategic performance measures with suppliers	0.152	0.038	3.964	0.000***
38	Concern about organisational factors of suppliers	0.056	0.033	1.713	0.087*
39	Concern about environmental factors in supplier selection decision	0.019	0.046	0.402	0.688
40	The adoption of supplier performance evaluation processes	0.048	0.045	1.068	0.286
41	Dependency on management or expert opinion and previous supplier performance and decisions	0.174	0.044	4.005	0.000***
42	Monitoring of individual supplier	-0.193	0.049	-3.970	0.000***
43	Adoption of the technological integration	0.057	0.027	2.097	0.036**
44	Adoption of the logistical integration	0.048	0.038	1.254	0.210
45	Emphasis of enhanced communication	-0.009	0.050	-0.174	0.862
46	Concern about quality of shared information along the supply chain	0.064	0.048	1.341	0.181
47	Concern about transparency among individuals	0.022	0.050	0.440	0.660

**Table 6 (continued)**

No.	Variables	Coefficient	Std. Error	t-Statistic	p-value
48	Joint development with partners in the supply chain	-0.123	0.050	-2.482	0.013**
49	Engagement in long-term relationship with suppliers	0.079	0.039	2.028	0.043**
50	The engagement in supplier qualification and selection process management	0.035	0.025	1.407	0.160
51	Strategic performance measures with suppliers	0.114	0.030	3.816	0.000***
52	Concern about organisational factors of suppliers	0.040	0.026	1.553	0.121
53	Concern about environmental factors in supplier selection decision	0.005	0.036	0.135	0.893
54	The adoption of supplier performance evaluation processes	0.037	0.035	1.064	0.288
55	Dependency on management or expert opinion and previous supplier performance and decisions	0.114	0.034	3.391	0.001***
56	Monitoring of individual supplier	-0.114	0.037	-3.034	0.003***
57	Adoption of the technological integration	0.046	0.021	2.194	0.029**
58	Adoption of the logistical integration	0.042	0.029	1.426	0.154
59	Emphasis of enhanced communication	-0.004	0.039	-0.111	0.911
60	Concern about quality of shared information along the supply chain	0.052	0.037	1.425	0.155
61	Concern about transparency among individuals	0.003	0.039	0.065	0.948
62	Joint development with partners in the supply chain	-0.076	0.038	-1.975	0.049**
63	Engagement in long-term relationship with suppliers	0.062	0.030	2.060	0.040**

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

$$R_1^2 = 0.7711, R_2^2 = 0.8460, R_3^2 = 0.8077, R_4^2 = 0.8077, R_5^2 = 0.7549, R_6^2 = 0.8504.$$

government's efforts to tightly regulate the national food market and eliminate the importation of poultry products. By issuing import approvals, high tariffs, and a discriminatory import permit fee for chilled or frozen uncooked meat, it has successfully prevented the importer from entering the domestic market and supported local poultry producers in Thailand [57].

#### 4.2. Effect of the adoption of sustainable practices on company's performance and food quality assurance

##### 4.2.1. Effect of internal and external SSCM practices on sustainable performance

Table 5 shows the effect of internal SSCM practices on the sustainable performance of food companies. Eqs. (3)–(5) show the relationships between internal sustainable supply chain practices (SSCM) and environmental performance, financial performance, and social performance, respectively.  $R_1^2$  of Eq. (3) of 0.7711 indicates that internal SSCM practices influenced approximately 77% of the variations in environmental performance. Similarly,  $R_2^2$  of Eq. (4) and  $R_3^2$  Eq. (5) show that

internal SSCM practices influence approximately 85% and 81% of the variations in financial and social performance, respectively (Table 5).

For the external SSCM,  $R_4^2$  of Eq. (6) indicates that external SSCM practices influence approximately 81% of the variations in financial performance;  $R_5^2$  of Eq. (7) and  $R_6^2$  Eq. (8) show that external SSCM practices influence approximately 75% and 85% of financial and social performance variations, respectively (Table 6).

Eq. (3) focuses on the relationship between internal SSCM practices and environmental performance. The results revealed that the following variables: general practices of environmental management, environmental protection management, and food safety management showed a positive relationship, whereas the variables of sustainable packaging showed a negative relationship with environmental performance. Regarding the relationship between internal SSCM practices and financial performance in Eq. (4), the general practices of environmental management, environmental protection management, food safety management, and social service and philanthropy had positive relationships with financial performance; on the other hand, sustainable packaging had a negative relationship with financial performance. Eq. (5) was used to study the relationship between internal SSCM practices and social performance. The results revealed that environmental management, environmental protection management, food safety management, and social service and philanthropy had positive relationships with social performance, whereas sustainable packaging was negatively correlated with social performance (Table 5).

Eqs. (6)–(8), respectively, show the relationships between the external sustainable supply chain practices (SSCM) and environmental performance, financial performance, and social performance.

The results of Eq. (6) revealed that the following variables – strategic performance measures with suppliers, dependency on expert opinion and previous supplier performance and decisions, adoption of technological integration, and engagement in a long-term relationship with suppliers – had positive relationships with environmental performance. On the other hand, monitoring individual suppliers and joint development with partners in the supply chain had negative relationships with environmental performance.

The results of Eq. (7) revealed that the following external SSCM practices had positive relationships with financial performance: engagement in supplier qualification and selection process management, strategic performance measures with suppliers, concern about suppliers' organisational factors, dependency on expert opinion and previous supplier performance and decisions, adoption of technological integration, and engagement in long-term relationships. However, monitoring individual suppliers and joint development with partners in the supply chain negatively affected environmental performance. Eq. (8) reveals that strategic performance measures with suppliers, dependency on expert opinion and previous supplier performance, adoption of technological integration, and food safety management had positive relationships with social performance. Nevertheless, monitoring individual suppliers and joint development with partners in the supply chain had negative relationships with social performance (Table 6).

A brief discussion of the results is presented below. Internal SSCM practices are significantly related to companies' environmental performance. This study found that both environmental and socially responsible management played a vital role in food companies. The food companies concerned about social responsibility and environmental management were able to fulfil their environmental development targets compared to other companies concerned about this issue. Previous studies found that the execution of environmental practices could lead to better environmental performance [15,58]. Moreover, internal socially responsible practices, particularly on employees, would increase awareness by protecting the environment and improving the company's environmental performance [59].

The results of this study also show the relationship between internal SSCM practices and financial performance. Financial performance is

obviously the most important factor that all companies are targeting to increase [7]. Companies embracing environmental management practices might cut production and operation costs during the processes. Thus, companies that integrate environmental responsibility and economic strategy might witness resource-saving effects, improvement of brand image, and the relationship among stakeholders, which are critical drivers of expanding revenue of the companies. It highlights that the good reputation and image of a company are positively related to sustainability issues and the development of eco-brand for easier access to market and a good network of partners in the industry [7]. Using more eco-friendly materials and processes at the company level could enhance production efficiency, minimise resource utilisation, and ultimately reduce production costs [7]. The study's results also showed that socially responsible management led to an improvement in financial performance. Similarly, previous research has revealed that companies that improve the working environment's safety conditions might reduce accidents, increase productivity, reduce losses within the system, and improve employee satisfaction. Therefore, to increase production efficiency, companies are expected to adopt socially responsible management practices [7]. Further, the results that revealed that key variables under environmental management and social responsibility management practices used for firm's internal practices influence the performance indicators (financial, environmental, quality assurance) and this validates the proponents of the Resource-Based View theory.

Supply chain member monitoring and assessment, and supply chain collaboration were considered critical factors that could improve a firm's financial performance [7]. By monitoring or working with other supply chain members, a company can achieve higher efficiency in production and lower waste emissions, resulting from fewer resources consumed and reduced production costs. On the other hand, the study results also indicated a connection between supply chain collaboration and the company's environmental performance [7,15,33]. Mastos and Gotzamani [7] revealed that customers and firms are more likely to be concerned about food origin, safety, quality, and sustainable production, such as biodiversity conservation and environmental pressure. More and more customers are willing to pay more for their demand for environmentally friendly products and services. Hence, for the implementation of SSCM, companies need to make significant investments to provide the right customer with the right product at the right place for sale and at the right price.

External SSCM practices influence the social performance of companies. This study found that adopting supply chain member monitoring and assessment was one of the drivers of social performance. Sancha et al. [60] found that monitoring and assessing suppliers and retailers positively influences social performance. For retailers, the sales of outdated food influence the firm's reputation, although it has performed well in food safety assurance. Thus, food companies need to reduce the risk of such activities by adopting an effective monitoring and evaluation mechanism. For instance, a good supplier–retailer relationship might benefit food safety assurance. Good cooperation between input suppliers, food producers, and retailers was essential to building mutual trust and social awareness, promote effective sustainability management of its supply chain, and contribute to the industry's sustainable development. Thus, adopting socially responsible management practices can improve social performance and productivity [7].

The results also revealed an association between external SSCM practices and environmental performance. Likewise, Sancha et al. [60] revealed that supplier and retailer monitoring, and evaluation positively affect environmental performance. Several supply chain members displayed unethical behaviour in managing food safety or failed to comply with the law. The abuse of additives harmed the quality of raw materials for the upstream supplier, contributing directly to food product safety. The sales of outdated foods affect the company's reputation for retailers, although they have performed well in food safety assurance. Thus, food companies must adopt effective monitoring and evaluation mechanisms to reduce such risks. Furthermore, the discovery that internal business



**Table 7**  
Effect of sustainable supply chain practices on food quality assurance.

Variables	Coefficient	Standard Error	p-value
Environmental Performance	0.1708	0.0725	0.0200**
Financial Performance	0.2570	0.0757	0.0009***
Social Performance	0.3010	0.0840	0.0005***
R-squared	0.7042	Mean dependent var	5.8714
Adjusted R-squared	0.6969	S.D. dependent var	0.5654
S.E. of regression	0.3113	Akaike info criterion	0.5349
Sum squared resid	11.8208	Schwarz criterion	0.6250
Log likelihood	-29.7018	Hannan-Quinn criter.	0.5715
F-statistic	96.7963	Durbin-Watson stat	1.8386
Prob(F-statistic)	0.0000		

Note: \*\*\* and \*\* indicate statistical significance at the 1% and 5% levels, respectively.

practices like supply chain member monitoring and assessment (SMA) and supply chain member collaboration (SCC) have an impact on performance metrics (financial, environmental, and quality assurance) confirms the Stakeholder theory. The findings support the notion that organisations' successes are strongly impacted by how well they incorporate supplier and stakeholder concerns into their operations.

#### 4.2.2. Effect of sustainable performances on food quality assurance

Table 7 shows the effect of sustainable supply chain management (SSCM) practices on food quality assurance<sup>1</sup>, including environmental performance, financial performance, and social performance. The results indicate that sustainable supply chain management practices influenced approximately 70% of the variations in food companies' quality assurance. All three dimensions of SSCM practices (environmental, financial, and social performance) positively influenced companies' quality assurance. For all business operations, SSCM continuously exposes its efforts to obtaining the positive outcomes of environmental and sustainable performance goals. The environmental practices could reduce cost based on technical and quality improvements, leading to the achievement of both enhanced environmental and financial performances [7]. Indeed, food companies with a competitive advantage could enhance their social reputation and achieve sustainable development by providing high-quality food products [15]. Moreover, good social performance helps companies promote food quality by adopting various social responsibility management practices [15,34,37]. According to Mastos and Gotzamani [7], people are firstly concerned about food safety and production practices as they directly consume food into their bodies. From the social and environmental perspectives of supply chains, environmental aspects (i.e. deforestation, climate change, fossil fuel consumption, CO2 emissions) and social aspects (i.e. fair wages, employee benefits, gender equity, and human rights) also positively affected the performance of SSCM. Further, globalisation, technological advances, food contaminations, and improved logistics infrastructure have increased people's concerns on the sustainability of FSC and SSCM.

Thus, food companies must undertake SSCM practices to achieve quality assurance. They may use advanced clean production technology or green packing materials to ensure food safety and improve the quality of food products, increasing the rate of resource utilisation and reducing pollution, thus, leading to better environmental performance.

## 5. Conclusions

This study examined the effect of both internal and external SSCM practices' adoption on sustainable performance and the effect of

environmental, financial, and social performances on food quality assurance of food companies in Thailand. Seemingly unrelated regression (SUR) and ordinary least squares regression (OLS) methods were employed to analyse data collected from 126 food companies in Bangkok, Thailand. The results indicate that internal and external SSCM practices positively influence food companies' environmental, financial, and social performances. Further, environmental, financial, and social performances positively influence the quality assurance of food companies. The food firms concerned about environmental management, socially responsible management, supply chain member monitoring and assessment, and supply chain collaboration could fulfil their environmental development targets, compared to firms that were less concerned about this issue.

The results showed that companies could improve environmental and social performances by strengthening internal environmental management and social responsibility management. Food companies can foster environmental performance throughout the business by closely working with other supply chain members. In addition, environmental and social performances improve the financial performance of companies. Moreover, this study revealed that companies could enhance their sustainable performance and increase food quality by adopting SSCM practices to supply better food products that are safe and healthy for customers. Thus, food companies should develop SSCM practices for sustainable performance and improve food quality.

This study provides the following policy recommendations. First, food companies should recognize food quality assurance and the factors affecting food quality assurance, including financial, social, and environmental performances as crucial for their survival and competitive advantage. Achieving economic interests should come with environmental and social responsibilities, especially food safety responsibility, which is critical for their corporate image and reputation. Second, food companies should implement SSCM practices for sustainable development to strengthen long-term environmental and social responsibility management, which is beneficial to quality assurance and development. Finally, the Government should strengthen the legislation in the food business environment to encourage food companies to carry out sustainable supply chain management to improve food safety levels, which is a concern to consumers in Thailand and the international market.

This study makes the following contributions: first, through the literature review on SSCM, despite the increasing research on SSCM, there is a scarcity of empirical evidence and theoretical reflection on sustainable supply chains in developing countries. Hence, this study attempts to investigate SSCM practices in Thailand, an emerging economy in Southeast Asia. Second, the paper's findings can enhance the knowledge of companies on the impacts of SSCM on enterprise performance to improve their sustainability and enhance competitive advantage. The findings can be used by food industry experts and can support them in implementing SSCM practices by examining the adopted practices, the sustainability performance measures, and the key factors of SSCM. Third, this study provides recommendations for policymakers to improve food companies' sustainability practices. In addition, this study provides an empirical contribution to the existing literature on the sustainability of food supply chains by using econometric approaches to analyse the effect of internal and external supply chain management practices on the environmental, financial, and social performances of food companies, and the effect of environmental, financial, and social performances on food quality assurance of the companies. Lastly, the study re-affirms the appropriateness of the Resource-Based View and Stakeholder theories in sustainable supply chain management studies. Thus, the study disclosed that sustainable internal practices such as sustainable packaging, environmental protection management, and food safety management have diverse impacts on firms' performance, reinforcing the Resource-Based View Theory. Likewise, the firm's external practices, such as strategic performance measures with suppliers, monitoring of individual suppliers, and adoption of technological integration, were found as significant predictors of performance. This,

<sup>1</sup> Food quality assurance indicators are concerns about the specification of products, specified quality criteria or standards, target fulfilment of specified quality criteria or standards, and records of recall products.

**Table 1a**  
Summary results of reliability test of the constructs.

Items	N	N of Items	Cronbach's Alpha
Internal SSCM Practices	30	40	0.974
Environmental management	30	24	0.974
General practices of environmental management	30	7	0.913
Green food production	30	4	0.980
Sustainable Packaging	30	6	0.820
Environmental Protection Management	30	7	0.950
Social responsible management	30	16	0.917
Food Safety Management	30	7	0.886
Social Service and Philanthropy	30	4	0.919
Employees Right Protection	30	5	0.851
External SSCM Management	30	14	0.930
Supply chain member monitoring and assessment	30	7	0.903
Supply chain member collaboration	30	7	0.823
Company's performance	30	18	0.961
Environmental performance	30	6	0.892
Financial Performance	30	8	0.944
Social performance	30	4	0.960
Quality assurance	30	5	0.958

therefore, validates the proponent of the Stakeholder theory. Despite the theoretical and practical contributions, this study is not without limitations as it used data obtained from a small sample of 126 food companies (although statistically representative and appropriate) in Bangkok, Thailand; hence, the results cannot be representative for the overall food industry in Thailand. Therefore, future studies may use larger samples conducted in other cities or regions in Thailand to generalise the results. Further, expanding the scope of the study to other countries in Southeast Asia, such as Malaysia, Indonesia, and Vietnam, would be an excellent opportunity for future research.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Data availability**

Data will be made available on request.

**Appendix**

**Table 1a**

**References**

[1] United Nations (2022). *World population prospects 2022* United Nations Department of Economic and Social Affairs, 1–52.

[2] Cagliano, R., Worley, C.G., & Caniato, F.F. (2016). The challenge of sustainable innovation in agri-food supply chains. *Organising Supply Chain Processes for Sustainable Innovation in the Agri-Food Industry*, 5, 1-30. [10.1108/S2045-0605-2016000005009](https://doi.org/10.1108/S2045-0605-2016000005009).

[3] Yamada Consulting Group (YCG). (2018). *Thailand's Food market overview. food demand and production*. Global agriculture towards 2050. High-Level Expert Forum: How to feed the world in 2050. YCG, Bangkok, Thailand. [https://www.yamada.bkbasic.com/market\\_research/thailands-food-market-overview/](https://www.yamada.bkbasic.com/market_research/thailands-food-market-overview/). Accessed September 30, 2022.

[4] A. Molotoks, P. Smith, T.P. Dawson, Impacts of land use, population, and climate change on global food security, *Energy Food Secur.* (2020), <https://doi.org/10.1002/fes3.261>.

[5] R.D. Raut, B.B. Gardas, V.S. Narwane, B.E. Narkhede, Improvement in the food losses in fruits and vegetable supply chain-a perspective of cold third-party logistics approach, *Oper. Res. Perspect.* 6 (2019) 2214–7160, <https://doi.org/10.1016/j.orp.2019.100117>.

[6] León-Bravo, V., Caniato, F.F.A., Moretto, A. & Cagliano, R. (2016). Alccas: innovation for sustainable supply chains for traditional and new products.

Organising Supply Chain Processes for Sustainable Innovation in the Agri-Food Industry, 5, 31-57. [10.1108/S2045-06052016000005010](https://doi.org/10.1108/S2045-06052016000005010).

[7] T. Mastos, K. Gotzamani, Sustainable supply chain management in the food industry: a conceptual model from a literature review and a case study, *Foods* 11 (2022) 2295, <https://doi.org/10.3390/foods11152295>.

[8] World Bank. (2015). Urbanisation in Thailand is dominated by the Bangkok urban area. Retrieved from World Bank Group: <https://www.worldbank.org/en/news/feature/2015/01/26/urbanization-in-thailand-is-dominated-by-the-bangkok-urban-area>.

[9] M. Pagell, A. Shevchenko, Why research in sustainable supply chain management should have no future, *J. Supply Chain Manag.* 50 (1) (2014) 44–55.

[10] T.A. Chin, H.H. Tat, Z. Sulaiman, S.N.L. Muhamad Zainon, Green supply chain management practices and sustainability performance, *Adv. Sci. Lett.* 21 (5) (2015) 1359–1362.

[11] N. Somsuk, T. Laosirihongthong, Prioritisation of applicable drivers for green supply chain management implementation toward sustainability in Thailand, *Int. J. Sustain. Dev. World Ecol.* 24 (2) (2017) 175–191.

[12] National Food Institute-NFI. (2022). Overview of Thai food industry in 2021. *Food Industry Outlook 2022*.

[13] United States Department of Agriculture (2022). *Food processing ingredients, Thailand*. United States Department of Agriculture, Foreign Agricultural Service, Report Number: TH2022-0024, 1–10.

[14] OIE. (2012). Overview of food industry. *Principle Knowledge of Food and Drug Industry*, 6-19.

[15] D. Ortiz-Gonzalo, S.B. Ørtenblad, M.N. Larsen, P. Suebpongsang, T.B. Bruun, Food loss and waste and the modernisation of vegetable value chains in Thailand, *Resour. Conserv. Recycl.* 174 (2021), 105714, <https://doi.org/10.1016/j.resconrec.2021.105714>.

[16] J. Wang, J. Dai, Sustainable supply chain management practices and performance, *Ind. Manag. Data Syst.* 118 (1) (2018) 2–21, <https://doi.org/10.1108/IMDS-12-2016-0540>.

[17] Thaipublica. (2016). Unsustainable business: inequalities, new rules and challenges of Thai business. *Thailand's Ethical and Sustainable Business Forum*. Retrieved from Thaipublica: <https://www.thaipublica.org/2016/03/unsustainablebusiness1>.

[18] K.Y. Tipayawong, T. Tiwaratrewit, A. Sopadang, Positive influence of green supply chain operations on Thai electronic firms' financial performance, *Procedia Eng.* 118 (2015) 683–690.

[19] K. Visamitanan, N. Assarut, Impact of green supply chain management practices on employee engagement and organizational commitment: mediating role of firm performance, *Glob. Bus. Rev.* (2021), 09721509211018569.

[20] Onputtha, S., Makedr, P., & Rojanapanich, P. (2018). The effect of green supply chain management on environmental performance in food and beverage firms in Bangkok and Metropolitan Area, Thailand.

[21] A. Pipatprapa, H.H. Huang, C.H. Huang, A novel environmental performance evaluation of Thailand's food industry using structural equation modeling and fuzzy analytic hierarchy techniques, *Sustainability* 8 (3) (2016) 246.

[22] J. Hong, Y. Zhang, M. Ding, Sustainable supply chain management practices, supply chain dynamic capabilities, and enterprise performance, *J. Clean. Prod.* 172 (2018) 3508e3519, <https://doi.org/10.1016/j.jclepro.2017.06.093>.

[23] A.C. Phan, H.A. Nguyen, P.D. Trieu, H.T. Nguyen, Y. Matsui, Impact of supply chain quality management practices on operational performance: empirical evidence from manufacturing companies in Vietnam, *Supply Chain Manag. Int. J.* 24 (6) (2019) 855–871.

[24] J. Hong, Z. Zhou, X. Li, K.H. Lau, Supply chain quality management and firm performance in China's food industry: the moderating role of social co-regulation, *Int. J. Logist. Manag.* 31 (1) (2020) 99–122.

[25] T. Perdana, B.S. Onggo, A.H. Sadel, D. Chaerani, A.L.H. Achmad, F.R. Hermiatin, Y. Gong, Food supply chain management in disaster events: a systematic literature review, *Int. J. Disaster Risk Reduct.* 79 (2022), 103183, <https://doi.org/10.1016/j.ijdrr.2022.103183>.

[26] Z. Zhang, J. Li, Z. Zhang, J. Li, Chapter 10. Big-data-driven low-carbon management, in: *Big Data Mining for Climate Change*, 2020, Elsevier, 2020, pp. 287–299, <https://doi.org/10.1016/B978-0-12-818703-6.00015-5>. Big Data Mining for Climate Change.

[27] N.M. Patel, V.A. Deshpande, Supply chain management for food processing industry- a review, *Int. J. Innov. Res. Sc. Eng. Technol.* 4 (12) (2015), <https://doi.org/10.15680/IJRSET.2015.0412079>.

[28] T. Akyazi, A. Goti, A. Oyarbide, E. Alberdi, F. Bayon, A guide for the food industry to meet the future skills requirements emerging with industry 4.0, *Foods* 9 (4) (2020) 2–15, <https://doi.org/10.3390/foods9040492>.

[29] Z. Kallas, M.F. Alba, K. Casellas, M. Berges, G. Degreef, J.M. Gil, The development of short food supply chain for locally produced honey: Understanding consumers' opinions and willingness to pay in Argentina, *Br. Food J.* (2019), <https://doi.org/10.1108/BFJ-01-2019-0070>.

[30] P.C. Muth, L.T. Huyen, A. Markemann, A.V. Zárate, Carcass grading for local Vietnamese Ban pigs and its potential for a quality feedback system in a short food supply chain, *Agric. Sci. Procedia* 5 (2015) 139–144, <https://doi.org/10.1016/j.aaspro.2015.08.021>.

[31] M.C. Stanciu, Analysis of the behavior and motivation of consumers towards short food supply chains, *Sci. Pap. Ser. Manag. Econ. Eng. Agric. Rural Dev.* 18 (4) (2018) 73–77.

[32] G. Vitterso, H. Torjusen, K. Laitala, B. Tocco, B. Biasini, P. Csillag, P. Wavresky, Short food supply chains and their contributions to sustainability: Participants' views and perceptions from 12 European cases, *Sustainability* 11 (17) (2019) 4800, <https://doi.org/10.3390/su11174800>.

- [33] The United Nations. (2022). International day of awareness on food loss and waste reduction 29 september. The United Nations. <https://www.un.org/en/observances/end-food-waste-day> (Accessed on 30 September 2022).
- [34] R. Baliga, R. Raut, S. Kamble, The effect of motivators, supply, and lean management on sustainable supply chain management practices and performance, *Benchmarking Int. J.* 27 (1) (2019) 347–381, <https://doi.org/10.1108/BJJ-01-2019-0004>.
- [35] J. Hong, Y. Zhang, M. Shi, The impact of supply chain quality management practices and knowledge transfer on organisational performance: an empirical investigation from China, *Int. J. Logist. Res. Appl.* 21 (3) (2018) 259–278.
- [36] A. Dales, N.M. Coe, M. Hess, Variegated national retail markets: negotiating transformation through regulation in Malaysia and Thailand, *Econ. Geogr.* 95 (2019) 90–111, <https://doi.org/10.1080/00130095.2018.1476060>.
- [37] L.A. German, A.M. Bonanno, L.C. Foster, L. Cotula, Inclusive business in agriculture: evidence from the evolution of agricultural value chains, *World Dev.* 134 (2020), 105018, <https://doi.org/10.1016/j.worlddev.2020.105018>.
- [38] C. Sancha, C. Gimenez, V. Sierra, Achieving a socially responsible supply chain through assessment and collaboration, *J. Clean. Prod.* 112 (3) (2015) 1934–1947.
- [39] N. Somsuk, T. Laosirihongthong, A fuzzy-AHP to prioritise enabling factors for strategic management of university business incubators: resource-based view (RBV) theory, *Technol. Forecast. Soc. Chang.* 85 (2014) 198–210.
- [40] Y. Duan, J.A. Aloysius, Supply chain transparency and willingness-to-pay for refurbished products, *Int. J. Logist. Manag.* 30 (3) (2019) 797–820, <https://doi.org/10.1108/IJLM-01-2019-0025>.
- [41] J. Glover, The dark side of sustainable dairy supply chains, *Int. J. Oper. Prod. Manag.* 40 (12) (2020) 1801–1827, <https://doi.org/10.1108/IJOPM-05-2019-0394>.
- [42] T. Gruchmann, S. Seuring, K. Petljak, Assessing the role of dynamic capabilities in local food distribution: a theory-elaboration study, *Supply Chain Manag. Int. J.* 24 (6) (2019) 767–783, <https://doi.org/10.1108/SCM-02-2019-0073>.
- [43] J. Miemczyk, D. Luzzini, Achieving triple bottom line sustainability in supply chains: the role of environmental, social and risk assessment practices, *Int. J. Oper. Prod. Manag.* 39 (2) (2019) 238–259, <https://doi.org/10.1108/IJOPM-06-2017-0334>.
- [44] A.M. Kitsis, I.J. Chen, Do motives matter? Examining the relationships between motives, SSCM practices and TBL performance, *Supply Chain Manag. Int. J.* 25 (3) (2019) 325–341, <https://doi.org/10.1108/SCM-05-2019-0218>.
- [45] S. Mitra, P.P. Datta, Adoption of green supply chain management practices and their impact on performance: an exploratory study of Indian manufacturing firm, *Int. J. Prod. Res.* 52 (7) (2014) 2085–2107.
- [46] D. Das, The impact of sustainable supply chain management practices on firm performance: lessons from Indian organisations, *J. Clean. Prod.* 203 (2018) 179–196.
- [47] J. Prasara-A, S.H. Gheewala, T. Silalertruksa, P. Pongpat, W. Sawaengsak, Environmental and social life cycle assessment to enhance sustainability of sugarcane-based products in Thailand, *Clean Technol. Environ. Policy* 21 (7) (2019) 1447–1458, <https://doi.org/10.1007/s10098-019-01715-y>.
- [48] A. Touboulic, H. Walker, Theories in sustainable supply chain management: a structured literature review, *Int. J. Phys. Distrib. Logist. Manag.* 45 (1/2) (2015) 16–42.
- [49] Think Insights. (2022). RBV – What is a resource-based view of strategy?. Retrieved from <https://thinkinsights.net/strategy/rbv-strategy/>. On October 13, 2022.
- [50] H. Park-Poaps, K. Rees, Stakeholder forces of socially responsible supply chain management orientation, *J. Bus. Ethics* 92 (2) (2010) 305–322.
- [51] Thailand Environment Institute (2021). Report on consumer information for sustainable consumption and production in food supply chain in Bangkok. Thailand Environment Institute, Nonthaburi, Thailand. URL: [https://www.tei.or.th/file/library/English\\_Report\\_on\\_SCP\\_in\\_Food\\_51.pdf](https://www.tei.or.th/file/library/English_Report_on_SCP_in_Food_51.pdf). Accessed on 30 September 2022.
- [52] A. Peungnumchai, A. Witayangkurn, & M. Nagai, H. Miyazaki, A Taxi zoning analysis using large-scale probe data: a case study for Metropolitan Bangkok, *Rev. Socionetw. Strateg.* 12 (2018) 21–45, <https://doi.org/10.1007/s12626-018-0019-4>.
- [53] National Food Institute-NFI. (2017). Overview of food industry. Retrieved from National Food Intelligent: [https://www.fic.nfi.or.th/foodindustry\\_quarterlySituation\\_detail.php?smid=1606](https://www.fic.nfi.or.th/foodindustry_quarterlySituation_detail.php?smid=1606).
- [54] T. Yamane, *Statistics: an Introductory Analysis (Second)*, Harper and Row, New York, 1967. Book.
- [55] Q. Zhu, J. Sarkis, Y. Geng, Green supply chain management in China: pressures, practices and performance, *Int. J. Oper. Prod. Manag.* 25 (5) (2005) 449–468.
- [56] National Food Institute-NFI. (2018). Overview of Thai food industry in 2017. *Food Industry Outlook 2018*.
- [57] Chanhirun, S. (2016). Thai food industry export values in 2015. Retrieved from TCIJ Thai; <https://www.tcijthai.com/news,2016,10,current,6468>. Accessed 30 September 2022.
- [58] P. Beske, A. Land, S. Seuring, Sustainable supply chain management practices and dynamic capabilities in the food industry: a critical analysis of the literature, *Int. J. Prod. Econ.* 152 (2014) 131–143.
- [59] A. Kolk, The social responsibility of international business: from ethics and the environment to CSR and sustainable development, *J. World Bus.* 51 (1) (2016) 23–34.
- [60] C. Sancha, C. Gimenez, V. Sierra, Achieving a socially responsible supply chain through assessment and collaboration, *J. Clean. Prod.* 112 (2016) 1934–1947.