Processed Seafood Sustainability Supply Chain Management Practices: A Comparison of Community Enterprises and SMEs

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Abstract

The purpose of this study was to empirically examine current manufacturing practices of sustainable supply chain management (SSCM) in processed seafood supply chain management, looking at the size difference between specific manufacturing organizations: community enterprises and SMEs. A survey was undertaken to collect data from processed seafood producers in the Rayong and Chonburi provinces, which are the main areas of processed seafood production in Thailand. The final 32 valid responses provided a response rate of 54.24%. The Wilcoxon Rank-Sum Test, a nonparametric test statistic, was utilized to compare the mean difference between the Rayong and Chonburi groups of processed seafood producers. The results indicated that SMEs have a significantly higher potential than community enterprises in terms of plan, source, make and delivery. Semi-structured interviews highlighted issues regarding SSCM practices, such as a lack of knowledge of how to achieve sustainable benefits, a lack of technology use, and the instability of raw material supply from the sea, related to weather conditions, leading to difficulties in production planning and sourcing. The results of this study can be used to reflect the current status of SSCM practices. Therefore, the findings should assist both community enterprises and SMES implement more efficient processes, leading to higher performance.

Keywords: Processed seafood, sustainability supply chain management, community enterprises, SMEs

Introduction

Due to global population growth, the demand and value of food have become one of the main interests of various groups, from governments to local groups of people. Customers are more careful about the origin of their food, the production methods and whether their food has an eco-friendly footprint. Additionally, increasingly demanding governmental regulatory requirements and market pressure have forced firms to integrate sustainability into their supply chains (Gupta et al., 2020). Therefore, there is a growing awareness of sustainability in supply chain management (Fahimnia et al., 2015; Govindan et al., 2020; El-Garaihy et al., 2024). All firms are aware of sustainable practices to gain economic benefits, create new revenues and subsequently increase customer and employee satisfaction (Carter et al., 2020; Yang & Wang, 2023). Sustainable Supply Chain Management (SSCM) is an approach that covers wider aspects from the processing of raw materials from the suppliers to the end-user (Yun et al., 2019; El-Garaihy et al., 2024). Supply Chain Management (SCM) covers all the activities of sourcing raw materials, manufacturing and coordination, storing and inventory, tracking, order management, distribution across all parts and delivery to customers (Carter et al., 2020). SSCM covers the scope of economic, environmental and social in the entire supply chain process, including intra-organizational and inter-organizational flows, by using innovative and collaborative approaches, to create sustainable value (Bentahar & Benzidia, 2018; Mastos & Gotzamani, 2022). SSCM seeks to change the competitive landscape, reducing trade barriers and driving both intra-organizational and inter-organizational managers to rethink their processes, technologies, products, and business models to ensure greener manufacturing practices and economic improvement. SSCM is now regarded as a major focus issue that enables the supply chain to operate with long-term aims (Carter et al., 2020; Yang & Wang, 2023).

Food manufacturing is one of the most critical sectors that encounter multiple environmental, economic, and social challenges, influencing a company's adoption of a sustainability strategy (Kuwornu et al., 2023; Sutikasana et al. 2023; Pearson et al., 2024). The practices of food firms are related to SSCM, either internally or externally, and can exist in various forms such as planning, organizational, operational and communication-based approaches (Mastos & Gotzamani, 2022). These could bring benefits for food safety and quality, leading to sustainable performance (Shibin et al., 2020; Kuwornu et al., 2023). Thailand's food processing industry is one of the leading drivers of national economic development, under the Industrial Development Strategy 4.0, a 20-year plan that is operational from 2017 to 2036 (Thailand Board of Investment, 2023). The major processed seafood export products are frozen cuttlefish, fish meat, canned tuna and shrimp products which provide over 70% of total food exports (Thailand Board of Investment, 2023; Madhavan et al., 2024), to serve consumers worldwide.

Prior research on SSCM, especially in developing countries, is still in its infancy (Georgise et al., 2017; Hong et al., 2018; Carter et al., 2020). Large multinational firms have started introducing sustainability management but small and medium enterprises (SMEs) tend to be less engaged (Fekpe & Delaporte, 2019; Rodriguez-Espindola et al., 2022). Previous research has indicated that an adaptation of SCCM practices in Thai food companies is still in the early stages (Kuwornu et al., 2023). Hence, previous studies on SSCM have been less concerned with food companies (Mastos & Gotzamani, 2022), especially in SMEs, since their development has been obstructed by limited resources, inflexible market responses and low risk tolerance (Kato & Charoenrat, 2018; Shibin et al., 2020; Yang & Wang, 2023). Therefore, the implementation of SSCM in community enterprises and SMEs is one of the main issues in achieving sustainable development.

The purpose of this study was to empirically investigate current SSCM practices in the management of the processed seafood supply chain, examining two types of different size enterprises, one a community enterprise and the other an SME, by using the supply chain operations reference model (SCOR Model). Our research question can be identified as "*What are the differences between the processed seafood SSCM practices of community enterprises and SMEs?*" This study was based on four mains of the SCOR model: plan, source, make and deliver.

The following sections review prior literature, outline research and data collection methods and present data analysis and results. Subsequently, a discussion of the results and conclusion are provided to compare SSCM practices of community enterprises and SMEs.

Materials and Methods

Sustainable Supply Chain Management

SSCM can be defined as the process of information management, material and capital flows and cooperation among companies along the supply chain taking into consideration the triple-bottom-line dimensions of sustainable development; economic, environmental and social into account which are derived from customer and stakeholder requirements (Seuring & Müller, 2008; Gupta et al., 2020). It includes practices such as green sourcing, waste management, reverse logistics, product recycling, pollution mitigation, and energy usage and resource conservation into SCM to maximize profits whilst minimizing environmental impacts and maximizing social wellbeing (Kusi-Sarpong et al., 2019; Narimissa et al., 2019; Elbary et al., 2022). Therefore, SSCM provides the ability to achieve competitiveness and performance improvement for a company. Firms of all sizes and industries are being challenged to become more responsible for the environment and society. Hence, it has been recognized that SSCM practices in their operations and management of their supply chain are necessary (Georgise et al., 2017; Carter et al., 2020).

Kuwornu et al. (2023) investigated SSCM practices on the sustainable performance and food quality assurance practices of food companies in Bangkok, Thailand. The study indicated that SSCM practices positively impact the companies' financial, environmental and social performance. Yang and Wang (2023) explored the relationship between SSCM, dynamic capabilities and enterprise economic performance by using hierarchical regression analysis. The results revealed that SSCM practices have a positive impact on both dynamic capabilities and economic performance. Yang and Wang (2023) also presented empirical results regarding different-sized firms which showed that large firms are more active in sustainable development than SMEs. Zeleke and Hailemariam (2023) examined the effects of different factors on the sustainable practices of Ethiopian apparel manufacturing industries. The results showed a significant relationship between factors (environmental, economic, and social perspectives) and sustainable practices. Khanam and Ghosh (2022) discovered the relationship between SSCM practices and the cost performance of manufacturing companies in Bangladesh. The results showed a positive relationship between sustainable procurement and investment recovery on cost performance. However, sustainable distribution provided a negative impact on cost performance.

Some researchers have used qualitative methods based on a literature review to explore the SSCM practices. For instance, there are several previous studies on SSCM practices and performance (Govindan et al., 2020; Khanam & Ghosh, 2022; Mastos & Gotzamani, 2022; Kuwornu et al., 2023; Yang & Wang, 2023). Elbary et al. (2022) focused on identifying barriers to SSCM implementation in the Egyptian fashion industry by conducting a systematic literature review. The study indicated that there has been limited research on SSCM practices, especially in developing countries. Barriers to SSCM implementation in the fashion industry were identified, including economic, social and environmental. Durmaz and Budak (2022) identified the main barriers to the Industrial Development Strategy 4.0 for SSCM implementation. The results indicated that uncertainty about economic profits, resistance to change and lack of infrastructure and tools in the SSCM for implementing that strategy are the main obstacles to employing Industrial Development Strategy 4.0 technologies in SSCM. However, only a few of them have considered the more specific context of micro-enterprises and SMEs (Kato & Charoenrat, 2018; Fekpe & Delaporte, 2019; Shibin et al., 2020; Yang & Wang, 2023). Therefore, this study is focused on SMEs and community enterprises, and the main contribution of this study is to identify the differences between the processed seafood SSCM practices of community enterprises and SMEs.

Firm size has been influential in the adoption of SSCM practices (Rodriguez-Espindola et al., 2022; Yang & Wang, 2023). Large firms are more active in SSCM practices, while SMEs have a lack of initiative to implement SSCM practices to some extent (Kumar et al., 2020; Rodriguez-Espindola et al., 2022; Yang & Wang, 2023). Large firms are expected to leverage different sources of ideas and resources to implement SSCM practices (Yang & Wang, 2023). Due to the availability of resources for investment, and readiness for change, large companies are more capable of integrating partners into their sustainable activities as well as being more likely to improve their knowledge and skills and gain benefits from SSCM practices. However, SMEs that strengthen the training of employees and promote social and environmental awareness could gain economic performance similar to large enterprises.

SMEs and Community Enterprises

SMEs are considered the backbone of many economies and shape the sustainability of both manufacturing and consumption (Fekpe and Delaporte, 2019; Rodriguez-Espindola et al., 2022; Salvador et al., 2023). SMEs contribute to the growth of national gross domestic product (GDP), and increase employment opportunities (Fekpe & Delaporte, 2019). In Thailand, SMEs are usually the same type of organizations (Naipinit et al., 2016). SMEs are defined in terms of the number of employees and business income (The Ministry of Industry, 2020). Firms with no more than 200 employees or annual business income not more than 500 million THB, and firms in the service and merchandising industries with less than 100 employees or annual business income not more than 300 million THB are categorized as SMEs (The Ministry of Industry, 2020). In 2020, there were approximately 3.13 million SMEs in Thailand, which is about 99.6% of all enterprises (Office of Small and Medium Enterprises Promotion , 2023). Hence, SMEs are increasingly part of supply chains and have the potential to shape the future by being positioned among the lower-tier suppliers with specialized technologies and high market share (Kato & Charoenrat, 2018; Fekpe & Dalaporte, 2019).

The Thai government supports SMEs through local, regional, and national programs, for example, cutting administrative costs and burdens, building networks across sectors and borders, technical and managerial training programmes, legal framework reinforcement, and provisions for financial assistance (Office of Small and Medium Enterprises Promotion , 2023). SMEs can access financing from commercial bank loans and can source funds from other financial institutions, the capital market and venture capital. However, some problems are challenges for SMEs, such as their development is hampered by limited resources, flexible market responses, low risk tolerance (Yang & Wang, 2023), and collateral constraints and government policies that have been put into place to address these constraints (Office of Small and Medium Enterprises Promotion, 2023).

Community enterprises have been formally recognized in Thailand since 1997 through the National Economic Development Strategy by the Royal Thai Government (Economic and Social Development Council, 2018) which promotes the clustering of people in communities, so they can become self-sufficient and support learning among members of the communities. Hence, it refers to a group of people in the same community that are organizing activities using the community's resources and legitimately registered to join together to improve their community's economy, highlighting self-sufficiency rather than profit (Cavite et al., 2023; Mettathamrong et al., 2022). To register and become a community enterprise, government regulations must adhered to. For example, the Department of Agricultural Extension, 2019 says, (i) the community enterprise must involve a minimum of seven families in the community, working together jointly; (ii) the main purpose must be to improve the overall community standard of living and self-reliance; and (iii) the business must be evaluated to satisfy moral standards. Therefore, people in the same community work collaboratively and respond to anything within the business operation such as finance, design, production, packing and selling.

The existing product-related practices are mostly based on the unique and original knowledge that has been transferred from generation to generation. Hence, there is a lack of insight information and marketing analysis to improve their products and sales performance (Cavite et al., 2023). There is more focus on using local material for production, based on local cultural and traditional thoughtfulness in the creation of their products. All community enterprises have to officially register with the Department of Agricultural Extension and the Ministry of Agriculture and Cooperatives. One of the most important advantages for community enterprises is the availability of funds to support and manage the community enterprise groups (Cavite et al., 2023). Therefore, community

enterprises supported by government agencies to consolidate their enterprise, assess their market, help them to join producer networks and deliver a product and service that results in customer trust and help them to expand their market base (Laiprakobsup, 2018). The key to success for community enterprises is efficient planning, with members discussing the financial plan, accounts, income and costs (Mettathamrong et al., 2022). Moreover, this also includes a sustainability plan to ensure that the community earns income and has a good quality of life. However, there are a number of obstacles for community enterprises in Thailand such as a lack of marketing knowledge and skills, financial issues, a lack of government agencies' support (e.g., training and knowledge), product and package design and a lack of technological, innovative and developmental skills (Cavite et al., 2023). Therefore, the main contribution of this study is to identify the differences between the processed seafood SSCM practices of SMEs and community enterprises.

There is some past research that is related to the SCOR model, regarding the relationship between the SCOR model and firm size, Islam and Karim (2011) investigated the SC performance in SMEs, and large sized firms across various types of manufacturing industries. Their results indicated significant differences in the strategic approach between SMEs and large manufacturers. Bourlakis et al. (2014) investigated the performance differences between micro, small and medium-sized firms, looking at the SC members' roles, including producers, manufacturers, wholesalers and retailers in a Greek dairy SC. It is necessary for different sized firms to have different sustainable measures that are appropriate and context specific (Bourlakis et al., 2014; Yang & Wang, 2023). The differences in size between SMEs and large firms have been recognized by previous literature (e.g., Hassini et al., 2012; Ghadge et al., 2017; Yang and Wang, 2023). For instance, large-sized firms provide significantly higher rates of financial returns compared with SMEs (Ghadge et al., 2017). Pradabwong et al. (2017) also asserted that medium-sized firms are usually limited in terms of resources, and they are more focused on cost reduction and sales growth, whereas large firms have the ability to provide resources, larger budgets and tend to look at the long term benefits, such as their overall competitive position.

SCOR is a tool for evaluating the SSCM concept (Ntabe et al., 2015; Ebrahimi et al., 2021; Saen & Izadikhah, 2024). Therefore, to measure the processed seafood manufacturing industry in Thailand, especially SMEs and community enterprises, this study considers the SCOR model as the four main constructs of plan, source, make and deliver. Plan is the process of collecting customer requirements, information on existing resources, supply resources, aggregate and prioritise demand requirements, plan inventory, distribution requirements, production materials (Kottala & Herbert, 2020), consideration requirements and resources to uncover planned capabilities and resource gaps. Companies have to consider and take actions such as planning for using new materials that are capable of reducing energy consumption, polluting emissions, toxicity, and size and weight of products (Bentahar & Benzidia, 2018; Narimissa et al., 2019). The use of information technology systems and smart technology such as the Internet of Things (IoT), Artificial Intelligence, big data and cloud computing will help to improve communication, information flow, collecting information and taking informed decisions by real time data such as customers' demands and product queries (Kumar et al., 2020; Mettathamrong et al., 2022). This phase is also related to packaging management to ensure product quality, prevention, and the guarantee of safe transport and storage. Source involves the association of supply sources and the execution of material and services sourcing on an ongoing basis to meet demand. It involves obtaining and searching for new materials that are easy to reuse, reduce, recycle and reduce waste and resources and/or implementing a sustainable sourcing strategy (Schneider & Wallenburg, 2012). Long term relationships with suppliers, information sharing

in real time and working collaboratively with suppliers tend to result in better performance (Pradabwong et al., 2017). In this circumstance, selecting quality suppliers is important to meet the criteria of environmental standards as well as the basis of technical and economic criteria (Centobelli et al., 2021; Yang & Wang, 2023).

Production involves all the activities operated internally by taking on sustainable objectives right from the production design phase. These processes include reducing production and inventory costs, reducing production lead-time, reducing waste during the production and quality improvement (Kottala & Herbert, 2020). To ensure concerns about sustainability are addressed, the production process has to include environmental criteria by using clean technologies, clean energy, such as solar or wind being used in production processes, environmentally friendly technology and processes in order to reduce dangerous waste, greenhouse gas emissions, recycling and remanufacturing (Bentahar & Benzidia, 2018; Govindan et al., 2020; Centobelli et al., 2021; Yang & Wang, 2023). Several best practices such as lean manufacturing, Just-in-Time (JIT), push-pull manufacturing that also improve transformational processes (Govindan et al., 2020). Delivery refers to activities associated with taking and fulfilling customer orders, related to the management of distribution infrastructure and outbound transportation (Setthachotsombut, et al., 2022). Optimization of logistics facility location, efficient modes of transportation (Centobelli et al., 2021). Bentahar and Benzidia (2018) and Saengsathien et al. (2023) indicated that concerns about sustainability in transportation, ecological transportation solution is a difficult choice in practice due to a financial constraint. The use of logistical solutions, for instance, cross-docking, which could involve deliveries of low quantities, leading to an increase in the number of deliveries and, thus, a rise in green house gas emissions.

Data Collection

A survey was utilized for data collection from processed seafood producers. A questionnaire was developed, based on previous research (e.g., Khanam & Ghosh, 2022; Mastos & Gotzamani, 2022; Kuwornu et al., 2023; Wungkana et al., 2023; Yang & Wang, 2023) to cover the main constructs of plan, source, make and delivery. Items were scored using a five-point Likert scale, so the respondents were able to provide answers. The survey also included some specific open-ended questions regarding problems and suggestions of SSCM practices to gain a deeper understanding concerning some specific issues, resulting in more intense evidence from key practitioners. For instance, (i) describes the current situation of SSCM practices of planning, sourcing, making and delivery; and (ii) describes any obstacle in the SSCM practices. A pre-test and pilot test were applied for item refinement and content justification. The responses were based on the criteria of community enterprises and SMEs from Thai processed seafood producers in the Rayong and Chonburi provinces, which are the main areas of processed seafood production in Thailand. The target respondents were community leaders, business owners or responsible people who know all the business operations of the community enterprises and SMEs, with 31 community enterprises and 28 SMEs being the target population for the data collection. The data collection started with a telephone call in advance to making an appointment, then personal interviews were carried out, with the interviewer going to their premises, asking those questions and evaluating the answers. The survey period was from January to March 2023. Descriptive statistics and nonparametric statistics, the Wilcoxon Rank-Sum Test was used to compare the mean difference between two groups of processed food producers in terms of planning, sourcing, production, and delivery.

Results

There was a total of 32 valid responses, providing a response rate of 54.24%. There were 18 participants from community enterprises and 14 were from SMEs. The majority of the respondents, from the community enterprises, were the team leaders, and the main respondents from SMEs were the business owners and production managers. The main items produced were: shrimp paste, fish sauce, dried squid, dried fish, fish balls and fish crackers. All of the SMEs were certified for food standards, for instance, Good Manufacturing Practice (GMP), Halal, and the Food and Drug Administration. However, there were only 2 community enterprises that had been certified by the Food and Drug Administration. Hence, most community enterprises are not food safety standard certified, and so they lack food safety awareness. The measurable variables of planning, sourcing, making and delivery were analysed by using nonparametric statistics, the Wilcoxon Rank-Sum Test was used to compare the mean difference between the two groups of processed seafood producers. The Wilcoxon Rank-Sum Test can be described as the nonparametric version of the two-sample t-test (Hogg and Tanis, 2006), used to compare the means (μ_1, μ_2) of two independent samples when the samples are not normally distributed. Table 1 shows the measurable variables of all the constructs, providing 7 items to measure planning, 4 items to measure sourcing, 5 items to measure making and 3 items to measure delivery.

Table 1 Descriptive statistics for community enterprises and SMEs

Constructs and items	Community enterprises		SMEs	
	Mean	Std.	Mean	Std.
Plan: Being able to work collaboratively with SC partners to plan these operations with environmental considerations	**1.865**	**1.645**	**4.122**	**0.899**
P1: Order quantity planning	0.333	0.840	3.643	0.842
P2: Production quantity planning	2.722	1.364	4.214	0.893
P3: Providing enough alternative sources to support demand variation (e.g., back up sources of main raw materials)	3.111	1.409	4.143	0.864
P4: Planning the procurement and sourcing of raw materials	2.556	1.542	4.071	0.829
P5: Providing facilities to transfer products to customers (e.g., transportation)	1.722	1.447	4.286	0.611
P6: Planning and designing products, considering the environmental impact	2.056	1.589	4.214	0.802
P7: Improving the coordination process by using information systems; trying to reduce steps of communication and becoming paperless	0.556	1.042	4.286	1.326
Source: Being able to work collaboratively with SC partners to procure raw materials with environmental considerations	**2.500**	**1.473**	**4.125**	**0.740**
S1: Raw materials from suppliers that meet requirements	2.778	1.437	4.357	0.745
S2: Selecting reliable and environmentally friendly sources of raw materials	3.000	1.455	4.071	0.829
S3: Transportation of raw materials, taking into consideration fuel consumption reduction and a full trip per demand	2.500	1.098	3.929	0.475
S4: Appropriate packaging used to pack the raw materials, taking environmentally friendly factors into account (e.g., reusable)	1.722	1.637	4.143	0.864

Table 1 (Cont.)

Constructs and items	Community enterprises		SMEs	
	Mean	Std.	Mean	Std.
Make: Being able to work collaboratively with SC partners in the operation of production processes with environmental considerations	**2.422**	**1.854**	**4.371**	**0.684**
M1: Applying lean manufacturing to the production processes	2.611	1.649	4.354	0.633
M2: Using clean technology, such as modifying machinery and equipment so that it has less impact on the environment	2.111	1.967	4.429	0.646
M3: Producing clean products, considering the environment and meeting the customers' requirements (e.g., quality and standard, etc.)	3.833	1.043	4.286	0.825
M4: Sufficient storage of raw materials in the warehouse for production, and being able to maintain a satisfactory condition of the raw materials	2.833	1.689	4.571	0.756
M5: Billing and receiving raw materials using information systems	0.722	1.406	4.214	0.579
Delivery: Being able to work collaboratively with SC partners to carry out various deliverables with environmental considerations	**3.167**	**0.966**	**4.381**	**0.623**
D1: Reducing environmental impacts in the transportation processes such as a transport full trip, fitting the shipping weight, choosing the shortest path and reducing fuel consumption	3.167	0.618	4.286	0.611
	3.389	1.037	4.214	0.699
D2: Delivering on time to the customers	2.944	1.162	4.643	0.497
D3: Using packaging that is environmentally friendly (e.g., reusable, reducing the use of plastic, etc.)				

The Fig. 1 shows the comparison of the results of the SSCM practices between community enterprises and SMEs. Community enterprises were found to have fewer sustainable practices than SMEs with a mean score of: plan (1.865), source (2.500), make (2.422), and delivery (3.167) on a five-point Likert scale. While SMEs provided the mean value higher than 4 for all aspects of: plan (4.122), source (4.125), make (4.371) and delivery (4.381).

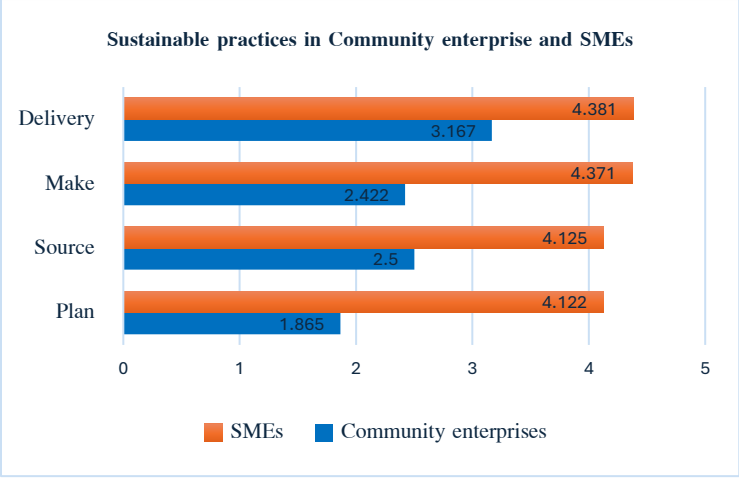

Figure 1 Sustainable practices in Community enterprises and SMEs

Table 2 shows the results of the data analysis. Normality tests were performed by using the Anderson-Darling Normality Test. The results showed that the data in terms of, plan, source, make and deliver are not normally distributed. Therefore, nonparametric statistics are appropriate. The empirical data analysis results were used to compare the current SSCM practices of the two sizes of processed seafood companies, SMEs and community enterprises. Regarding the nonparametric statistical analysis results, SMEs have a significantly higher potential than community enterprises in terms of production planning (Z=4.786, p-value = 0.000), sourcing (Z= 4.159, p-value = 0.000), production (z=4.786, p-value = 0.000) and delivery (Z= 3.913, p-value = 0.000).

The important findings from the open-ended questions during the interview are that SMEs and community enterprises have some obstacles regarding order quantity planning due to the instability of the raw materials (e.g., shrimp, fish), as the supply from local fishermen is also dependent on seasonal conditions. However, this created a clear benefit of sustainability for local sourcing, as there was an increase in the freshness of raw materials and a minimization of transportation costs.

Table 2 Data analysis results

Construct	Mean (Std.)		Anderson-Darling Normality Test (*p*-value)	Wilcoxon Rank-Sum Test (*p*-value)
	Community enterprises	SMEs		
Plan	1.865 (1.646)	4.122 (0.899)	0.046	Z=4.786 (0.000)*
Source	2.500 (1.473)	4.125 (0.740)	0.044	Z= 4.159 (0.000)*
Make	2.422 (1.854)	4.371 (0.685)	0.005	Z=4.786 (0.000)*
Deliver	3.167 (0.966)	4.381 (0.623)	0.005	Z=3.913 (0.000)*

*significant at <0.05

Community enterprises also explained that they have a lack of knowledge and ability to apply information systems to improve billing; receiving raw materials and the coordination process, as well as there being a lack of funding to support their operations. Hence, billing and receiving raw materials were often facilitated by using paper or without notes. Additionally, most of the packaging used to pack raw materials is made of plastic and sealed on the top to protect from air and dust and to ensure the quality and safety of the products. Corrugated boxes, bubble wrap and tapping materials are used for the delivery and are not reused due to hygiene and safety issues. They have realized the problems and would like to improve their packaging to be more environmentally friendly. However, they have inadequate knowledge and skills to develop and create new packaging. In terms of delivery, most of the vehicles used for transportation are motorcycles, so their products cannot be transported in large quantities and product delivery is based on customer orders without prioritizing areas, or the shortest distances.

Discussion

The results of this study identify the processed seafood SCCM practices of community enterprises and SMEs in Thailand. This study is based on four main parts of the SCOR model: plan, source, make and deliver. The results can be summarized as follows. Firstly, in term of production planning, the results indicated that SMEs have a significantly higher potential than community enterprises, with Z=4.786, *p*-value = 0.000. Therefore, SMEs performed better than community enterprises in terms of working collaboratively with their supply chain partners,

regarding order quantity, production quantity, providing enough alternative sources to support demand variation, planning the procurement and sourcing of raw materials, providing facilities to transfer products to customers, planning and designing products taking into account environmental impact, and improving coordination processes by using information systems and trying to reduce steps of communication and become paperless. This research is in line with prior studies, which state that information systems enhance community involvement also, improve supply chain partners effectively working collaboratively in on-time information sharing (Fekpe & Delaporte, 2019; Rodriguez-Espindola et al., 2022; Salvador et al., 2023). Also, government support can encourage and financially assist SMEs to invest in information technology to help with the implementation of Industrial Development Strategy 4.0 technology in SMEs (Kumar et al., 2020; Mettathamrong et al., 2022). In contrast, there is a lack of access to new technology in community enterprises (Mettathamrong et al., 2022). There was only little applied technology due to the cost and knowledge required. This results in a lack of efficient planning, lack of planning knowledge and especially in developing sustainability planning. The interview results of our study also show that community enterprises have limited knowledge and ability to apply information systems to improve billing; receiving raw materials and the coordination process, as well as there being a lack of funding to support their operations.

Secondly, the nonparametric statistical analysis results show that SMEs have a significantly higher potential than community enterprises in terms of sourcing with a Z-statistics of 4.159 and p=0.000. Sourcing is the ability to work collaboratively with SC partners to procure raw materials with environmental considerations. Hence, it refers to raw materials from suppliers that meet requirements, selected sources of raw materials that are reliable and environmentally friendly, transportation of raw materials under the conditions of fuel consumption reduction and a full trip per demand and using appropriate packaging to pack the raw materials, taking environmentally friendly into account. The finding is in line with previous research, which states that community enterprise members must share knowledge and build relationships with their supply chain partners, as well as the government, agencies, other communities, or universities that provide training to gain knowledge and skill to operate SSCM more effectively (Cavite et al., 2023; Mettathamrong et al., 2022).

Thirdly, the results of this study show that SMEs have a significantly higher potential than community enterprises in terms of production with Z=4.786 and p=0.000. In terms of "make", this is the ability of a firm to work collaboratively with SC partners in the operation of production processes with environmental considerations in applying lean manufacturing processes into the production processes, using clean technology, and producing cleaner products by taking into account the environment and meeting the customer requirements. The result consists of prior studies such as Kato and Charoenrat (2018), Fekpe and Dalaporte (2019) who indicated the importance of SMEs, especially in lower-tier suppliers with a high market share. Additionally, with managerial and technical support from the government and training programs, as well as the opportunity to get soft loans from commercial banks (Chen et al., 2023). Therefore, SMEs have more opportunities to organizationally integrate sustainability to ensure that production processes take into account environmental concerns as well as meeting customer requirements.

Lastly, the results show that SMEs have a significantly higher potential than community enterprises in terms of delivery with Z= 3.913 and p= 0.000. Delivery is described as the ability to work collaboratively with SC partners to carry out various deliverables with environmental considerations. It includes aspects of reducing environmental impacts in transportation processes, on time delivery to the customers and using packaging that is environmentally friendly. Hence, community enterprises can be seen as less concerned about environmental impacts

caused by transportation and packaging for their products. The finding is in line with previous research by Cavite et al. (2023) and Saengsathien et al. (2023). As the regards the results of the interviews, they also show that community enterprises are more concerned about the environmental impact. However, they have limited knowledge and find it difficult to develop and create new packaging that is more environmentally friendly. In terms of delivery, most of the vehicles used for transportation are motorcycles, so their products cannot be transported in large quantities and product delivery is based on customer orders without prioritizing areas, or the shortest distances. Hence, low quantity deliveries would increase the number of deliveries and, as a result, exhaust emissions. Therefore, this finding is important because it describes SSCM practices of both SMEs and community enterprises, a comparison in terms of plan, source, make and delivery of the two types of businesses.

Conclusion and Suggestions

Our study provides a better understanding of the current state of SSCM practices in processed seafood production, especially in community enterprises and SMEs. The results show that SMEs are more concerned with SSCM practices, and that it provides a significant higher impact than community enterprises in terms of plan, source, make and delivery. This is supported by the information obtained from the open-ended questions during the interviews, highlighting that both SMEs and community enterprises rely on local suppliers, which are unpredictable because of weather conditions. This leads to a lack of ability in planning, sourcing and producing processed seafood for the market. Community enterprises have realized the importance of SSCM practices; however, there is a lack of knowledge and skill to improve their supply chain, to be more concerned about the environment as well as economic and social perspectives. The findings are in accordance with previous research such as Elbary et al. (2022), Durmaz and Budak (2022), Mettathamrong et al. (2022) and Salvador et al. (2023) who highlighted the lack of sufficient knowledge as a primary barrier and which has to be addressed first, since it can directly drive other barriers. The results of this study can be used to reflect the current status of SSCM practices and help understand the limitations of existing sustainability practices and the need for improvements.

The contribution of this research is that it provides evidence that Thai processed seafood community enterprises and SMEs still need to improve their SSCM practices. Therefore, it is important for both SMEs and community enterprises to learn new knowledge and improve their current knowledge, information technology systems and competencies to achieve greater SSCM practices. Both types of firms, especially community enterprises need to work more collaboratively with their supply chain partners to share knowledge and resources in order to improve and achieve more sustainability in practice. Also, community enterprises should receive a greater level of education regarding food safety standards to enhance food security, minimizing waste in the supply chain and achieving a higher level of SSCM practices. The key limitations of this research include the small sample size and the fact that data collection was mainly focused on a small area: Rayong and Chonburi provinces. Hence, the coverage should be extended to cover the whole country. The findings should assist both community enterprises and SMES to implement more efficient processes, leading to higher performance.

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Author Contributions

Author 1: Designed and directed the research, the main conceptual ideas and proof outline, design of methodology, data analysis and interpretation, manuscript writing, manuscript review and editing.

Author 2: Questionnaire development, data collection, data analysis.

Conflict of Interests

All authors declare that they have no conflicts of interest.

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