The Environment and Social Aspects of Green Supply Chain Performance Indicators in Thai Industries

Itsariyaporn Luanghan[1], Panu Buranajarukorn[1,*], Sutanit Puttapanom[1], Kwanniti Khammuang[1], and Katechan Jampachaisri[2]

ARTICLE INFO

Article history:
Received: 11 October 2024
Revised: 13 February 2025
Accepted: 21 March 2025
Online: 31 March 2025

Keywords:
Supply chain performance indicators
Environmental aspect
Social aspect
Thailand industries
Exploratory Factory Analysis (EFA)

ABSTRACT

Currently, businesses must prioritize policies and operations that are responsible towards the environment and society. Therefore, the approach of green supply chain management, which emphasizes environmental and social considerations, is a way to demonstrate a business's commitment. However, environmental and social supply chain indicators from previous research have been varied and not clearly delineated. This study aims to (1) categorize the indicators for each environmental and social aspect, and (2) determine the components of these indicators and the performance measurement of Thai industry supply chains using the EFA technique. Data was collected by questionnaire surveying from 50 business participants. The research results indicate that 3 indicators for both Environmental and Social aspects, totaling 6 indicators, had a KMO value of 0.76, Bartlett's test = 36.748 ($p<0.001$), and MSA values ranging from 0.68-0.82, which are acceptable values. It can be concluded that the first component, Eco-design, has a higher consistent than Environmental supportive activities and the environmental management system. Meanwhile, the second component, health and safety at work, has a higher consistent than worker's rights and green product. However, further studies on specific industries and other suitable indicators for the context of Thai industries are recommended for interested parties.

1. INTRODUCTION

The situation of global warming and societal changes significantly impacts people's lives, especially in the context of business competition in producing goods and services under the framework of reducing environmental pollution. However, a changing society must develop its potential to enhance organizational quality to meet standards and gain acceptance in today's environment- and society-conscious world [1]. This includes improving supply chain efficiency from suppliers to customers and logistics activities [2]. Considering business operations in the industrial sector of goods and services throughout the supply chain, it can be said that businesses should oversee and take responsibility for environmental and social aspects by establishing concrete environmental and social policies to reduce industrial pollution [3].

However, the industrial sector acknowledges green supply chain management approaches and is enthusiastic about performance indicators that need to be implemented to achieve efficient management results, affecting profits, corporate image, and market share, while reducing environmental concerns in the 21st century [4]. Meanwhile, Huiling Zeng's [5] suggested that the environmental dimension of the supply chain involves activities that reduce carbon dioxide emissions, energy use, and sustainable organizational development. These outcomes lead to the assessment of an organization's environmental and social conditions.

Organizations need to measure environmental performance [6], identifying environmental supply chain performance indicators as a critical issue for modern industrial operations. Reasons for this include regulatory compliance, cost-effectiveness, coexistence with communities, and competitive advantage. Such performance measurement impacts industrial standards and financial efficiency improvements [7]. Meanwhile, organizations are increasingly collaborating with customers, considering environmental aspects and eco-design, and focusing on products and production processes to engage customers. Additionally, they work together to enhance environmental sustainability and reduce waste [8].

The dimensions of environmental and social supply chain performance indicators have been studied extensively. Apichat Sopadang's [1] focused on the Thai sugar industry, covering environmental aspects such as energy consumption, resource consumption, emissions, waste, and

[1]*Department of Industrial Engineering, Nareasuan University, Phitsanulok, 65000, Thailand.*
[2]*Department of Mathematics, Nareasuan University, Phitsanulok, 65000, Thailand.*
* *Corresporndning author:* Panu Buranajarukorn; Email: panub@nu.ac.th.

social aspects including employee satisfaction, customer satisfaction, health and safety, and noise pollution. Elisa Kusrini's [6] study on the Indonesian palm oil industry added environmental indicators like water and energy usage, waste generation, global warming potential, biochemical oxygen demand (BOD), chemical oxygen demand (COD), waste reuse percentage, percentage of certified crude palm oil, material usage, acidification potential, and products with take-back policies. Social indicators included lost workdays due to injury or illness, hours of employee training, worker job satisfaction, local community employment, physical load index, electrical and noise hazards, average length of employee service, and hazards related to high-speed components.

Panpatil [8] research presented two perspectives: (1) green supply chain performance in relation to environmental regulations, including ISO 14001 certification, internal environmental management, green policies, rewards, and incentives; and (2) sustainable performance indicators affecting environmental aspects such as air emissions mitigation, water and solid waste reduction, toxic material consumption reduction, accident frequency reduction, and improvements in environmental and social outcomes including professional ethics, stakeholder welfare, community and occupational health and safety, protection of rights, and reduction in environmental impacts and risks to society.

Sharma's [4] study on the Indian food industry evaluated environmental aspects like the effectiveness of green supply chain management in reducing emissions, water and solid pollutants, and toxic material consumption compliance. Conversely, Zeng [5] global environmental indicators considered carbon intensity, carbon productivity, and green revenue share, highlighting the importance for organizations to use these performance indicators to assess organizational management effectively. These indicators also reflect organizational policies towards environmental and social responsibilities. Furthermore, researchers and supply chain management practitioners are increasingly interested due to environmental degradation impacts [9], alongside societal responsibilities [10].

Based on the previous research considerations, researchers have further studied the key issues with the objective of finding environmental and social supply chain performance indicators relevant to the appropriate industry performance in Thailand. Upon further study, it was found that Habidin [11] utilized EFA and CFA techniques to assess flexibility indicators in the automotive supply chain for suppliers in Malaysia. Similarly, Gandhi [12] research used EFA and CFA techniques to explore multidimensional indicators for measuring service quality in medium and small-scale manufacturing industries in India. Conversely, Gandhi [13] additional research incorporated SEM techniques to measure product distribution quality.

Habidin [14] research employed factor analysis to evaluate sustainability management in the supply chain. Observing these various techniques, Hejazi [15] research applied CFA and SEM techniques to identify variables relating to environmental and social dimensions for sustainable efficiency. After reviewing the literature, it can be summarized that EFA is a method for examining variables structures that have not been previously studied. On the other hand, CFA is a method to validate variables comprehensively against the dataset, following the previous findings of EFA, to determine their appropriateness [16]. Similarly, SEM techniques require theoretical backing and previous research to link various variables together effectively [15].

For this research, the researchers focus on finding supply chain performance indicators from new environmental and social perspectives within the context of the Thai industry. Therefore, we have chosen to use the EFA technique to explore correlations of indicators that align with each perspective. The next section will present the operational steps.

2. MATERIALS AND METHODS

2.1 Environmental and Social Supply Chain

The management of green supply chains friendly to the environment involves a blend aimed at improving environmental performance. Researchers have defined dimensions of supply chains based on varying criteria depending on the company and strategy, such as eco-design, ISO 14000 standards, and life cycle product analysis [17]. Concurrently, green supply chain management and environmental initiatives often pursue sustainable environmental goals through controlling energy and resource usage, reducing production waste, and legally compliant disposal. Additionally, it encompasses organizational capabilities in efficient waste management [15].

Moreover, sustainable environmental practices are crucial in business operations due to the waste and greenhouse gases emitted throughout the supply chain, comprising procurement and material management, manufacturing processes, marketing distribution, and reverse logistics [9]. These practices lead to various benefits such as reducing marketing costs, increasing sales, and fostering sustainable customer relationships, applying environmentally friendly strategic principles to environmental transformations [18]. Furthermore, they focus not only on advancing green technology and innovation but also on enhancing business environmental performance [19].

2.2 Environmental and Social Aspect of Supply Chain Performance Indicators

In this research, the researchers have presented various perspectives related to environmental and social aspects of supply chain performance indicators derived from literature reviews and previous research, as follows:

Green design: quality regulation, which refers to product warranty capabilities such as defective product handling and non-compliant delivery [20]; environmental performance, which focuses on cost reduction in procurement, energy use, operational processes, transportation, and storage, including environmental accident reduction [17]; green manufacturing, which involves manufacturing systems and hazardous material control using energy-saving technologies, waste reduction, environmental-friendly practices, and greenhouse gas and CO2 emission control [4]; green packaging, which entails packaging characteristics that optimize loading methods suitable for spaces like warehouses or trailers [3]; recovering and recycling used products, involving the volume of waste disposed from operations and appropriate recycling methods [21]; and stakeholders pressure, encompassing the organizational/brand image scope in driving environmental aspects, competitive strategy impacts, and environmentally friendly practices [4].

Green supply chain: supplier-customer collaboration, which emphasizes the critical involvement of suppliers in sharing with customers, including planning/design, customer feedback, and green procurement [4]; reverse logistics, which involves the collection, processing of used products, material returns, and components in the supply chain [7]; reducing activities, which refers to measures or practices to reduce activities impacting transportation or storage, including activities causing environmental issues [22]; and organization of logistics networks, which develops intelligent infrastructure systems to enhance competitiveness and operational efficiency across the entire network, focusing on process optimization and cost reduction within logistics network operations [23].

Environmental aspect: Environmental management system, which involves operations under clear environmental policies, including designing regulatory compliance tracking systems such as ISO 9000 and ISO 14001 standards, crucially driven by organizational management commitment [4]; Green product, products resulting from diverse manufacturing processes from inception to end [24]; Green warehouse, focusing on safe storage of diverse goods and materials to reduce pollution and energy use suitable for the area [8]; Eco-design, product design for the environment emphasizing process improvement to reduce costs and environmental impacts [9], including recyclable component reuse [24]; and Green transportation, reducing carbon emissions and environmental pollutants in transportation networks, including green prevention strategies [8].

Social aspect: Worker's rights, which involves equal treatment of employees, no child labor, and ethical practices towards the company [20]; Health and Safety at work, the number of employees affected by injuries and illnesses from work practices, including receiving health and safety benefits [20]; and Environmental supportive activities, focusing on supporting activities that help management make decisions, including providing convenience for employees to contribute to environmental success [9].

3. RESEARCH METHODOLOGY

3.1 Sampling Method and Data Collection

This research specified a targeted sample size of 50 respondents [25], comprising businesses engaged in manufacturing and service sectors that were actively operating. The researchers distributed the questionnaire via email and received completed responses in full. In cases where respondents had ambiguities in their questionnaire responses, clarification was sought through telephone communication [7]. Therefore, the returned questionnaires provided comprehensive data.

3.2 Questionnaire

The questionnaire design drew from a literature review and research related to supply chain performance indicators in both upstream and downstream dimensions. The development process involved two steps, employing 10 experts comprising academic specialists and business representatives, 5 each, totaling 10 individuals [20].

Step 1, the supply chain performance indicators identified from the literature review and relevant research were evaluated for content validity using the IOC technique, encompassing 4 perspectives and 18 indicators, scoring between 0.70 to 1.00 for all questions [25].

Step 2, the questionnaire was assessed for reliability using the Split-Half method, revealing a correlation coefficient of 0.935 [26]. This indicates that the questionnaire items are consistent and reliable. Thus, the questionnaire items deemed suitable for further analysis consist of 2 perspectives and 6 indicators, as depicted in Figure 1.

3.3 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is a multivariate analysis used in research derived from surveys, typically involving a large number of factors, with one reference factor (latent variable) [27]. The primary objective is to survey a limited number of variables. However, when measuring multiple-variable data scales with basic assumptions, the underlying factor analysis entails n factors specified in the dataset, considering the minimum number of factors relative to their interrelationships [28], [29].

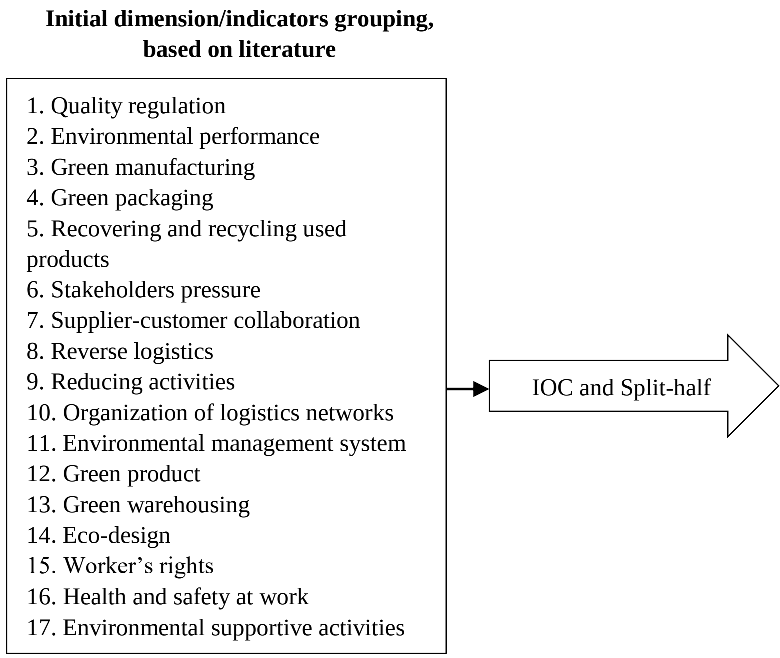

Fig. 1. Developing green supply chain performance indicators for Environmental and social aspects.

Additionally, this technique represents a latent structure comprising a set of indicators requiring observational research [30]. It is a statistical method that minimizes the number of hypothetical structural elements, including factors, dimensions, latent variables, and internal characteristics, while explaining observed variance. This tool is also applicable for identifying factors in social and behavioral sciences [31].

The steps and statistical methods used were as follows:

The researcher utilized R Studio Version 4.2.1 for conducting EFA analysis, following the statistical approach outlined by KILIÇ [29]. The analysis proceeded through the following steps:

Step 1: Data segmentation of survey respondents using count and percentage.

Step 2: Determination of the interrelationships among indicators in the dataset using statistics such as Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Barlett's Test of Sphericity.

Step 3: Assessment of each indicator's fit within the dataset using Measures of Sampling Adequacy (MSA).

Step 4: Determination of the appropriate number of variables in the structure using Factor Analysis to extract common factors.

Step 5: Evaluation of factor loadings for each variable and cumulative variance to examine the variability of the dataset.

4. RESULTS AND DISCUSSION

4.1 Data Analysis of Survey Respondents

This study utilized a targeted questionnaire administered to a specific sample group of 50 individuals [32]. The questionnaire was completed comprehensively, with data that accurately reflected the realities and needs of the businesses. It was found that the majority of respondents held managerial positions, totaling 17 individuals, accounting for 34%. Additionally, 21 respondents (42%) had over 15 years of work experience. The businesses represented were predominantly in manufacturing and production, with 20 respondents (40%), while medium-sized and small-sized businesses comprised 30 respondents (60%), as shown in Table 1.

Table 1. Characteristics of respondents (n=50)

Respondent	Category	n	(%)
1. Position	Owner	15	30.0
	Manager	17	34.0
	Supervisor	15	30.0
	Operation staff	3	6.0
2. Work's experience	< 5 years	2	4.0
	5 - 10 years	13	26.0
	10 - 15 years	14	28.0
	> 15 years	21	42.0
3. Business type	Production sector	20	40.0
	Service sector	10	20.0
	Production and service sector	20	40.0
4. Business size	Medium and Small	30	60.0
	Large	20	40.0

4.2 The Environmental and Social Aspects of Green Supply Chain (ESAGSC) Performance Indicators.

For Table 2, the statistical analysis results include KMO, Barlett's test, and MSA to determine the relationships among the efficiency indicators of ESAGSC, comprising 6 indicators. The KMO value of 0.76 indicates good intercorrelation among the performance indicators, demonstrating a satisfactory sample adequacy. The Barlett's test value of 36.748 with a significance level of $p<0.001$ confirms the confidence in the performance indicators. Regarding MSA, individual indicators of performance were considered, revealing acceptable values ranging between 0.68 and 0.82, which exceed the threshold of > 0.30, as reported by [33] and aligned with findings by [34]

Table 2. KMO, Barlett's test, and MSA of ESAGSC

Statistics' test	Results
KMO	0.76
Bartlett's Test	36.748 (p<0.001)
MSA	ESAGSC1 ESAGSC2 ESAGSC3 0.82 0.73 0.75 ESAGSC4 ESAGSC5 ESAGSC6 0.76 0.68 0.79

After considering the relationships among the performance indicators, they were analyzed using Exploratory Factor Analysis (EFA) to refine and align the new composite indicators appropriately with statistical criteria. The analysis proceeded as follows:

Step 1: Identification of the components of interest using Eigenvalues, which amounted to 0.837, exceeding the threshold of 0.500 and approaching 1.000 [35]. This led to the determination of 2 components.

Step 2: Variable analysis utilizing Principal component analysis (PA) and Varimax rotation method [14]. The results are summarized in Table 3, explaining the variables as follows:

Variable 1 comprises ESAGSC2, ESAGSC3, and ESAGSC6 with Rotated factor loadings of 0.932, 0.915, and 0.729, respectively.

In this regard, the researcher observed that within the context of the Thai industry in case study, ESAGSC2 Eco-design consistent closely with the research of Shekari, H. et al., (2016), yielding a consistent of 0.973. Meanwhile, ESAGSC3 Environmental supportive activities aligns with Shekari, H. et al., (2016) with a consistent of 0.940, contrasting with the research of Q. J. KOKAB (2019) which reports a consistent of 0.667. Additionally, ESAGSC1 Environmental management system correlates inversely with Shekari, H. et al., (2016), at 0.924.

For the second set of variables, ESAGSC2, ESAGSC5, and ESAGSC1 have rotated factor loadings of 0.712, 0.745, and 0.441, respectively. Furthermore, the researcher found that ESAGSC5 consistently with the research of Hejazi, M.T. et al., (2023) at 0.744, while ESAGSC1 Green product consistent inversely with the research of Q. J. KOKAB (2019) at 0.832. However, both sets of variables are accounted for variation in the data about 74.50% [35].

Table 3. The resulted exploratory factor analysis of environmental and social aspects of green supply chain

Items	Factor name (Indicators)	Rotated factor loading		Communalities
		1	2	
ESAGSC2	Eco-design	0.932		0.94
ESAGSC3	Environmental supportive activities	0.915		0.93
ESAGSC6	Environmental management system	0.729		0.79
ESAGSC4	Workers' rights		0.712	0.88
ESAGSC5	Health and safety at work		0.745	0.58
ESAGSC1	Green product		0.441	0.35
Eigenvalues		4.147	0.837	
% of variance		0.466	0.279	
Cumulative variance			0.745	

When the components analysis results were used to develop the ESAGSC performance indicators, they were reorganized as follows: Environmental aspects; ESAGSC2: Eco-design, ESAGSC3: Environmental supportive activities, and ESAGSC6: Environmental management system, and Social aspects, ESAGSC4: Worker's rights, ESAGSC5: Health and safety at work, and ESAGSC1: Green product, as shown in Figure 2.

5. CONCLUSIONS

This study aims to analyze the relationship between green supply chain performance indicators and environmental and social aspects in the Thai industry using the EFA technique through a process of selecting performance indicators. From previous studies [4],[7],[24], the 18 indicators were reduced to 6 using IOC and Split-half techniques based on input from 5 academic experts and industry stakeholders. The study focused on both production and general service sectors, utilizing a specific sample group of 50 respondents.

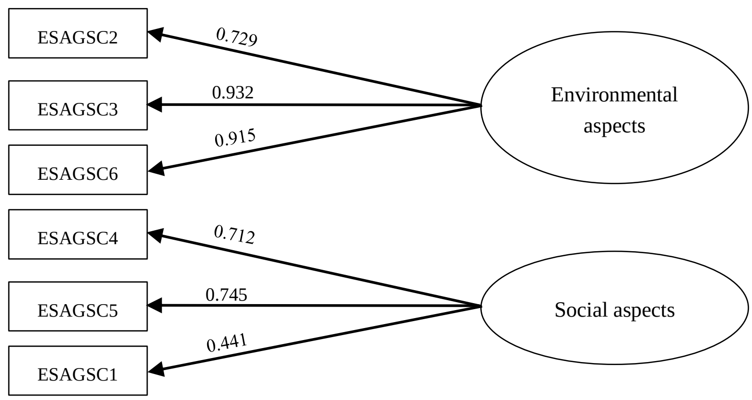

Fig. 2. Development of environmental and social aspects of green supply chain indicators using EFA.

Statistical analysis using R software revealed significant findings: KMO value was 0.76, Barlett's test resulted in 36.748 ($p<0.001$), and MSA ranged between 0.68 – 0.82 across two components. These components include Environmental aspects consisting of Eco-design, Supportive activities, and Environmental management system, and social aspects comprising Worker's rights, Health and Safety at work, and Green product. Overall, the six indicators are accounted for variation in data about 0.745, which exceeds the threshold of 0.500, indicating acceptable reliability.

However, the researchers also found that Eco-design is the indicator with the highest loading at 0.932, while green product has the lowest loading at 0.395. This suggests that the industry places more importance on product design than on manufacturing products that are environmentally friendly. Additionally, the industry also emphasizes the health and safety of workers, as well as worker's rights and environmental management systems, which show closely similar levels of importance.

6. FUTURE SCOPE

Since this study focuses on the overall Thai industry, those interested may further investigate specific industries. However, medium-sized or small businesses looking to apply these performance indicators should consider testing them in practice. For future studies, these performance indicators should be tested in real businesses to assess their applicability.

REFERENCES

[1] Sopadang, A.; Wichaisri, S. and Banomyong, R. 2017. Sustainable Supply Chain Performance Measurement a Case Study of the Sugar Industry. *Proceedings of the International Conference on Industrial Engineering and Operations Management.* Rabat, Morocco, April 11-13, 2017

[2] Aroonsrimorakot, S. and Laiphrakpam, M. 2023. Green Supply Chain Management (GSCM) and Circular Economy (CE): A Rapid Review of their Conceptual Relationships. *Asia Social Issues*., 7(3), pp. 2-18.

[3] Shekari, H.; Biuki, N.A.; Karimi, A.H.M. and Nodushan, A.A. 2016. Identifying Indicators of Green Supply Chain Management in Atlas Tile Company: Taking Environmental Considerations into Account. *Proceedings of 42nd The IRES International Conference*, Amsterdam, Netherlands, June 26, 2016, pp. 11-14.

[4] Sharma, V.K.; Chandna, P. and Bhardwaj, A. 2017. Green supply chain management related performance indicators in agro industry: *A review. Journal of Cleaner Production*., 141 (2017), pp. 1194-1208.

[5] Zeng, H.; Li, R.Y.M. and Zeng, L. 2022. Evaluating Green Supply Chain Performance Based on ESG and Financial Indicators. *Frontiers in Environmental Science*., 10.982828. https://doi:10.3389/fenvs.2022.982828

[6] Kusrini, E. and Primadasa, R. 2018. Design of Key Performance Indicators (KPI) for Sustainable Supply Chain Management (SSCM) Palm Oil Industry in Indonesia. *MATEC Web of Conferences*., 159(02068) https://doi.org/10.1051/matecconf/201815902068

[7] Rao, P.H. 2014. Measuring Environmental Performance across a Green Supply Chain: A Managerial Overview of Environmental Indicators. *VIKALPA*., 39(1), pp. 57-74.

[8] Panpatil, S.S.; Prajapati, H. and Kant, R. 2023. Effect of Green Supply Chain Practices on Sustainable Performance Indicators: a Fuzzy MADM Approach. *Process Integration and Optimization for Sustainability*., 7, pp. 475–488.

[9] Kumar, R. and Chandrakar, R. 2012. Overview of Green Supply Chain Management: Operation and Environmental Impact at Different Stages of the Supply Chain. *International Journal of Engineering and Advanced Technology*., 1(3), pp. 1-6.

[10] Bodendorf, F.; Wonn, F.; Simon, K. and Franke, J. 2022. Indicators and Countermeasures of Modern Slavery in Global Supply Chains: Pathway to a Social Supply Chain Management Framework. *Business Strategy and The Environment*., 32, pp. 2049–2077.

[11] Habidin, N.F.; Janudin, S.E.; Hudin, N.S.; Md Zabit, M.N.; Fuzi. N.M. and Ong, S.Y.Y. 2019. Supply Chain Process of Environmental Information System: Exploratory Factor Analysis. *International Journal of Supply Chain Management*., 8(3), pp. 592-595.

[12] Gandhi, S.K.; Sachdeva, A. and Gupta, A. 2018. Developing a scale to measure employee service quality in Indian SMEs. *Management Science Letters*., 8, pp. 455–474.

[13] Gandhi, S.K.; Sachdeva, A. and Gupta, A. 2018. Distributor service quality in Indian SMEs: A bi-directional customer

perspective. *Uncertain Supply Chain Management*., 6, pp. 335–356.

[14] Gandhi, S.K.; Sachdeva, A. and Gupta, A. 2019. Supplier service quality in supply chains of Indian SMEs: A dual direction dyadic perspective. *Uncertain Supply Chain Management*., 7, pp. 289–310.

[15] Hejazi, M.T.; Al Batati, B. and Bahurmuz, A. 2023. The Influence of Green Supply Chain Management Practices on Corporate Sustainability Performance. *Sustainability*., 15, pp. 5459. https://doi.org/10.3390/ su15065459

[16] Habidin, N.F.; Salleh, M.I.; Md Latip, N.A.; Azman, M.N.A. and Fuzi, N.M. 2015. Confirmatory Factor Analysis of Flexibility Supply Chain for Malaysian Automotive Suppliers. *Sains Humanika*., 7(1), pp. 1–7.

[17] Faris, H.M. and Maan, H.Y. 2020. Evaluation of green supply chain management practices under uncertainty environment: case study in the company for batteries industry. *IOP Conf. Series: Materials Science and Engineering*., 881 (012085), doi:10.1088/1757-899X/881/1/012085.

[18] Khalili, J. and Alinezhad, A. 2018. Performance evaluation in green supply chain using BSC, DEA and data mining. *International Journal of Supply and Operations Management*., 5(2), pp. 182-191.

[19] Uygun, O. and Dede, A. 2016. Performance evaluation of green supply chain management using integrated fuzzy multi-criteria decision making techniques. *Computers & Industrial Engineering*., 102, pp. 502–511.

[20] Kusrini, N. and Maswadi. 2021. The performance improvement of sustainable palm oil supply chain management after COVID-19: Priority indicators using F-AHP. *Uncertain Supply Chain Management*., 9, pp. 227–236.

[21] Kumar, A.; Shrivastav, S.K.; Avinash K. Shrivastava, A.; Panigrahi, R.R.; Mardani, A. and Cavallaro, F. 2023. Sustainable Supply Chain Management, Performance Measurement, and Management: A Review. *Sustainability*., 15, pp. 5290. https://doi.org/10.3390/su15065290

[22] Oršič, J.; Rosi, B. and Jereb, B. 2019. Measuring Sustainable Performance among Logistic Service Providers in Supply Chains. *Technical Gazette*., 26(5), pp. 1478-1485.

[23] Reshetnikova, O.; Dyczkowska, J. and Olkiewicz, M. 2022. The Concept a Logistic Network Organization Lviv-Rzeszow. *Scientific Papers of Silesian University of Technology Organization and Management Series*., 158, pp. 513-524.

[24] Kokab, Q.J.; Mari, S.I.; Bhatti, S. and Memon, M.S. 2019. Exploratory and Conformity Factor Analysis of the Green logistics practices in Textile Sector of Pakistan. *Sindh University Research Journal (SCIENCE SERIES)*., 51(2), pp. 285-290.

[25] Wattanakomol, S. and Silpcharu, T. 2023. Characteristics of entrepreneurs in sustainably successful micro, small, and medium enterprises. *Uncertain Supply Chain Management*., 11, pp. 1359–1368.

[26] Pronk, T.; Molenaar, D.; W. Wiers, R. and Murre, J. 2022. Methods to Split Cognitive Task Data for Estimating Split-Half Reliability: A Comprehensive Review and Systematic Assessment. *Psychonomic Bulletin & Review*., 29, pp. 44–54.

[27] Maskey, R.; Fei, J. and Nguyen, Hong-Oanh. 2018. Use of exploratory factor analysis in maritime research. *The Asian Journal of Shipping and Logistics*., 34(2), pp.091-111.

[28] Jain, V. and Ajmera, P. 2018. Quantifying the variables affecting Indian medical tourism sector by graph theory and matrix approach. *Management Science Letters*., 8(2018), pp. 225–240.

[29] Kiliç, A.F. 2020. Exploratory Factor Analysis with R Software. *Anadolu University Journal of Education Faculty*., 4(3), pp.276-293.

[30] Bido, D.S.; Mantovani, D.M.N. and Cohen, E.D. Destruction of measurement scale through exploratory factor analysis in production and operations research. *Gest. Prod., São Carlos*, 25(2), pp. 384-397.

[31] Watkins, M.W. 2018. Exploratory factor analysis: a guide to best practice. *Journal of Black Psychology*, 44(3), pp.219-246.

[32] Yujun, C. 2023. Supply Chain Determination of Business Continuity and Competitive Advantage. *Dinasti International Journal of Economics, Finance and Accounting*., 3(6), pp. 681.690.

[33] Tortorella, G.L.; Prashar, A.; Antony, J.; S. Fogliatto, F.; Gonzalez, V. and Filho, M.G. 2023. Industry 4.0 adoption for healthcare supply chain performance during COVID-19 pandemic in Brazil and India: the mediating role of resilience abilities development. *Operations Management Research*., https://doi.org/10.1007/s12063-023-00366-z

[34] R. Mitchell, K.A.; J. Brassil, K.; Fujimoto, K.; M. Fellman, B.; Shay, L.A. and E. Springer, A. 2020. Exploratory Factor Analysis of a Patient-Centered Cancer Care Measure to Support Improved Assessment of Patients' Experiences. *Value Health*., 23(3), pp. 351–361.

[35] Özkanlısoy, Ö. and Bulutlar, F. 2023. Measuring Supply Chain Performance as SCOR v13.0-Based in Disruptive Technology Era: Scale Development and Validation. *Logistics*., 7, 65. https://doi.org/10.3390/logistics7030065