

Evaluating Sustainable Practices in Supply Chains: A Conceptual Framework for ESG Performance Assessment.

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Abstract

Assessing the sustainability of supply chains is a challenging research topic, and this study proposes a possible conceptual framework through a review of previous research literature. The study first delves into the impact of the supply chain at all levels and then proposes multiple variables that affect the sustainable supply chain, including the overall performance of the supply chain, the economic impact, the environmental impact, the social impact, and so on. In terms of supply chain performance evaluation, the study further proposes two different concepts, one is to regard the supply chain as the weighted sum of the participating enterprises according to the performance evaluation method of general corporate governance, and the evaluation method is to use the performance of input and output as the basis for evaluation, and the other is to consider the supply chain as a whole and conduct overall performance evaluation from the perspective of sustainable supply chain. At the end of this study, a possible conceptual architecture diagram is also presented as a reference for subsequent researchers.

Keywords: ESG, Supply Chain Performance, Sustainable Practice

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Introduction

Background

ESG has become a key indicator to promote the sustainable development of enterprises, including environmental protection, social responsibility, and corporate governance, and is an important cornerstone for building trust in enterprises by investors and consumers (Zhou et al., 2022). ESG emphasizes corporate subjectivity, highlights the added value of sustainable operation created by products and services, and connects the global consumer network, highlighting the importance of environmental investment, and promoting enterprises to formulate strategic layouts for environmental issues in advance.

At the same time, ESG can also be used as a specific indicator for external evaluation of a company's sustainability practices, and excellent ESG performance is usually more easily recognized by the capital market. Conversely, failure to disclose ESG-related information may be a barrier to companies expanding into internationally competitive markets (Arvidsson & Dumay, 2022). Therefore, the active practice of ESG has become a key issue that needs to be addressed urgently by major industrial enterprises. The supply chain is a system composed of many corporate activities, and as ESG has become an important criterion for enterprise evaluation, whether the supply chain also operates in the spirit of ESG has become one of the issues of concern to consumers and the public.

With the growing global focus on sustainability issues, companies must demonstrate their commitment to environmental sustainability and social responsibility to meet the expectations of customers, investors, and regulators. Internally, enterprises also need to accelerate transformation to achieve a balance between business development and environmental protection and actively promote the sustainable development of enterprises. Velte (2017) companies already have a set of methods to follow to measure ESG performance, but how to apply this method to the supply chain at the same time has become one of the challenges faced by supply chain managers today.

This article will explore the history and theory of the beer game. It begins with a summary of the history and goals of the beer game, followed by a discussion of its main lessons. Later explain their application to contemporary supply chain challenges and real-world examples of successful implementation.

Main Research Objectives

The research objectives of this study include:

1. An in-depth look at the key aspects of ESG's impact on the supply chain.
2. Propose a conceptual framework for supply chain ESG performance evaluation.

Literature Review

Supply Chain Theory

In the operation of today's enterprises, activities are usually divided in the form of the organization of the supply chain. So, in this section, we'll give a clearer definition of the supply chain (Snyder & Shen, 2019).

A supply chain is a network of individuals and companies involved in the creation and delivery of products to consumers. The supply chain starts with the raw material producer and extends to the trucks delivering the finished product to the end user. Supply chain management is a crucial process because an optimized supply chain can reduce costs and increase the efficiency of the production cycle. As a result, today's businesses are actively looking to improve their supply chains to reduce costs and remain competitive.

Sustainable supply chain

In recent years, industries and enterprises have introduced and implemented ESG (E-Environmental, S-Social, G-Corporate Governance) as a key performance indicator to improve operational performance (Li, et al., 2021) Among the various management functions of enterprise operations, procurement has become an effective management tool with great potential. By developing sustainable procurement policies and practices, companies can make a substantial contribution to achieving sustainable development by changing the impact that may occur throughout the product or service life cycle, minimizing potential disadvantages.

The supply chain of an enterprise or organization plays a key and important role in this process. Effective management of the supply chain is an indispensable part of enhancing the competitiveness of an organization. In addition to the traditional evaluation considerations such as quality, cost, delivery time, and service, "sustainable development of the supply chain" is an important consideration in supplier management. In order to strengthen and improve the sustainability performance of the supply chain, it is necessary to first formulate a system of "Supplier Management Standards" and cooperate with quantitative mechanisms such as evaluation and satisfaction surveys to encourage suppliers to comply with and implement them and promote the overall supply chain to move towards the goal of sustainable development.

Traditional supplier management broadly includes the following mechanisms: (Spekman et al., 1999)

- Sourcing and investigation of new suppliers
- Supplier written information and on-site review
- Supplier selection and grading
- Supplier quality assurance system checks
- Supplier performance evaluation system

Nowadays, in response to the trend of sustainability, the following evaluation items have been added to supplier management (Zimmer et al., 2016):

- Optimize the supplier selection process
- Key Supplier Identification Criteria
- Corporate Sustainability and Social Responsibility Audit
- Supplier process quality audit

In addition, its system and supervision should be established concerning the following commonly used relevant international norms and norms:

Value Chain Management, VCM (McGuffog & Wadsley, 1999)

Responsible Business Alliance, RBA (Wicks, 2009)

Business Social Compliance Initiative, BSCI (Egels-Zandén & Wahlqvist, 2007)

Business Environmental Performance Initiative, BEPI (Roy et al, 2013)

Global Reporting Initiative, GRI (Tarquinio et al., 2018)

ISO 20400:2017 (Goebe et al., 2018)

United Nations Sustainable Development Goals UN SDGs (Lee, et al., 2020).

Green supply chain

The green supply chain is an environmentally sustainable business model that aims to minimize the adverse impact of production on the environment. It encompasses all phases of the product life cycle, including raw material procurement, manufacturing, transport logistics, and product use and recycling. (Lamba & Thareja, 2021).

The core goal of a green supply chain is to conserve resources, improve energy efficiency, reduce carbon emissions, and ensure product quality and sustainability. This business model focuses on the full range of environmental impacts and strives to adopt sustainable practices at every stage of product production to promote green development and reduce the impact of production on the natural environment.

There are many advantages to promoting green supply chains (Astawa et al., 2021):

1. Improve efficiency and reduce costs. A green supply chain is not only beneficial to environmental protection and reducing carbon emissions, but also brings tangible benefits to businesses in terms of business and production. By conserving resources and improving energy efficiency, companies can reduce production costs while reducing expenses on waste disposal and environmental burdens.

2. Enhance the positive image of the brand in addition to the advantages of production, the green supply chain can also improve the competitiveness and brand value of the enterprise. As global consumers pay more attention to environmental issues, more and more consumers are inclined to support environmentally friendly products and companies. By building a green supply chain, companies can build a positive image, meet consumers' demand for environmental protection, enhance brand image and loyalty, and enhance market competitiveness.

3. Comply with regulatory and policy requirements A green supply chain helps companies comply with relevant regulations and government environmental requirements. As more and more countries and regions implement environmental protection regulations, requiring companies to reduce carbon emissions, reduce waste generation and reduce pollutant emissions, establishing a green supply chain has become an effective way to ensure compliance and avoid possible fines and legal risks.

4. Promote collaboration between companies green supply chains promote close collaboration between companies and stakeholders. This requires collaboration with suppliers, partners, communities, and governments to achieve environmental sustainability goals. Such collaborations help build long-term partnerships, work together to find innovative solutions, share resources and knowledge, and achieve mutual economic and environmental benefits.

Value chain of the supply chain

Michael E. Porter first introduced the concept of Value Chain in 1985, which is primarily applicable to vertically integrated companies and emphasizes the competitive advantage of a single enterprise (Porter, 2001).

According to Porter, "Every business is a collection of activities that perform in the process of designing, producing, selling, distributing, and supporting its products. All of these activities can be demonstrated through a value chain."

A company's value creation is structured through a series of activities, which can be divided into two categories: basic and ancillary. Basic activities include internal logistics, production operations, external logistics, marketing and sales, service, etc., while ancillary activities include procurement, technology development, human resource management, and enterprise infrastructure. These distinct but interrelated production and business activities form a dynamic process of value creation, i.e., the value chain.

Since the supply chain is made up of many companies that participate together, the value chain of the supply chain is created by these participating companies. However, due to the different value chain orientations of individual enterprises, the value chain of the entire supply chain must be coordinated and run between these enterprises before it can be formed.

Theory of ESG

Origin and Development of ESG

Environmental, social, and corporate governance (ESG) is a range of factors that are considered when investing, including environmental, social, and corporate governance issues (Gelles, 2023). The term ESG was first widely used in 2004 in a report titled "Who Cares Who Wins", which was an initiative of financial institutions (UN Environment Programme-Finance Initiative, 2004) at the invitation of the United Nations. In less than 20 years, the ESG movement has evolved from a United Nations initiative for corporate social responsibility to a global phenomenon with more than \$30 trillion in assets under management (Holder, 2019). According to Morningstar, Inc., in 2019 alone, ESG-related products attracted \$176.7 billion in capital inflows, a growth rate of 525% from 2015. According to Morningstar, U.S. ESG investment funds saw \$3.1 billion in capital inflows in 2022, while non-ESG funds lost \$370 billion when the stock market fell during the same period (Chung & Michaels, 2019).

However, some critics claim that ESG-related products are unlikely to have the expected impact of raising the cost of capital for polluting companies (Berk & Van Binsbergen, 2021), while also blaming the greenwashing movement (Armstrong, 2021).

The impact of ESG on financial investment Deloitte

The challenges of ESG issues to enterprises mainly cover the following six aspects, and it is recommended that enterprises evaluate how to integrate ESG elements in their corporate development strategies through different aspects and respond quickly to market demand (Freiberg et al., 2020).

1. Economic: The issue of sustainable management affects the investment trend of the financial market has changed the structure of the financial market and has a broad and profound impact on the financing methods and investor relations management of enterprises.

2. Social aspect: The public generally expects companies to pay more attention to sustainability issues Consumers, investors, credit rating agencies, suppliers, etc. expect companies to strengthen sustainability issues, so the existing customer relationship management system should incorporate ESG issues for future optimization.

3. Technical: Promote relevant scientific research and technological innovation based on the concept of sustainability Environmental protection, energy saving, and waste reduction have become important issues that enterprises must consider when developing new products and services. Disruptive technologies can be developed with the potential to create new markets, new business models, and new value networks, which may further impact the way the entire supply chain operates, including procurement, production, and transportation.

4. Environment: Environmental factors need to be considered in the overall supply chain planning In the era of the global supply chain, environmental factors (such as forest fires, plastic pollution, etc.) will directly or indirectly increase the company's operational risks, and enterprises need to prepare for the possible impact of climate on their operations to enhance or maintain the interests of the enterprise.

5. Legal aspect: ESG concepts continue to influence global environmental regulations International and regional regulations related to sustainable operation continue to formulate new regulations related to sustainable operation, such as carbon tax, carbon neutrality, carbon dioxide emissions, environmentally friendly packaging, and other restrictions have been put on the road. Enterprises will face increasing operating pressure and need to optimize internal and external sustainability risk management and financial control processes in advance to cope with related challenges.

6. Politics: ESG changes the political discussion and guides the direction of policymaking in various countries The greening initiatives of many governments, as well as the environment-related financial grants or tax schemes of international organizations such as the United Nations and the European Union, have a significant impact on the development of corporate strategies, and will directly change the way companies transparently disclose their reports to shareholders and all stakeholders.

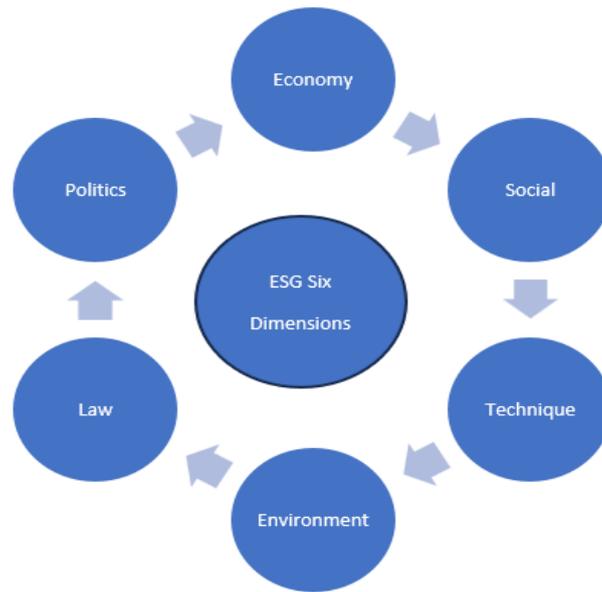


Figure 1 Six aspects of the impact of ESG on enterprises

ESG evaluation indicators

Taking laptops as an example, Jiang proposed a factor analysis of output performance measurement in supply chain management, as shown in Table 1(Jiang, 2003).

Table 1 Analysis of factors for output performance measurement of supply chain management

factor	The name of the variable
Supplier performance	The supplier's ability to continuously improve the quality of delivery
	The ability of suppliers to respond quickly to changes in demand
	Supplier on-time delivery achievement rate
	Supplier ability to reduce lead time for delivery
Manufacturer performance	Reduced cost of product inventory
	Reduced product shipping costs
	Product quality improvement
	The cost of manufacturing products has decreased
	Improve the ability to adapt to uncertain situations
	The on-time delivery compliance rate has been improved
	The lead time for product delivery is very short

Table 1 (Continued)

factor	The name of the variable
Customer satisfaction performance	Accuracy of market demand forecasts
	The out-of-stock rate decreases
	Adaptability to changes in market demand
	Respond quickly to customer needs
	Shipment accuracy improved
	Provide perfect after-sales service
	The number of customer complaints has decreased
Overall supply chain performance	Increased customer loyalty
	The supply chain is more responsive
	Total supply chain costs are reduced
	Improve the quality of products and services provided by the supply chain
	The ability of the supply chain to respond to fluctuations in demand
	The supply chain can quickly change product design and introduce new products
	The supply chain achieves strategic and organizational goals

Research Methods:

This study adopts a conceptual approach in which the main concepts of previous studies are first collected, and then these concepts are synthesized to propose a feasible research framework.

The main concepts explored in this study are as follows:

1. The concept of a sustainable supply chain
2. The concept of a green supply chain
3. The concept of ESG evaluation indicators
4. The concept of performance evaluation indicators for the supply chain
5. A performance evaluation model for inputs and outputs
6. What are the commonly used ESG evaluation indicators in the world?

Results and Discussion

Theory Development

ESG evaluation indicators are commonly used in the world.

As a company's ESG performance requires a comprehensive and in-depth analysis, it usually relies on an impartial third-party organization to assist in the evaluation. However, there is a lack of unified regulations and judgment criteria for ESG scores of different institutions, so the ESG scoring criteria of a company in different institutions may be different. Nonetheless, these assessments will focus on three major areas:

environmental, social and corporate governance, although the specific details of focus in each area may vary. Here are the three main ESG scoring agencies:

1. MSCI Morgan Stanley is one of the world's leading index providers as a provider of financial information research services to help investors quickly understand market changes through indices. MSCI further subdivides the three scoring criteria into 10 themes and 35 specific sub-categories assigns different weights to each sub-category according to the industry sector, and finally calculates the ESG rating. Rated from highest to lowest, representing "leading", "average" and "lagging ", there are currently about 8,500 companies in the world, including about 120 companies in Taiwan that fall within the scope of MSCI's ESG rating research. If you want to know the ratings of other companies, you can check the official website of MSCI (Giese et al.,2021).

2. FTSE Russell, another index provider, FTSE Russell, has also launched a unique ESG evaluation mechanism, which is further subdivided into 14 themes and 300 indicators from the original three scoring criteria, and assigns corresponding weighted scores to each indicator according to the exposure of each industry and the importance of the theme. The rating is 0~5 points from high to low, and there are currently about 200 companies in Taiwan within the research scope of FTSE Russell, but FTSE Russell does not disclose the ratings of each company for free and can only refer to it from the constituent stocks of the Taiwan Sustainability Index (Tay & Tay, 2023).

3. Sustainalytics Sustainalytics is the most extensive authority on ESG scoring, rating more than 13,000 companies worldwide. The rating method is based on the scoring of enterprises in corporate governance, key ESG issues and the unique problems that may be encountered in various industries, and divides the risks faced by enterprises into two types: controllable and uncontrollable, and the controllable risks are further divided into controlled and uncontrolled, and then the controllable risks are further deducted from the uncontrollable risks, which is the final ESG score and rating. ESG ratings are classified from good to bad as no risk, low risk, medium risk, high risk, and severe risk, with lower scores representing better ESG ratings (Diez-Cañamero, et al., 2020).

Green Supply Chain Assessment Indicators

The green supply chain assessment index is the performance of the supply chain from the perspective of environmental protection, as shown in Table 5.

Table 5 Evaluation factors of green supply chain performance

Evaluation object	First-level indicator	Secondary indicators	Calculation formula
Green supply chain performance	Profitability	Net profit margin on sales (a1)	Net profit margin on sales = net profits/sales revenue
		Rate of return of investment (a2)	Rate of return of investment (ROI) = income before tax/total investment
		Return on equity (a3)	Return on equity = net income/average shareholders' equity
		Operating profit growth rate (a4)	Operating profit growth rate = operating profit growth this year/total operating profit for the previous year
	Environmental performance	Carbon intensity (b1)	Carbon intensity = carbon footprint/operating revenue
		Carbon productivity (b2)	Carbon productivity = operating revenue/carbon footprint
		Green revenue share (b3)	Green revenue share = green revenue/operating revenue
	Operational performance	Inventory turnover (c1)	Inventory turnover = operating revenue/average balance of inventory
		The proportion of products sold (c2)	The proportion of products sold = sales (total inventory amount + sales amount)
		Total asset turnover (c3)	Total asset turnover = sales/average total assets

Performance evaluation factors of supply chain governance

The performance evaluation factors of supply chain governance include the following: (1) executive compensation; (2) bribery and corruption;(3) Political lobbying and donations;(4) Board diversity and structure;(5) Tax strategy, etc.

Proposed Conceptual Architecture Diagram

This study proposes a proposed conceptual architecture diagram for sustainable supply chain management, as shown in Figure 2

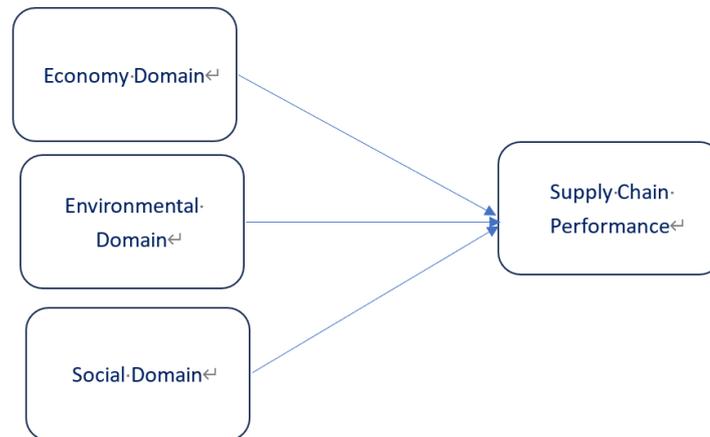


Figure 2 Conceptual architecture diagram of supply chain sustainability management

This conceptual architecture diagram of supply chain sustainability management considers the environmental, social, and corporate governance aspects, and TASS also proposes three evaluation factors for this architecture, as shown in Table 3.

Table 3 Aspects of comprehensive ESG performance evaluation

Environmental Surfaces	Social aspect	Governance surface
Green Consumption, renewable energy Climate governance Operational Processes	Promote public interest participation Social services Employee Care and Labor Relations Workplace friendliness and diversity balance product responsibility	Operational and financial performance Organizational Operations Material issues Internal control mechanism
Greenhouse gas inventory Carbon management Water management	Industry involvement Customer Benefits Respond to international SD	Risk Management Policy Board Governance Information, Disclosure and Transparency
Waste management Environmental Performance Exam administration Energy efficiency Green Finance	Award Records	Corporate Mission Regulatory issues Supply chain management

Conclusion

This study aims to take a closer look at the impact of ESG on the supply chain and identify what needs to be done to drive sustainability. By adopting a conceptual research approach, we study in detail the main aspects of ESG impact on the supply chain and propose a conceptual framework for ESG performance evaluation of the supply chain.

In the study, we mainly focus on the issues of sustainable supply chain, green supply chain, and supply chain evaluation under ESG indicators. At the same time, we delved into the concept of supply chain performance assessment, including the input-output performance model. In addition, we have conducted a detailed discussion on the ESG evaluation indicators commonly used internationally. Finally, we propose a framework for evaluating supply chain performance under the concept of ESG.

Due to the limited time, we were unable to conduct an empirical study, which provides room for extension for follow-up researchers. We hope that future research will build on our proposed framework to further validate the specific impact of ESG on supply chain performance.

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