

The antecedents and consequences of green innovation on China's logistics industry's sustainable organizational performance

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Abstract

Purpose: The research objectives of this paper are the factors leading to and outcomes of green innovation and the factors affecting the organizational performance of sustainable development in China's logistics industry.

Design/method/approach: Based on literature review, this study adopted the research design of quantitative survey method. A cross-sectional design was used for one-time data collection, and different statistical tests were used for proposition.

Findings: Environmental Transformational Leadership (ETL) and Green Knowledge Management (GKM) were selected as antecedents based on their impact on the environment. These two variables have a significant impact on Sustainable Organizational Performance (SOP), respectively. The inclusion of green innovation factors is because they do have a impact on SOP as consequences variables. However, in order for enterprises to maintain a green development perspective, green innovation factors need to be added in (Green Process Innovation, Green Knowledge Innovation and Green Management Innovation) which can drive enterprises to continuously update green environment measures.

Research limitations/implications: Academic research on the logistics industry has always been active, but existing research has certain deficiencies in depth and breadth. This article mainly discusses the causes and consequences of green innovation, both of which are deepening and enriching the research on sustainable organizational performance related to it, making up for the shortcomings of current research, and have important theoretical reference significance.

Practical implications: Current research on green innovation in the logistics company has problems that are difficult to implement in practice, which has a negative impact on sustainable organizational performance. In response to this problem, we proposed methods for implementing green innovation and the antecedents that affect green innovation, which can effectively improve the negative impact of the inability to implement sustainable organizational performance caused by green innovation.

Originality/value: This paper presents a novel mode relationship framework for the sustainable development factors of the logistics industry.

Keywords: Green Innovation, Green Logistics, Sustainable Organizational Performance, Sustainable Development of Enterprises

Introduction

Sustainability is becoming a priority for the corporate world due to the significant changes brought about by the COVID-19 (Alraja et al., 2022). Sustainability and sustainable development have been essential research objectives for scholars (Yong et al., 2020). Environmental protection is a major issue facing businesses today, and companies must find a delicate balance between promoting economic development and conducting operations in an environmentally responsible manner.

Organization sustainable development performance refers to the comprehensive achievements of enterprises in achieving economic and environmental sustainable development goals, and is used to measure the level of sustainable development of organization (Chowdhury et al., 2022). With the deepening of the concept of sustainable development, more and more companies are paying more attention to the impact of their economic behavior on the environment while maintaining economic sustainability, and while maintaining a good image of social responsibility, companies also cause rising operating costs (Abner & Ferrer, 2019). Therefore, how to minimize the adverse affect on the environment while improving financial performance is the challenge that enterprises face when implementing sustainable development strategies.

The logistics industry is an important support for the development of China's national economy (He et al., 2017). With the rapid economic growth, China's logistics demand continues to grow. In 2020, despite the significant impact of the COVID-19 pandemic and the formidable challenges posed by the complex international situation, the logistics operation of the entire industry continued to recover steadily. In 2020, the total social logistics volume in China is projected to reach 30.01 trillion yuan, showing a 3.5% year-on-year increase, representing a growth in comparison to the previous year. Additionally, the total cost of social logistics for the same period is expected to reach 14.9 trillion yuan, showing a 2.0% increase in comparison to the last year. The total cost of social logistics accounted for 14.7% of GDP, basically unchanged from the previous year (Murdock et al., 2021).

With the rapid growth of the virtual economy, the volume of China's logistics business is projected to exceed 80 billion units in 2020 (Wang et al., 2023). According to the National Bureau of Statistics, energy consumption in transportation, warehousing, postal services and other fields increased from approximately 297 million tons of standard coal in 2011 to approximately 436 million tons of standard coal in 2018. And its proportion in my country's total energy consumption also increased from 7.7% to 9.2%. It is expected that during the "14th Five-Year Plan" period, it will continue to show a rapid upward trend. The green development of the logistics industry is playing an increasingly important role in the national green development strategy (Sun et al., 2018).

According to Figure 1 from the study "Carbon Emissions of China's Express Industry" published by the international environmental protection organization Greenpeace, China's express industry's carbon emissions will increase by more than 200% in five years, with the growth rate slowing from 2011 to 2022 due to a variety of factors. In 2021, the annual growth rate of China's express delivery business will exceed 25% for eleven consecutive years. According to the figure, from 2017 to 2022, there was a substantial surge in carbon emissions from China logistic industry have increased significantly, rising from 18.37 million tons to 55.65 million tons. This represents an astounding increase of over 200% within the span of five years, demonstrating an annual compound growth rate of nearly 25%.

Generally, this research has two research objectives, which are:

1. To investigate the green innovation have impact on sustainable organizational performance.

(1) To investigate the process innovation have a positive impact on sustainable organizational performance.

(2) To investigate the green management innovation have a positive impact on sustainable organizational performance.

(3) To investigate the green technology innovation have a positive impact on sustainable organizational performance.

2.To examine the antecedents have impact on green innovation.

(1) To examine the environmental transformational leadership has relationship with green innovation.

(2) To examine the green knowledge management has relationship with green innovation.

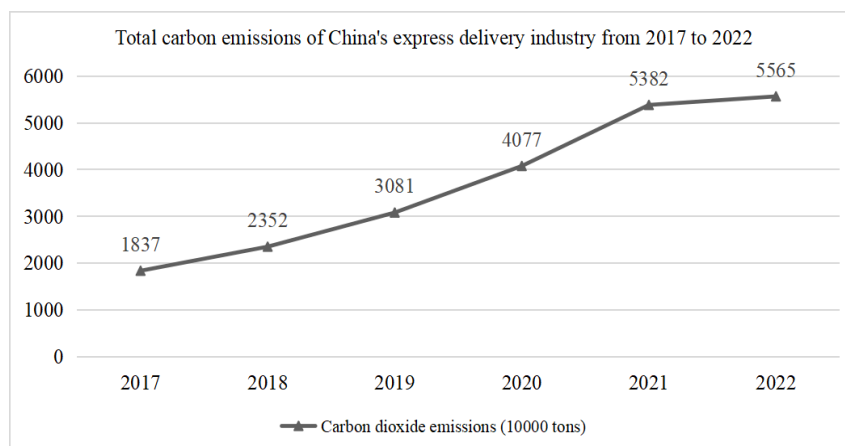


Figure 1: China's carbon emissions from 2017 to 2022
(Data source: China's Express Delivery Industry's carbon Emissions)

Literature Review

The sustainable organizational performance (SOP) of enterprises is composed of three factors: social performance, economic performance, and environmental performance (Chowdhury et al., 2023). These three performances respectively constitute the development direction of the sustainable organizational performance of the enterprise. In other words, if a company wants to achieve a sustainable development perspective, these factors need to be considered. This project will start with the content of environmental transformational leadership and green knowledge management to study the influencing factors of environmental performance of SOP. The following will expand on some basic theoretical knowledge to describe SOP. Figure 2 shows the sustainability of organization theory framework.

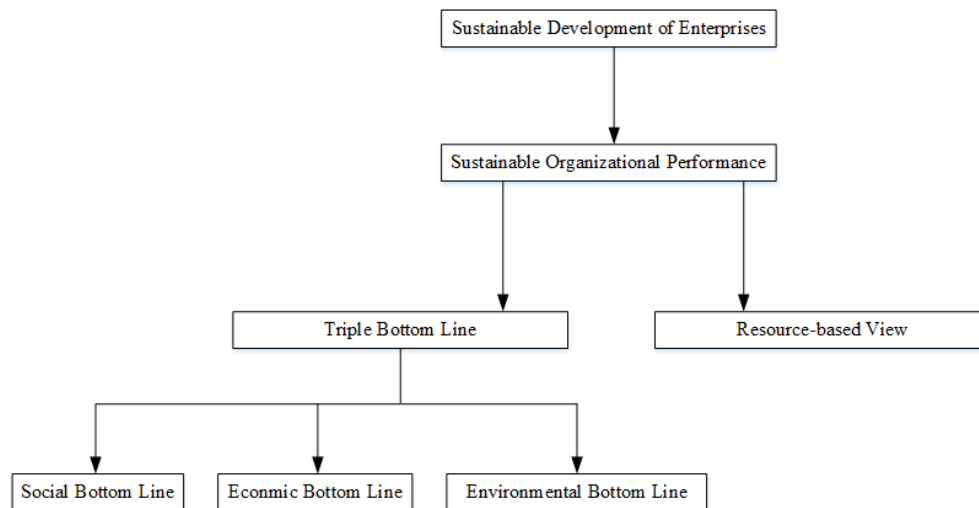


Figure 2: The sustainable development of enterprises theory framework.

Triple Bottom Line Theory

The concept of the triple bottom line (TBL) encompasses a sophisticated accounting framework that incorporates three fundamental dimensions: social, economic, and environmental. Numerous organizations have wholeheartedly embraced the TBL framework as a means to comprehensively evaluate their performance, with the ultimate goal of enriching their business value (Hammer & Pivo, 2017). Business writer Elkington (1998, 2018) claims to have coined the term in 1994. The content of TBL is defined around three factors: society, economy, and environment. Nowadays, enterprise management cannot achieve sustainable development strategies without the influence of these three factors.

Resource-based View Theory

The resource-based view (RBV) is a management framework utilized to identify the enterprise resources that a company can leverage in order to gain sustainable competitiveness. Barney's (1991) article, "Enterprise Information and Sustained Competitive Advantage," is widely acknowledged as a seminal work in the development of the RBV. The RBV focuses management's attention on the internal resources of the company, with the aim of identifying properties, abilities, and responsibilities that have the potential to yield sustainable competitive advantage. During the 1990s, the RBV of enterprises, according to the resource advantage theory, emerged as the predominant paradigm in strategic planning. Compare with the degree, RBV posited that sustainability development is derived from the development of enhanced capabilities and resources (Bromiley & Rau, 2016). Scholars in the field of strategic human resource management have adopted this perspective, positing that high-commitment human resource strategies cultivate rare and valuable employee resources at the organizational level, thereby contributing to the enterprise's competitive advantage (Collins, 2021). Barney (1991) asserted that in order for resources to possess the potential to serve as sources of sustainability, they need to find research able value, and not sustainable. These criteria are now commonly referred to as the VRIN criteria.

Environmental Transformational Leadership

Environmental transformational leadership (ETL) has been recognized as the most appropriate leadership style to influence employee autonomy motivation and improve PEB, so there are calls to cultivate or improve leaders' ETL capabilities (Gurmani et al., 2021).

Green Knowledge Management

Green Knowledge Management (GKM) entails the methodical generation, dissemination, utilize and apply knowledge and information pertaining to environmental sustainability in practical implementation. This organization's goal is to advocate for more sustainable practices and reduce the environmental effect of human activities (Yu et al., 2022).

Green Innovation

Green innovation (GI) encompasses all forms of innovation aimed at reducing environmental affect and optimizing the utilization of green resources. This practice not only enhances a company's competitive edge, but also improves its economic and environmental performance (Zhao et al., 2021).

The Dimension of Green Innovation

In previous studies, green innovation often influenced various variables through different dimensions as factors. Therefore, this section will introduce several green innovation dimensions related to SOP.

Green Process Innovation(GPI): GPI involves implementing strategies to minimize waste generated during the production process (Bhatia, 2021; Khan et al., 2021).

Green Knowledge Innovation(GKI):GKI encompasses the methodical advancement, distribution, and implementation of knowledge and information pertaining to environmental sustainability. Its aim to develop more sustainable activities and reduce the affect of human activity on the environment (Yin & Yu, 2022).

Green Management Innovation(GMI): GMI is a consist of environmentally conscious business management that committed to reduction pollution, waste, and emissions. It emphasizes the proactive approach to environmental sustainability and focus on reducing the adverse environmental affect of business activities (Narueharadhol et al., 2021).

Research Framework

The theoretical framework of this article is outlined on the basis of the above theoretical and empirical reviews. The theoretical review explains the importance and components of sustainable organizational performance based on its theoretical basis. The empirical section explains the empirical results of previous studies related to different methods. Therefore, the basic structure of the relationship between the antecedents variable and the consequences variable is presented in the form of a box and arrow diagram in Figure 3.

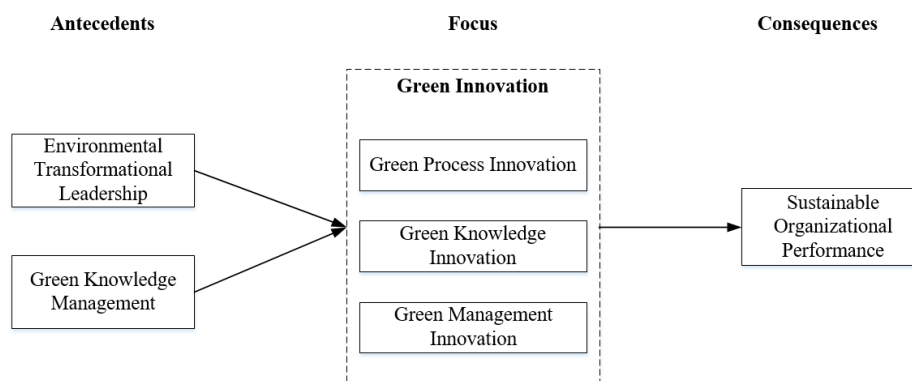


Figure 3: Research Framework

The dependent variable in Figure 3 is the sustainable organizational variable, which is summarized based on the main factors of the TBL theory and RBV theory. According to the literature description, it can be found that the three bottom lines in TBL theory correspond to the three sustainable performance of sustainable development, among which the results of environmental performance are particularly important for the environmental development of today's society. The resource theory is the basis for limiting the utilization of resources by enterprises while paying attention to their sustainability. This means that enterprises cannot ignore the reasonable allocation of resources solely for their own development. Refusing excessive exploitation is an important basis for environmental protection today.

ETL and GKM were selected as antecedents based on their impact on the environment. These two variables have a significant impact on SOP, respectively. The inclusion of green innovation factors is because they do have a impact on SOP as consequences variables. However, in order for enterprises to maintain a green development perspective, green innovation needs to be added as a focus factor, which can drive enterprises to continuously update green environment measures.

Proposition Development

Based on the literature review and the proposed framework, seven main propositions are proposed to state the relationships between the studied variables. Literature support will be reviewed to justify the propositions. The following propositions are proposed to reflect and answer the purpose of this study.

1) ETL and GI

Elshaer et al. (2022) studied the association between transformational environmental leadership (ETL), environmental organizational citizenship behavior (OCBE), and green innovation (GI). The results indicate that ETL has a beneficial effect on OCBE. Furthermore, it was discovered that OCBE acts as a mediator between ETL and GI.

Perez et al. (2023) proposed a model to demonstrate the relationship between green transformational leadership style (GTFL) and GHRM on organizational environmental performance (EP). Based on the literature, three sets of hypotheses were proposed to frame the following propositions.

P1(a): Environmental transformational leadership influences green process innovation.

P1(b): Environmental transformational leadership influences green management innovation.

P1(c): Environmental transformational leadership influences green technology innovation.

2) GKM and GI

Sahoo et al. (2023) asserts that the implementation of GKM and green technology innovation practices can enhance corporate environmental performance. Furthermore, empirical evidence from experiments indicates a positive correlation between green knowledge management and green innovation.

The goal of Bhattarai (2023) is to investigate the connection between green innovation, green knowledge management, and green innovation culture. The results show that green innovation and green innovation culture are positively impacted by green knowledge management.

Therefore, it can be inferred that green knowledge management plays a critical role in determining the success of both green innovation and green innovation culture. Building on these findings, three sets of propositions are put forward in this section.

P2(a): GKM influences green process innovation.

P2(b): GKM influences green management innovation.

P2(c): GKM influences green technology innovation.

3) GI and SOP

Asadi et al. (2020) has identified an significant trend in recognizing the value of green innovation to organizational sustainability research. Küçükoğlu et al. (2015) investigated the affect of green innovation on the performance of environmentally sensitive companies. The research conclusion shows that green innovation activities have a significant impact on corporate environmental performance and competitive advantage.

These years, there has been a limited of paper on the interplay between green supply chains, green innovation, environmental performance, and competitive. Therefore, Imran et al. (2021) Establish a comprehensive pathway model to guarantee the achievement of SOP. And this article explores the impact of green innovation on sustainable performance and finds that green innovation has a positive correlation with sustainable organizational performance. Wang et al. (2023) are concerned about the organizational capacity to achieve sustainable development goals. In this regard, the relationship between green innovation (especially green technology and management innovation) and sustainable organizational performance was studied. In addition, research was conducted on whether green knowledge management can enhance the

ability to innovate green and achieve sustainable development goals. Based on the survey results, it is evident that green knowledge management has enhanced organizational capabilities in research objective. Furthermore, green innovation has been identified as a significant positive predictor of sustainable development for enterprises. In this section, we will provide three hypotheses, the following hypotheses were framed.

P3(a): Green process innovation impacts sustainable organizational performance.

P3(b): Green knowledge innovation influences sustainable organizational performance.

P3(c): Green management innovation influences sustainable organizational performance.

Methods

This study adopted the research design of quantitative survey method (Sekaran & Bougie, 2016). A cross-sectional design was used for one-time data collection, and different statistical tests were used for hypothesis testing. The purpose of this study is to determine the positive impact of GHRM, organizational citizenship environmental behavior, and corporate environmental responsibility on sustainable organizational performance. Structural tools are used to examine frameworks and assumptions. The scale utilized in this study comprises dimensions and items pertaining to GHRM and OCBE, corporate environmental responsibility, leadership for environmental change, green innovation, and sustainable organizational performance.

In the context of this study, population refers to the logistics industry in China. The reason for investigating the logistics industry is because self-evident that the development of the logistics industry promotes economic growth, but its impact on the ecological environment is uncertain. Therefore, it is worthwhile to investigate whether the development of the logistics industry can ultimately facilitate the coordinated advancement of economic growth and the ecological environment. According to data from the National Statistical Office, the energy consumption of transportation, warehousing, and postal services increased from approximately 297 million tons of standard coal in 2011 to about 436 million tons of standard coal in 2018, and its proportion in my country's total energy consumption also increased from 7.7% to 9.2%. It is expected that during the "14th Five-Year Plan" period, it will continue to demonstrate a rapid

upward trend. The greening of the logistics industry is becoming increasingly significant in the national green development agenda. This research focuses on the A-level logistics business. Based on the classification and evaluation indicators of logistics enterprises, the assessment of A-level logistics enterprises is primarily categorized into three types: transportation type, warehousing type, and comprehensive service type. According to their respective evaluation index systems, they aim at the company's operating conditions, assets, equipment and facilities, management and services, personnel quality, and informatization level. Comprehensive evaluation and certification of logistics enterprises is conducted in accordance with normative and standard procedures, encompassing six aspects, sixteen to eighteen indicators and projects. Therefore, only those participants who understand corporate environmental responsibility, green activities and sustainable performance will be contacted.

In order to provide reasonable sample data, G*Power software is a commonly used analytical program for calculating sample size in social science research (Cohen, 1992). According to the calculations of G*power 3.1.9.4, it was determined that a minimum sample size exceeding 382 respondents is required with the settings proposed by Cohen (1992) $f^2 = 0.2$ (effect size), $\alpha = 0.01$ (error type one), $\beta = 0.05$ (error type two). An online questionnaire was developed to investigate the research hypotheses, with items derived from available literature and subsequently modified according to study conditions.

Discussion and Conclusion

This study contributes to the existing literature on green innovation by investigating the factors leading to and outcomes of green innovation. It also enhances our understanding of the influence of sustainable organizational performance on firm development. This article explores the causal relationship between sustainable organizational performance and green innovation, with a focus on logistics companies and their demands for sustainable development.

The research primarily examines the elements influencing the sustainable organizational performance and green innovation within China's logistics industry. It aims to establish a new relationship model for the industry's sustainable development, while also providing guidance for future green initiatives. Subsequent research will focus on exploring the impact of additional variables on various dimensions of green innovation and seek to empirically validate the correlation between each variable.

Theoretical Implications

Academic research on the logistics industry has always been active, but existing research has certain deficiencies in depth and breadth. This article mainly discusses the causes and consequences of green innovation, both of which are deepening and enriching the research on sustainable organizational performance related to it, making up for the shortcomings of current research, and have important theoretical reference significance.

Practical and Social Implications

Current research on green innovation in the logistics industry has problems that are difficult to implement in practice, which has a negative impact on sustainable organizational performance. In response to this problem, we proposed methods for implementing green innovation and the antecedents that affect green innovation, which can effectively improve the negative impact of the inability to implement sustainable organizational performance caused by green innovation. In addition, on the basis of avoiding the drawbacks of existing research methods, our method can also help promote the sustainable development of the logistics industry. Therefore, the practical significance of this article is to provide more effective green innovation methods for sustainable organizational performance in the logistics industry, reduce the negative impact of

failure to implement sustainable organizational performance, and promote the sustainable development of the logistics industry.

Limitations and Suggestions for Future Research

Despite the many dedication of the current research, this study has certain limitations that deserve to be reported. This research was conducted in a logistics company, but the same model and theory can also be applied to the new energy vehicle industry or organizations that need to carry out green innovation.

It is suggested that in future research, the moderating role of green innovation among factors affecting sustainable organizational performance can be studied. In addition, other factors such as information technology and corporate environmental responsibility can also be studied as antecedents of green innovation to expand the body of knowledge and answer future research questions by using other relevant theories.

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