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RESEARCH ARTICLE

Supply chain optimization for environmental sustainability and economic growth

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Abstract
As the globe strives to solve severe environmental challenges, the concept of a low-carbon economy that prioritizes low energy use, little pollution, and sustainable development is gaining support. The supply chain management industry is not safe from the possibilities and threats posed by this new development. In light of the emerging norm, it is imperative that all supply chain links be economically and ecologically sustainable. For conventional businesses, ensuring environmental advantages and practicing the issue of equitably dividing supply network node profits is exacerbated by green supply chain management. This paper was prompted by the increasing need for information on green supply chain management (GSCM). GSCM is based on the idea of incorporating ecological considerations into traditional SCM practices. Therefore, GSCM is vital in shaping the cumulative environmental effect of businesses engaged in supply chain operations. To assess environmental sustainability requirements, we provide a best-worst method (BWM), a subset of China-based sectors in order to fill this void. The BWM was used to evaluate and quantify the impact of a variety of industrial operations and criteria on environmental quality. To make sure this approach is effective and reliable, we polled 34 experts for their input on which indications from our preliminary literature analysis would be most useful. This study's findings, supported by a sensitivity analysis, indicated stated "waste management" was the single most important indication for China-area businesses to achieve environmental sustainability. The results of this study provide industry managers, decision-makers, and practitioners with the information they need to choose areas of focus during the implementation phase that will have the most impact on promoting social sustainability in their organizational supply chain and moving toward sustainable growth.

Keywords Green supply chain management (GSCM) · Best-worst method (BWM) · Waste management · Sustainable growth

Introduction

Companies need to be more productive and adaptable as globalization and competition heat up. In addition to satisfying customers, businesses should adhere to stringent economic goals and practice sustainable operations (Samal 2019). Efficient SCs are critical for producing high-quality goods and delivering them on time; thus, the sustainable development of SCs is a crucial part of running any successful business (Dai et al. 2022). The amount of levels, resources, and services within a SC all contribute to the difficulty of maintaining its operations in a sustainable way (Pal and Yasar 2020). Multiple activities, sites, and facilities in various locations (including separate nations, regions, or even different areas of the globe) make up contemporary industrial firms, as stated in Kouhizadeh et al. (2021). To guarantee SCs' efficacy, competitiveness, sustainability, and expansion, the author contends that various SC activities, including as planning, collaboration and coordination, and response to consumer requests, must be taken into account (X. Lin et al. 2021). In tandem with the maturation of the market economy, new challenges have emerged in the green supply chain system (Q. K. Li et al. 2020). Optimizing green supply chain management (GSCM) has to pay greater attention to the concept of low carbon and environmental protection as it evolves because the supply chain network of the green economy has become

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an opportunity for companies to achieve rapid development). The environmental effects of suppliers and manufacturers are becoming more important to consumers as they seek to optimize green supply. In addition, people are seeking appropriate models in order to maintain harmony in their relationships and take into account a wider range of external elements (Yan et al. 2021). The vast majority of them propose green supply chain structures based on mathematical programming methods (H. Wu et al. 2022). The goals of green economics may be attained via studying business metrics that reflect environmental performance. Yu and Huo (2019) uses multi-objective analysis, supply chain structure analysis, supplier-manufacturer relationships, and the green supply chain's environmental value as analytical criteria to find the best possible solution (Y. Wang et al. 2023).

When properly implemented, GSCM ensures that the right item gets to the right customers at the right time in the right amount at the right price (Härting et al. 2020). Short-term GSCM objectives include reducing cycle time and inventory and increasing efficiency; long-term strategic objectives include increasing revenues through market share and customer delight, which consequently increase productivity (Huo et al. 2019). The SCM literature has long acknowledged the merits of SCM and its potential advantages. Supply chain cost savings may be seen in areas such as reduced inventory, improved forecasting, faster delivery times, shorter fulfillment cycles, and higher fill rates all quantifiable advantages of SCM (Ozdemir et al. 2022). Since buying expenses account for around 80% of a company's sales income, efficient SCM is essential small- and medium-sized company prosperity (Huang et al. 2021). Benefits of improved electronic trading include increased customer service and responsiveness, less risk, shortened product development cycle times, reduced inventory, and fewer redundant inter-organizational activities, all potential benefits of GSCM (Duong et al. 2022). Boonmee et al. (2021) discovered that using GSCM principles might result in improvements to inventory turnover, manufacturing lead times, adaptability, forecasting precision, cost savings, and resource planning precision (Z. Li et al., 2021b). Governments, businesses, and their supply chain partners are working together to decrease energy and pollution, reducing environmental risks and increasing public support as GSCM processes grow. Working together has the potential to increase everyone's environmental knowledge (Walker et al. 2020). Cost savings (through material conservation, lower energy consumption, and lower water use), improved brand reputation, and reduced environmental responsibility have all accrued to businesses that have adopted SCM methods (Saurabh and Dey 2021). Poor environmental performance may have serious consequences for the natural world and cost businesses money via reduced stock value. According to Fang et al. (2023), corporations whose actions are beneficial to the environment see their stock prices rise, whereas companies whose actions are damaging to the environment have their stock prices fall. Therefore, businesses that care about their impact on the environment may find it easier to get funding from ethical investors.

Supply chain greening seeks a happy medium between maximizing economic output and minimizing environmental impact. Businesses have made efforts to "green" their supply chains in order to address pressing environmental concerns like as resource depletion and pollution. This implies that they have formed supply chains for the acquisition of environmentally better products or the development of standardized approaches to waste minimization and operational efficiency. In the twenty-first century, logistics management faces a new and pressing challenge: how to green the supply chain. An important issue is how to get companies to care about the environment and really do something about it inside their supply chain operations. The inbound and outbound logistics activities of China's manufacturing firms are potential polluters; this article investigates the prevalence of GSCM methods across these firms, as well as the connection between environmental sustainability and economic development. Through its involvement in quality management and environmental management systems, the company gained insight into organizational and operational concerns (Gao et al. 2020). Because GSCM was supported by management, it gained consensus from all levels of staff and fostered cooperation across divisions (Gao et al. 2021). We demonstrate strong positive connections between environmental sustainability, economic development, and the adoption of GSCM practices after controlling for characteristics including legislation, marketing, supplier, cost constraints, industry levels of the relevant practice, and organizational size (Ding et al. 2023). Supply chain managers are under increasing pressure to enhance their company's economic and environmental performance, prompting them to investigate and adopt GSCM strategies (Chen et al. 2023). Operations management and the supply chain have benefited greatly from the environmental and social sustainability established by sustainable development. The following is the structure of this research: sections 2 ("Literature review"), 3 ("methodology"), 4 ("empirical results"), 5 ("policy implications"), and 6 ("implications for practice") present the study's findings and limitations, respectively; the "Literature review" section contains a literature review of studies green supply chain management, and the environment and sustainable development; the "Methodology" section describes variables and methodology; section 4 displays empirical results; the "Results and discussion" section displays discussion and conclusion; and the "Conclusion and policy recommendations" section concludes the study with policy implications and study limitations.

Literature reviews

To successfully manage the movement of goods, money, and information to suit the needs of a company, a supply chain (SC) connects diverse parties from the client to the supplier through production and service. Scientists have been arguing for sweeping reforms to the profit-driven manner SCs have traditionally been run. The growing dangers posed by global warming and climate change have boosted the importance of efforts to green SCs. Sustainability challenges in SCM have just lately received attention from academics (K. H. Wang et al. 2021); (Y. A. Abbas et al. 2022); (Inês et al. 2020); (Salahuddin et al. 2019); (Cao 2022); (Franco et al. 2021). The sustainable economic practices are those that meet today's demands without jeopardizing the ability of future generations to do the same. Liu and Dong (2021) recognize the importance of green and lean methods in ensuring a company's long-term viability. The implementation of these strategies along the SC paves the way for better economic, environmental, and social outcomes (Yahman and Setyagama 2022). Reducing reductions in cost and lead time improved process flow, fulfillment of customer expectations, and environmental improvement, and boosting staff morale and dedication are just some of the advantages of aligning lean with sustainability concepts, as reported by Gnangoin et al. (2023). Sustainability can be influenced by adopting green SC practices, as evidenced by Ford's decision to use; instead of using cardboard boxes, auto components may be sent in recyclable plastic containers, reducing transportation expenses by roughly a quarter (Gong 2022). In order for a business to endure, it must take care of more than just the bottom line, risks associated with its goods, its environmental waste, and the safety of its employees and the general public (Rehman et al. 2021). Zastempowski (2022) also take into account that the capacity to comprehend and control the economic, environmental, and social risks associated with SC is an integral part of SC sustainability. The operations area has been a focal point of severe concerns regarding environmental sustainability due to costs and SC disturbance (fragility), frequently including sustainable development that prioritizes people, earth, and profit. The development of business sustainability features an integrated framework which now includes resilience along with a focus on stakeholders, volunteers, and long-term performance view. Small- and medium-sized firms (SMEs) may find synergistic advantages that increase value production if they focus on resilience and sustainability. Thus, SC resilience is crucial to SC sustainability. These preceding reasons suggest that a sustainable SC may be developed by simultaneously deploying the lean, resilient, and green SCM paradigms. However, the literature reveals that the majority of studies have only examined one or two SCM paradigms at a time. Lean management and SC sustainability are discussed in a review in Elavarasan et al. (2020); resilient SCM and sustainability are developed in Lu et al. (2019) and Qader et al. (2022); and the intersection of green and sustainability in a SC setting is investigated in Economics and Academic (2021). The authors of a review article on the topic of SC sustainability definitions (Z. Wang and Tang 2020) note that resilience is seldom included in such documents. To meet the sustainability problem in SC, therefore, new integrative management techniques are required (Rehman et al. 2023). "Carrying products and services from suppliers, various manufacturers, and finally to customers using information flow, material flow, and monetary transactions in an environmentally friendly manner" is how the term "green supply chain" is defined (Malek and Desai 2020); (Vanhercke et al. 2021); (Abdur et al. 2022); (Tang 2022); (Bag et al. 2021);(Madni 2023) (H. Khan et al. 2023); (Kumar et al. 2021); (Gorjian et al. 2021); (D. Liu et al. 2021); (Xu et al. 2023); (Hou et al. 2019). When it comes to exports and economic development, the green supply chain—which is environmentally friendly—includes consumers, suppliers, purchases, warehouses, packing, production, and transportation, as well as the whole green design. Since exports depend on supply chain activities, there is a strong connection between the two. In particular, a green supply chain is increasingly vital to economic development because of the positive impact it has on the environment. Recent research shows a strong correlation between improvements in the supply chain and expansion of the economy, suggesting a novel strategy for fostering economic development (Hu et al. 2022).

A new kind of economic growth that takes into account sociological, ecological, and social factors (Dong et al. 2022) was inspired by studies in logistics and supply chain. A country's GDP may benefit from green supply chain management since it encourages exports. In this setting, items are exported to foreign organizations through an export exchanging organization. As part of the supply chain, these export swapping firms will manage export paperwork, logistics, and transportation. Therefore, in this procedure, supply chain management is directly tied to export logistics and transportation. Because of its positive impact on the environment, the green supply chain is also crucial. Green supply chain management was shown to significantly impact both competitiveness and economic performance in research conducted. Researchers have proposed a number of different strategies for implementing GSCM (F. Chien et al. 2021). They are also known as GSCM or activities by other researchers (Sun et al. 2021). Organizational operations, characteristics, and industry may all influence the GSCM methods. A business that opts to utilize green purchasing, green manufacturing and materials management, green distribution and marketing, and green reverse logistics are the four pillars of GSCM (F. S. Chien et al. 2022) (Fattorini and Regoli 2020). On the other side, they spoke about green logistics, which included green purchasing, green manufacturing, green distribution, and reverse logistics. Similarly, they presented GSCM's primary components, which they identified as "green procurement," "green manufacturing," "green operations," "reverse logistics," and "waste management," respectively. The global supply chain management (GSCM) will be investigated in this research within the categories of green buying and inbound logistics, green manufacturing, green materials management, green distribution/marketing, and reverse logistics (Khan, Hou, Irfan, Zakari and Le, 2021a, Khan, Yu and Sharif, 2021b, Li, Yang, Shi and Cai, 2023b, Li et al, 2021a, Li et al, 2023a, Li, Zhou and Huang, 2021b, Liang, Brunelli, Septian and Rezaei, 2020b).

According to the research that has been conducted, the strategic view and performance of SCM may be evaluated along a number of different dimensions. Some of these aspects include quality, services, speed, and the generation of value for end customers. In addition, utilizing these dimensions is the best way to try to grasp the business model and the solutions that can be implemented to deal with certain external environmental difficulties (Duignan et al. 2022). As a result, strategic supply chain management necessitates a pliable and adaptable strategy for reorganizing and revamping supply chain activities in response to external influences. To ensure that SCM is efficient and successful in dealing with environmental problems, several companies, like Procter & Gamble (P&G), have modified their supply chain processes (Cerný et al. 2021). Vasiliu and Dobrea made an effort by beginning SCM research which has been conducted on a number of different companies; however, the results have been ambiguous in explaining why integrated and included operations have a less sustainable effect. Vasiliu and Dobrea made an effort to research possible obstacles and problems associated with SCM in different types of businesses. The tiny sample size is another flaw in the study of Vasiliu and Dobrea which draws any firm conclusions (Alzubi and Akkerman 2022). Nonetheless, there are signs of both the strengths and challenges that supply chain management faces while trying to be more logical and strategic in the face of the ever-changing nature of the environment (Khurana et al. 2021). Strategic emphasis, processing standards, information technology support, measurements, and coordination are where the benefits and negatives (M. Abbas and Zaini 2021) reside. Strategic supply chain management has been shown to increase service levels; however, the same research indicated that it does not always succeed in reducing negative environmental impacts. Strategic SCM at SMEs is significantly influenced by factors other than SCM approaches (Jinru et al. 2021).Whether strategic SCM has a greater or lesser influence on social and environmental sustainability in developing, transitional, or established economies is unclear due to a lack of definitive research. Interestingly, it is clear that the lack of proper social sustainability suffers as a result of strategic supply chain management (Zhu et al. 2021; Pjanić 2019; Yusliza et al. 2019). Implications for societal sustainability of inadequate strategic supply chain management is mitigated by operational efficiency (L. Lin and Hong 2022).

Methodology

Table 1 shows that since the concept of green supply chain management's impact on environmental sustainability and economic growth in the China region from 2009 to 2022 is multi-criteria, a multi-criteria decision-making method (MCDM) could be used to evaluate the relative importance of the various criteria. We propose (but not limit ourselves to) as a resource for learning more about the various MCDM approaches already in use today. Sustainable supply chain management is only one example of an area where MCDM techniques have been put to use. Securing (2013) is a great resource for learning more about the latter. Because of its novelty and the special benefits, it offers for this article the "best worst method" (BWM) which was chosen for this research. In the following paragraphs, we will go into further details about the procedure.

Best worst method

To put it simply, BWM is a pairwise comparison-based approach designed for MCDM situations (Liang et al. 2020a). BWM offers two major benefits over other MCDM strategies: the fundamental justification for choosing BWM in this research is that compared to other MCDM methods, which use a full pairwise comparison matrix, BWM (i) uses less data for pairwise comparisons and (ii) yields more consistent results. Quite a few practical issues have benefited from this technique. For instance, Wu et al. (2019) have utilized BWM to figure out the optimal packaging arrangement for shipping cargo from distribution centers to airports. The strategy was also used to choose the most effective suppliers in another research by Moslem et al. (2020). With the goal of analyzing the identified risks, Munim et al. (2020) created a methodology for risk assessment in the context of business continuity management systems. Other areas where BWM has been put to use include assessing the efficacy of university-industry PhD projects, measuring the quality of scientific output, and making decisions about transportation modes, suppliers, and the quality of scientific research.

In an MCDM, or multi-criteria decision-making, situation, the BWM method compares two criteria against one another to establish relative importance. The five key phases in using BWM as a solution approach are as follows:

Step 1: Find vitally crucial factors to consider $\{c_1, c_2, \ldots, c_n\}$.

Step 2: Find the criteria that are the best (B) and the worst (W).

Table 1 Industrial applications of the best worst method (BWM)

Authors' contribution in a series	Authors' contribution in a series	Authors' contribution in a series
1.	The BWM was used by Rezaei et al. (2015) in a supplier development model to categorize suppliers.	The BWM was used by Rezaei et al. (2015) in a supplier development model to categorize suppliers.
2.	In 2016, Rezaei et al. utilized BWM to assess supplier selection procedures by comparing conventional and environmental metrics.	In 2016, Rezaei et al. utilized BWM to assess supplier selection procedures by comparing conventional and environmental metrics.
3.	Multi-optimal solutions were developed by Rezaei et al. (2016) using interval analysis and linear BWM.	Multi-optimal solutions were developed by Rezaei et al. (2016) using interval analysis and linear BWM.
4.	Salimi and Rezaei (2016) used BWM to combine academic and commercial endeavors and evaluate their effectiveness.	Salimi and Rezaei (2016) used BWM to combine academic and commercial endeavors and evaluate their effectiveness.
5.	Key performance metrics for chosen outstations were determined using BWM by (I. Khan et al., 2021a)	Key performance metrics for chosen outstations were determined using BWM by Rezaei et al.
6.	Using BWM, (Astawa et al. 2021) found social sustainability criteria and ranked their relevance in the industrial sector.	Using BWM, Ahmadi et al. (2017) found social sustainability criteria and ranked their relevance in the industrial sector.
7.	Using BWM, Zhou et al. (2022) investigated what criteria determined the viability of biomass conversion technologies in the Dutch market.	Using BWM, van de Kaa et al. (2017) investigated what criteria determined the viability of biomass conversion technologies in the Dutch market.
8.	Gupta (2018) used BWM to determine which airline provided the highest level of service.	Gupta (2018) used BWM to determine which airline provided the highest level of service.
9.	Nasir et al. (2022) used BWM to identify the external forces most and least significant to sustainable SCM in the oil and gas industries.	Used BWM to identify the most and least important external forces to sustainable SCM in the oil and gas industries
10.	The research and development activities of Dutch small and medium-sized businesses were evaluated by Salimi and Rezaei (2018) using BWM.	The research and development activities of Dutch small and medium-sized businesses were evaluated by Salimi and Rezaei (2018) using BWM.
11.	Alzubi and Akkerman (2022) used BWM to evaluate obstacles to implementing sector 4.0 in the Bangladeshi leather sector.	Moktadir et al. (2018) used BWM to evaluate obstacles to implementing sector 4.0 in the Bangladeshi leather sector.
12.	The optimal place to manufacture bioethanol was determined using BWM by Munim et al. (2020).	The optimal place to manufacture bioethanol was determined using BWM by Kheybari et al. (2019).

Step 3: Rate B's importance relative to the other criteria on a scale from 1 (not at all essential) to 9 (very important). The vector is what we get after this process $A_B = (a_{B1}, a_{B2}, \ldots, a_{Bj}, \ldots, a_{Bn})$, where a_{Bj} is the preference of B over criterion j.

Step 4: Use a scale from 1 to 9 to figure out how much weight other criteria carry in comparison to W. Vector

Aw = $(a_{1W}, a_{2W}, \ldots, a_{jW}, \ldots, a_{nW})$ is the output of this procedure, where a preference for criteria j over W is indicated by ajW

Step 5: Find the weight that's just right $\left(w_1^*, w_2^*, \ldots, w_n^*\right)$

The following optimization model is used to determine how much weight each criterion should be given:

such that

$$\min \backslash \max_{j} \left\{ |w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W| \right\} \tag{1}$$

$$\sum_{j=1}^{n} w_j = 1$$

$w_j \geq$ greatest absolute difference of 0 for every j, where the goal function minimizes $\{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$ for all j. The first model may be used to create the

Min ξ

Such that

$$|\, w_B - a_{Bj}w_j \,| \leq \xi, \text{for all} j \tag{2}$$

$$|\, w_j - a_{jW}w_W \,| \leq \xi, \text{for all} j \tag{3}$$

$$\sum_{j=1}^{n} w_j = 1 \tag{4}$$

$$w_j \geq 0, \text{for all} j$$

Each level of the criterion hierarchy represents a local weight, which is the output of model 2 at that level. In a criterion hierarchy, the global weight of a criterion is determined by multiplying the weights of the criteria that branch off of the trunk line by themselves. Model 2's goal function, denoted by the number, is the consistency ratio of pairwise comparisons; hence, this should be taken into account. Note that we used the program found at http://www.bestworstmethod.com to solve model 2.

Using a weighted sum function that takes into account the relative importance of each criterion, an aggregate score for each provider may be determined (Eq. 5)

$$V_i = \sum_j u_{ij} w_j \text{for all} i \tag{5}$$

Where *uij* represents supplier i's score on criteria. In this case, j is the BWM-estimated global mass for criterion j.

Using the BWM's aggregate weight, we establish the following definition for the weighted decision matrix Mn*m:

$$M_{n\times m} = \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_i \\ A_n \end{matrix} \begin{bmatrix} a_{11}w_1 & a_{12}w_2 & \ldots & a_{1j}w_j & a_{1m}w_m \\ a_{21}w_1 & a_{2j}w_2 & & a_{2j}w_j & a_{2m}w_m \\ & \vdots & \ddots & \vdots & \\ a_{i1}w_1 & a_{i2}w_2 & \ldots & a_{ij}w_j & a_{im}w_m \\ a_{n1}w_1 & a_{n2}w_2 & & a_{nj}w_j & a_{nm}w_m \end{bmatrix}, \tag{6}$$

where *aijwj* option i's score on criterion j (*aij*) multiplied by criterion j's global weight as defined by the BWM (*wj*). Matrix Mink's alternatives, A1 to An, may be seen as points in a space with dimensions the choice criterion. A cloud is formed by these coordinates, with its center at the coordinates' origin. For MCDM problems with more than three criteria, options are analyzed by projecting them onto a plane in all m dimension relationship between the alternatives and the criteria. The concept of GAIA was proposed to map out the available options from a higher-dimensional realm onto a flat surface (Sahebi et al. 2020). In two criteria that have the highest data dispersion, a PCA is built from the algebraic matrix (i.e., covariance-variance matrix, eigenvalue, and eigenvector), and the round them are selected as coordinate axes to project the information of a decision matrix onto a new plane.

Step 6: Covariance matrix computation

By calculating the covariance matrix (Cnn), we can see how the decision matrix's many options are connected to one another. Keep in mind that the covariance matrix Cnn contains the covariance information for all possible pairings of the initial options.

$$C_{n\times n} = \begin{bmatrix} Cov(A_1,A_1) & Cov(A_1,A_2) & \ldots & Cov(A_1,A_i) & Cov(A_1,A_n) \\ Cov(A_2,A_1) & Cov(A_2,A_2) & & Cov(A_2,A_i) & Cov(A_2,A_n) \\ & \vdots\vdots & \ddots & \vdots\vdots & \\ Cov(A_i,A_1) & Cov(A_i,A_2) & \ldots & Cov(A_i,A_i) & Cov(A_i,A_n) \\ Cov(A_n,A_1) & Cov(A_n,A_2) & & C\,ov(A_n,A_i) & Cov(A_n,A_n) \end{bmatrix} \tag{7}$$

Results and discussion

Due to its complex nature, assessing environmental performance is challenging. This makes it hard for decision-makers to tell which criteria are relative to one another. Jafar Rezaei put out the BWM method for MCDM in 2015. Basic multi attribute rating, analytical network process, analytical hierarchy process, and fuzzy preference programming methodology are some of the further MCDM methodologies. These strategies compute the relative importance of each criteria using the pairwise comparison approach to zero in on the most important one. MCDM approaches are utilized in the field of sustainable development, namely the multi-criteria multi-Period Outranking Method (MUPOM). The backdrop of uncertainty and the participation of stakeholders and experts are ignored, however. Wu and Song (2022) indicate that BWM methods may be utilized to improve the speed and accuracy with which multi-criteria issues are resolved. BWM is simpler, faster, and easier to construct than other MCDM approaches since it uses less comparison data and, hence, does not require entire pairwise comparison matrices. A two- or three-criterion comparison scheme with which BWM may provide a unique solution is described in. BWM may provide numerous optimum solutions for a system that lacks consistency. Researchers have started using BWM in practical settings because to its unique properties, as seen in Table 1.

From our first set of eight indicators (Table 1), we were able to narrow it down to the final set of eight (Table 2).

According to Table 3, the most important or best indication for ensuring supply networks' continued commitment to environmental sustainability 1, 3, 4, 7, 8, 12, 13, 14, 17, 19, 23, 26, 27, 29, 31, 32, and 33.

Selecting the best criterion preference over other criteria

Professionals were polled to determine how crucial each factor was to them on a scale from 1 to 9. For example, the vector comparison between the best criterion and the other criteria developed by expert 18 is shown in Table 4. And scaling of other criteria over the worst criterion by expert 18 (others-to-worst) seen in Table 5.

Selecting the other criteria preference over the worst criterion

The other criteria were to be rated higher by the experts than the criterion that was rated the lowest, on a scale from 1 to 9. Table 7 displays the scaling results for respondent number 18 out of the whole pool of 34.

MATLAB was then used to solve the BWM model. Table 6 displays expert 18's preferred allocation of importance to several sustainability indicators and goal functions.

Using Eq. (2), we used MATLAB to calculate the appropriate weights for each indicator in BWM models for the remaining experts. Table 7 shows the average (arithmetic mean) ideal weights obtained by averaging the indicators' weights as selected by 34 experts. This investigation demonstrated a very stable and efficient system, with L* values very near to zero across all simulations. As was previously said, Bangladesh's garment sector is a major economic driver. Chinese supply chains may benefit from greater environmental sustainability if the country's textile sector generated less trash. Many Chinese factories and tanneries create waste that is harmful to people and the environment. The next two most significant indicators were resource use (EC3) and reuse and recycling (EC7), each of which was given a weight of 0.1276%. For this reason, after the implementation of sustainable waste management systems, businesses should prioritize the reuse and recycling of their byproducts and surplus goods. By making the most of what we have, we can keep our planet habitable and our economy booming. Researchers in China discovered that ISO certification was the weakest indication supply chain environmental performance. This might be due to the fact that Chinese companies have little experience with ISO certification. Maintaining ISO criteria across the Chinese supply chain is difficult because of a lack of awareness on the part of vendors. But we think the top indicators offer the greatest promise for boosting China's environmental sustainability. Tabulated

Table 2 Selected environmental indicators for application purpose

Selected major metrics marks of recognition	Selected major metrics marks of recognition
Managing Waste in the EC1	Managing Waste in the EC1
Sustainable energy practicesEC2	Sustainable energy practicesEC2
Use of Amazon EC3 Resources	Use of Amazon EC3 Resources
EC4 Emissions of Carbon Dioxide and Carbon Monoxide	EC4 Emissions of Carbon Dioxide and Carbon Monoxide
Official EC5 ISO 14001 Accreditation	Official EC5 ISO 14001 Accreditation
EC6 Pollution of Land	EC6 Pollution of Land
To recycle and reuseEC7	To recycle and reuseEC7
The employment of poisonous substances (such as lead, arsenic, and toxic compounds) EC8	The employment of poisonous substances (such as lead, arsenic, and toxic compounds) EC8

Table 3 Best and worst criteria identified by experts

Measures of success experts' consensus on the optimal solution the worst option, according to the experts	Measures of success experts' consensus on the optimal solution the worst option, according to the experts	Measures of success experts' consensus on the optimal solution the worst option, according to the experts
The Control and Management of Waste (EC1) 1, 3, 4, 7, 8, 12, 13, 14, 17, 19, 23, 26, 27, 29, 31, 32, 33	The Control and Management of Waste (EC1) 1, 3, 4, 7, 8, 12, 13, 14, 17, 19, 23, 26, 27, 29, 31, 32, 33	-
Use of Renewable Energy (EC2) 6 1, 4, 6, 8, 9, 10, 15, 21, 25, 30	Use of Renewable Energy (EC2) 6 1, 4, 6, 8, 9, 10, 15, 21, 25, 30	Use of Renewable Energy (EC2) 6 1, 4, 6, 8, 9, 10, 15, 21, 25, 30
Utilization of Resources (EC3): 2, 5, 9, 7	Utilization of Resources (EC3): 2, 5, 9, 7	Utilization of Resources (EC3): 2, 5, 9, 7
Extent of carbon dioxide and carbon monoxide emissions (EC4) 34 32	Extent of carbon dioxide and carbon monoxide emissions (EC4) 34 32	Extent of carbon dioxide and carbon monoxide emissions (EC4) 34 32
25 EC5 for ISO 14001 certification 11 16 19 20 22 23 24 25 26 27 28 29 31 33 34	25 EC5 for ISO 14001 certification 11 16 19 20 22 23 24 25 26 27 28 29 31 33 34	25 EC5 for ISO 14001 certification 11 16 19 20 22 23 24 25 26 27 28 29 31 33 34
EC6-11-03 Land Pollution	EC6-11-03 Land Pollution	EC6-11-03 Land Pollution
Utilized items (6, 10, 15, 16, 18, 21, 22, 24, 30) must be recycled (EC7)	Utilized items (6, 10, 15, 16, 18, 21, 22, 24, 30) must be recycled (EC7)	-
Use of hazardous materials (lead, arsenic, and harmful chemicals) (EC8)	28	12, 14, 17

in Table 7, the combined weight of EC6 (land pollution) and EC8 (lead, arsenic, and toxic chemicals) is 0.0754. Both the carbon footprint (EC4) and the use of renewable energy (EC2) were given a weight of 0.0564, placing them in the fourth and fifth positions, respectively, among the most important indicators. Therefore, these indicators should be included into environmental management strategies, considering the priority placed carbon footprint was not as heavily considered as it should have been by governments and international organizations working to reduce carbon emissions. This is because there are not many heavy metal or chemical businesses in China, two largest sources of carbon pollution.

The rankings of the remaining variables were not substantially altered by the sensitivity analysis. Table 8 ranks sensitivity analysis iterations based on their impact on environmental sustainability metrics. In addition, both charts show the typical relative importance and order of the criteria. Table 7 shows that throughout the course of nine iterations of sensitivity testing, EC1's weight shifted from 0.1 to 0.9. Table 7 depicts the relative importance of the various indicators throughout the course of each run. Consequently, there was a major shift in how the other criteria were weighted when the priority indicator shifted. On the other hand, as shown in Table 7, there was little variation in the relative indicator rankings throughout the experiment. In Table 7, the outermost line represents the position of EC5 for a range of EC1 weights. At the 0.6 weight, when EC5 was ranked 6 and where all the other lines were equally significant, the line turned concave. Since the other weights shifted in tandem with the weight of EC1's shift, the trend in both sets of numbers is understandable, and see Table 8 ranking of environmental sustainability indicators during sensitivity analysis.

Research shows that GSCM and sustainability performance are intrinsically linked within the SCM framework. As was previously mentioned, the vast majority of research (C. Wang et al. 2020) (Mubarik et al. 2021) have shown a statistically significant correlation between the two variables in question. Involving suppliers in green product design and incorporating environmental principles into operations are two examples of unexplored areas. Taking this into account, this research proposes environmental cooperation as a buffer between green supply chain management methods and sustainability outcomes. It is anticipated that the existence of environmental cooperation would simplify the adoption of GSCM processes. Sustainable development and logistics are brought together in green supply chain management. Business strategy and conduct are also influenced by definition of sustainable development "the integration of economic, social, and environmental goals." Despite the fact that GSCM's purview is novel, the field's popularity has skyrocketed in recent years (Umar et al. 2022). It is widely acknowledged that GSCM is a transparent integration and attainment of social, environmental, and economic objectives via the methodical coordination of important inter-organizational

Table 4 Scaling of the best criterion over other criteria by expert 18 (best-to-others)

Most important criterion	EC1	EC2	EC3	EC4	EC5	EC6	EC7	EC8
Waste management (EC1)	1	5	9	6	3	5	3	7

Table 5 Scaling of other criteria over the worst criterion by expert 18 (others-to-worst)

Some Other Factor ISO 14001 accreditation (EC5) is a rather insignificant criterion.	Some Other Factor ISO 14001 accreditation (EC5) is a rather insignificant criterion.
EC1 9	EC1 9
EC2 4	EC2 4
EC3 7	EC3 7
EC4	1EC4 1
EC5 5	EC5 5
EC6 2	EC6 2
EC7 5	EC7 5
EC8 8	EC8 8

Table 6 Optimal weights of the criteria based on the scaling of expert 18

L* weight, a key indicator of weight	L* weight, a key indicator of weight	L* weight, a key indicator of weight
EC1 0.3671 0.0756	EC1 0.3671 0.0756	EC1 0.3671 0.0756
EC2 0.0845	EC2 0.0845	EC2 0.0845
EC3 0.2769	EC3 0.2769	EC3 0.2769
EC4 0.0658	EC4 0.0658	EC4 0.0658
EC5 0.0342	EC5 0.0342	EC5 0.0342
EC6 0.1566	EC6 0.1566	EC6 0.1566
EC7 0.0233	EC7 0.0233	EC7 0.0233
EC8 0.0765	EC8 0.0765	EC8 0.0765

business activities to enhance long-term economic performance. This study's findings, along with those from others, suggest that green supply chain activities focused on the outside world, such as green buying and reverse logistics, do not improve an organization's bottom line. This might mean that the projects' advantages will go to other parties rather than the company itself. In green buying, for instance, a company's attention is directed on the enhancement of its suppliers' environmental performance. Green materials and other inputs may help the company in the long run, but the initiative's immediate impact is on the suppliers. Khokhar et al. (2020) supports this view by showing that there is no correlation between PSR and cost savings. However, he does find a correlation between PSR and cost savings through the mediation of supplier performance. This suggests that the direct benefit of green purchasing reflects first on suppliers and then on firm performance.

Conclusion and policy recommendations

Expanding the supply of green buildings which are being implemented commercially and on a large scale is considered contingent upon the existence of a green supply

Table 7 Final optimal weights of the selected criteria

Optimal weight as a key indication	Optimal weight as a key indication
To dispose of garbage (EC1) = 0.3679	To dispose of garbage (EC1) = 0.3679
Energy conversion efficiency (EC2): 0.0564	Energy conversion efficiency (EC2): 0.0564
Utilization of Resources (EC3): 0.1276	Utilization of Resources (EC3): 0.1276
Emissions of carbon monoxide and carbon dioxide (EC4): 0.0854	Emissions of carbon monoxide and carbon dioxide (EC4): 0.0854
A certificate from ISO 14001 (EC5) 0.0356	A certificate from ISO 14001 (EC5) 0.0356
EC6: 0.0754 Land Pollution	EC6: 0.0754 Land Pollution
EC6: 0.0754 Land Pollution	EC6: 0.0754 Land Pollution
Exposure to poisonous substances (EC8) 0.0965 Lead, arsenic, and chemical abuse	Exposure to poisonous substances (EC8) 0.0965 Lead, arsenic, and chemical abuse
Ratio of consistencies, $L^* = 0.0643$	Ratio of consistencies, $L^* = 0.0643$

Table 8 Ranking of environmental sustainability indicators during sensitivity analysis

Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	Indicators of Health Nor- mal0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
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chain. The green building supply chain has the potential to provide environmental, social, and economic benefits that extend well beyond the walls of the actual green building. Competitive advantage and new economies of scale and economies of scale may be brought to the firm and the area via a more resource-efficient strategy, and a change in materials and technology (Chinese Commission). New employment, economic development, and a green, low-carbon economy may be fostered through acquiring the necessary new skills and instituting organizational transformation. Sustainable supply chain management in the construction industry not only lessens the strain on natural resources during building projects, but it also significantly lessens the overall environmental harm that is incurred throughout construction, constructing the fundamental model for green supply chain optimization. The supply chain model is predicated on either a single-objective producer who solely cares about profit and the environment, or a dual-objective manufacturer and retailer who both care about profit and the environment. We examine the relationship between the manufacturer's and retailer's level of environmental preference and GSCM's ideal decision-making process across all three models. The findings indicate the following:

(1)Manufacturing and retail businesses that prioritize environmental sustainability boost product greenness, company-wide environmental friendliness, and overall demand. The greenness and environmental friendliness of products have been on the rise as manufacturers and retailers have become more environmentally conscious. In fact, when both manufacturers and retailers prioritize eco-friendliness, product demand is at its highest. Obviously, aiming for environmental friendliness will greatly increase businesses' environmental protection levels and give them a leg up in the green consumer market

(2)The more the manufacturers' preference for environmental friendliness, the greater the retailer's profit and the lesser the manufacturer's profit when both are considered simultaneously. Manufacturers have a lower environmental preference and retailers have a higher preference when both profit and environmentally friendly goals are considered, while retailers have a higher preference and properly consider environmental objectives, which is beneficial to manufacturers' profits. Supply chain profits rise initially, but fall as manufacturers and consumers become more environmentally conscious. In other words, if businesses operate under the assumption that consumers have a preference for environmentally friendly options, then doing so will improve the green degree of products, boost supply chain profits, and create a win-win situation for both business profits and ecological sustainability. Investment in green environmental protection without considering the financial impact might be disastrous for businesses.

(3)Both wholesale and retail prices go up first as companies become more environmentally conscious, and then they go down when companies become equally concerned with profit and environmental friendliness. When businesses first start thinking about environmental goals, merchants and manufacturers alike may optimize profits by adopting a high-price approach that increases revenue per unit. However, when environmental preference is strong, the price of green research and development is high, and the whole supply chain adopts the price reduction strategy to support the growth in product demand, the overall optimization condition of "small profits but quick turnover" is realized. This research provided a framework for business leaders to implement environmentally responsible practices across their supply chains. There has been no research done on this subject in relation to Chinese supply networks. Our research helped business leaders choose which metrics need their attention first. The findings of this research have real-world applications, especially for China's manufacturing sector. In addition, the study's findings made it possible to rate sectors according to their supplier chain's effectiveness in promoting environmental sustainability. The current research provides a framework for selecting the most and least important criteria against which to evaluate this performance. China's garment, small manufacturing, production, and tannery sectors all contributed data to our investigation. This research is significant because it may help industrial managers in other developing nations think about how they may improve the environmental sustainability of their supply chains. Implications for industrial managers in other developing countries assessing the environmental sustainability of their supply networks are a key contribution of this study. The results of this research may be used in a number of different ways to aid decision-makers. Success in implementing environmental GSCM principles depends on a wide range of technical, policy, and strategic considerations. To encourage green transport and logistics, the government could provide rebates and tax breaks for cars with eco-friendly designs. Regulatory oversight and government initiatives encouraging environmentally responsible industrial expansion certification schemes that support and promote a sustainable agenda are the result of collaboration between the logistics industry and government regulatory bodies. To discourage non-green logistics activities, regulatory authorities should implement high taxes and import levies, and other financial penalties on polluting logistics systems. The government should provide low-interest loans to businesses interested in using renewable and environmentally friendly energy sources.

Research limitations and future directions

Although every attempt was made to get the study started in a thorough manner, it could always be done better. There are caveats to this research, just as there are to any other. The study's primary shortcoming is its exclusive emphasis on China; future research should expand its scope to include other emerging nations. Due to the cross-sectional nature of the study, participants were surveyed just once over the specified time period. In light of the possibility of variation or additional confirmation with the passage of time, future researchers should think about panel research that follows the same people throughout time to ensure consistent results delays. Therefore, this layout would provide more hard proof. In addition, in-depth interviews with industry leaders on panels would be useful. However, although the quantitative approach has provided some truth (with a focus on numerical depiction of connection), the qualitative approach would provide more nuanced nuances of the truth that is really valuable. That is to say, there is a good likelihood of uncovering previously unknown relationships between the research variables and qualitatively focused patterns and characteristics. However, this research may aid new sectors in establishing supply networks that minimize environmental impact. Superior environmental performance may provide a competitive edge in today's economy. As both consumers and governments place a greater emphasis on protecting the environment, the results of this study will be invaluable to researchers and business leaders alike.

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Author contribution Zhaoguang Liao: conceptualization; data curation; methodology; writing—original draft; data curation; visualization; supervision; editing; writing—review and editing; and software.

Data availability The data can be available on request

Declarations

Ethical approval and consent to participate The authors declare that they have no known competing financial interests or personal relationships that seem to affect the work reported in this article. We declare that we have no human participants, human data or human tissues.

Consent for publication N/A

Competing interests The authors declare no competing interests.

References

Abbas, M., & Zaini, A. (2021). Lecture Notes in Mechanical Engineering Proceedings of the 3rd International Conference on Separation Technology.

Abbas YA, Mehmood W, Lazim YY, Aman-Ullah A (2022) Sustainability reporting and corporate reputation of Malaysian IPO companies. Environ Sci Pollut Res 29(52):78726–78738. https://doi.org/10.1007/S11356-022-21320-9/TABLES/7

Abdur M, Zeeshan R, Farrukh F (2022) When would the dark clouds of financial inclusion be over , and the environment becomes clean ? The role of national governance. Environ Sci Pollut Res 0123456789. https://doi.org/10.1007/s11356-021-17683-0

Ahmadi HB, Kusi-Sarpong S, Rezaei J (2017) Assessing the social sustainability of supply chains using Best Worst Method. Resources, Conservation and Recycling 126:99–106

Alzubi E, Akkerman R (2022) Sustainable supply chain management practices in developing countries: an empirical study of Jordanian manufacturing companies. Clean Prod Lett 2:100005. https://doi.org/10.1016/J.CLPL.2022.100005

Astawa IP, Astara IWW, Mudana IG, Dwiatmadja C (2021) Managing sustainable microfinance institutions in the Covid-19 situation through revitalizing Balinese cultural identity. Quality - Access Success 22(184):131–137. https://doi.org/10.47750/qas/22.184.17

Bag S, Pretorius JHC, Gupta S, Dwivedi YK (2021) Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities. Technol Forecast Soc Chang 163:120420. https://doi.org/10.1016/j.techfore.2020.120420

Boonmee C, Arimura M, Kasemset C (2021) Post-disaster waste management with carbon tax policy consideration. Energy Rep 7:89–97. https://doi.org/10.1016/j.egyr.2021.05.077

Cao H (2022) Entrepreneurship education-infiltrated computer-aided instruction system for college Music Majors using convolutional neural network. Front Psychol 13. https://doi.org/10.3389/FPSYG.2022.900195

Cerný M, Gogola M, Kubalák S, Ondruš J (2021) Blockchain technology as a new driver in supply chain. Transp Res Procedia 55(2019):299–306. https://doi.org/10.1016/j.trpro.2021.06.034

Chen W, Wang B, Chen Y, Zhang J, Xiao Y (2023) New exploration of creativity: cross-validation analysis of the factors influencing multiteam digital creativity in the transition phase. Front Psychol 14:1102085. https://doi.org/10.3389/FPSYG.2023.1102085/BIBTEX

Chien F, Ajaz T, Andlib Z, Chau KY, Ahmad P, Sharif A (2021) The role of technology innovation, renewable energy and globalization in reducing environmental degradation in Pakistan: a step towards sustainable environment. Renew Energy 177:308–317. https://doi.org/10.1016/J.RENENE.2021.05.101

Chien FS, Hsu CC, Andlib Z, Shah MI, Ajaz T, Genie MG (2022) The role of solar energy and eco-innovation in reducing environmental degradation in China: evidence from QARDL approach. Integr Environ Assess Manag 18(2):555–571. https://doi.org/10.1002/IEAM.4500

Dai Z, Ma Z, Zhang X, Chen J, Ershadnia R, Luan X, Soltanian MR (2022) An integrated experimental design framework for optimizing solute transport monitoring locations in heterogeneous sedimentary media. J Hydrol 614:128541. https://doi.org/10.1016/J.JHYDROL.2022.128541

Ding K, Choo WC, Ng KY, Zhang Q (2023) Exploring changes in guest preferences for Airbnb accommodation with different levels of sharing and prices: using structural topic model. Front Psychol 14:1120845. https://doi.org/10.3389/FPSYG.2023.1120845/BIBTEX

Dong G, Kokko A, Zhou H (2022) Innovation and export performance of emerging market enterprises: the roles of state and foreign ownership in China. Int Bus Rev 31(6):102025. https://doi.org/10.1016/J.IBUSREV.2022.102025

Duignan MB, Everett S, Mccabe S (2022) Annals of Tourism Research Events as catalysts for communal resistance to overtourism. Ann Tour Res 96:103438. https://doi.org/10.1016/j.annals.2022.103438

Duong, A. T. B., Vo, V. X., do Sameiro Carvalho, M., Sampaio, P., & Truong, H. Q. (2022). Risks and supply chain performance: globalization and COVID-19 perspectives. International Journal of Productivity and Performance Management, ahead-of-p(ahead-of-print). https://doi.org/10.1108/IJPPM-03-2021-0179

Economics, I., & Academic, B. (2021). Rsep conferences (Issue May).

Elavarasan RM, Shafiullah G, Padmanaban S, Kumar NM, Annam A, Vetrichelvan AM, Mihet-Popa L, Holm-Nielsen JB (2020) A comprehensive review on renewable energy development, challenges, and policies of leading Indian states with an International Perspective. IEEE Access 8:74432–74457. https://doi.org/10.1109/ACCESS.2020.2988011

Fang YK, Wang HC, Fang PH, Liang B, Zheng K, Sun Q, Li XQ, Zeng R, Wang AJ (2023) Life cycle assessment of integrated bioelectrochemical-constructed wetland system: environmental sustainability and economic feasibility evaluation. Resour Conserv Recycl 189:106740. https://doi.org/10.1016/J.RESCONREC.2022.106740

Fattorini D, Regoli F (2020) Role of the chronic air pollution levels in the Covid-19 outbreak risk in Italy. In: Environmental Pollution, vol 264, Elsevier Ltd. https://doi.org/10.1016/j.envpol.2020.114732

Franco MAJQ, Pawar P, Wu X (2021) Green building policies in cities: a comparative assessment and analysis. Energ Buildings 231:110561. https://doi.org/10.1016/j.enbuild.2020.110561

Gao H, Hsu PH, Li K, Zhang J (2020) The real effect of smoking bans: evidence from corporate innovation. J Financ Quant Anal 55(2):387–427. https://doi.org/10.1017/S0022109018001564

Gao H, Shi D, Zhao B (2021) Does good luck make people overconfident? Evidence from a natural experiment in the stock market. J Corp Finan 68:101933. https://doi.org/10.1016/j.jcorpfin.2021.101933

Gnangoin TY, Kassi DF, Kongrong OY (2023) Urbanization and CO2 emissions in Belt and Road Initiative economies: analyzing the mitigating effect of human capital in Asian countries. Environ Sci Pollut Res 30(17):50376–50391. https://doi.org/10.1007/S11356-023-25848-2/TABLES/8

Gong W (2022) Organizational design: an overview and a primer research for those of PPPs in the developing countries. J Chin Hum Resour Manag 13(2):65–75. https://doi.org/10.47297/WSPCHRMWSP2040-800506.20221302//INIT.JS

Gorjian S, Sharon H, Ebadi H, Kant K, Bontempo F, Marco G (2021) Recent technical advancements , economics and environmental impacts of fl oating photovoltaic solar energy conversion systems. J Clean Prod 278:124285. https://doi.org/10.1016/j.jclepro.2020.124285

Gupta H (2018) Assessing organizations performance on the basis of GHRM practices using BWM and Fuzzy TOPSIS. Journal of environmental management 226:201–216

Härting R-C, Sprengel A, Wottle K, Rettenmaier J (2020) Potentials of blockchain technologies in supply chain management - a conceptual model. Procedia Comput Sci 176:1950–1959. https://doi.org/10.1016/j.procs.2020.09.334

Hou Y, Iqbal W, Shaikh GM, Iqbal N, Solangi YA, Fatima A (2019) Measuring energy efficiency and environmental performance: a case of South Asia. Processes 7(6):325. https://doi.org/10.3390/pr7060325

Hu F, Qiu L, Zhou H (2022) Medical device product innovation choices in Asia: an empirical analysis based on product space. Front Public Health 10:893. https://doi.org/10.3389/FPUBH.2022.871575/BIBTEX

Huang X, Huang S, Shui A (2021) Government spending and intergenerational income mobility: evidence from China. J Econ Behav Organ 191:387–414. https://doi.org/10.1016/J.JEBO.2021.09.005

Huo B, Gu M, Wang Z (2019) Green or lean? A supply chain approach to sustainable performance. J Clean Prod 216:152–166. https://doi.org/10.1016/j.jclepro.2019.01.141

Inês C, Guilherme PL, Esther MG, Swantje G, Stephen H, Lars H (2020) Regulatory challenges and opportunities for collective renewable energy prosumers in the EU. Energy Policy 138:111212. https://doi.org/10.1016/j.enpol.2019.111212

Jinru L, Changbiao Z, Ahmad B, Irfan M, Nazir R (2021) How do green financing and green logistics affect the circular economy in the pandemic situation: key mediating role of sustainable production. Econ Res-Ekonomska Istrazivanja. https://doi.org/10.1080/1331677X.2021.2004437

Khan H, Weili L, Khan I (2023) The effect of political stability, carbon dioxide emission and economic growth on income inequality: evidence from developing, high income and Belt Road initiative countries. Environ Sci Pollut Res 30(3):6758–6785. https://doi.org/10.1007/S11356-022-22675-9/TABLES/13

Khan I, Hou F, Irfan M, Zakari A, Le HP (2021a) Does energy trilemma a driver of economic growth? The roles of energy use, population growth, and financial development. Renew Sustain Energy Rev 146. https://doi.org/10.1016/j.rser.2021.111157

Khan SAR, Yu Z, Sharif A (2021b) No silver bullet for de-carbonization: preparing for tomorrow, today. Resour Policy 71:101942. https://doi.org/10.1016/j.resourpol.2020.101942

Kheybari S, Kazemi M, Rezaei J (2019) Bioethanol facility location selection using best-worst method. Applied energy 242:612–623

Khokhar M, Iqbal W, Hou Y, Abbas M, Fatima A (2020) Assessing supply chain performance from the perspective of Pakistan's manufacturing industry through social sustainability. Processes 8(9):1064

Khurana S, Haleem A, Luthra S, Mannan B (2021) Evaluating critical factors to implement sustainable oriented innovation practices: an analysis of micro, small, and medium manufacturing enterprises. J Clean Prod 285:125377. https://doi.org/10.1016/j.jclepro.2020.125377

Kouhizadeh M, Saberi S, Sarkis J (2021) Blockchain technology and the sustainable supply chain: theoretically exploring adoption barriers. Int J Prod Econ 231:107831. https://doi.org/10.1016/j.ijpe.2020.107831

Kumar S, Raut RD, Nayal K, Kraus S, Yadav VS, Narkhede BE (2021) To identify industry 4.0 and circular economy adoption barriers in the agriculture supply chain by using ISM-ANP. J Clean Prod 293:126023. https://doi.org/10.1016/j.jclepro.2021.126023

Li J, Yang X, Shi V, Cai G (2023b) Partial centralization in a durable-good supply chain. Prod Oper Manag. https://doi.org/10.1111/POMS.14006

Li QK, Lin H, Tan X, Du S (2020) H∞consensus for multiagent-based supply chain systems under switching topology and uncertain demands. IEEE Trans Syst, Man Cyber: Syst 50(12):4905–4918. https://doi.org/10.1109/TSMC.2018.2884510

Li W, Shi Y, Zhu D, Wang W, Liu H, Li J, Shi N, Ma L, Fu S (2021a) Fine root biomass and morphology in a temperate forest are influenced more by the nitrogen treatment approach than the rate. Ecol Indic 130:108031. https://doi.org/10.1016/J.ECOLIND.2021.108031

Li X, Wang F, Al-Razgan M, Mahrous Awwad E, Zilola Abduvaxitovna S, Li Z, Li J (2023a) Race to environmental sustainability: can structural change, economic expansion and natural resource consumption effect environmental sustainability? A novel dynamic ARDL simulations approach. Resour Policy 86:104044. https://doi.org/10.1016/J.RESOURPOL.2023.104044

Li Z, Zhou X, Huang S (2021b) Managing skill certification in online outsourcing platforms: a perspective of buyer-determined reverse auctions. Int J Prod Econ 238:108166. https://doi.org/10.1016/J.IJPE.2021.108166

Liang F, Brunelli M, Rezaei J (2020a) Consistency issues in the best worst method: measurements and thresholds. Omega (United Kingdom) 96:102175. https://doi.org/10.1016/j.omega.2019.102175

Liang F, Brunelli M, Septian K, Rezaei J (2020b) Belief-based best worst method. Int J Inf Technol Decis Mak. https://doi.org/10.1142/S0219622020500480

Lin L, Hong Y (2022) Developing a green bonds market: lessons from China. Eur Bus Organ Law Rev 23(1):143–185. https://doi.org/10.1007/S40804-021-00231-1

Lin X, Lu K, Hardison AK, Liu Z, Xu X, Gao D, Gong J, Gardner WS (2021) Membrane inlet mass spectrometry method (REOX/MIMS) to measure 15N-nitrate in isotope-enrichment

experiments. Ecol Indic 126:107639. https://doi.org/10.1016/J.ECOLIND.2021.107639
Liu D, Xie Y, Hafeez M, Usman A (2021) The trade - off between economic performance and environmental quality : does financial inclusion matter for emerging Asian economies ? Environ Sci Pollut Res. https://doi.org/10.1007/s11356-021-17755-1
Liu Y, Dong F (2021) How technological innovation impacts urban green economy efficiency in emerging economies: a case study of 278 Chinese cities. Resour Conserv Recycl 169(February):105534. https://doi.org/10.1016/j.resconrec.2021.105534
Lu H, Ma X, Ma M (2019) What happened and will happen in the energy sector under the impact of COVID-19 ? Review 2019:1–21
Madni GR (2023) Meditation for role of productive capacities and green investment on ecological footprint in BRI countries. Environ Sci Pollut Res 30(28):72308–72318. https://doi.org/10.1007/S11356-023-27478-0/TABLES/4
Malek J, Desai TN (2020) A systematic literature review to map literature focus of sustainable manufacturing. J Clean Prod 256:120345. https://doi.org/10.1016/j.jclepro.2020.120345
Moktadir MA, Ali SM, Rajesh R, Paul SK (2018) Modeling the interrelationships among barriers to sustainable supply chain management in leather industry. Journal of cleaner production 181:631–651
Moslem S, Campisi T, Szmelter-Jarosz A, Duleba S, Nahiduzzaman KM, Tesoriere G (2020) Best–worst method for modelling mobility choice after COVID-19: evidence from Italy. Sustainability 12(17):6824. https://doi.org/10.3390/su12176824
Mubarik MS, Kazmi SHA, Zaman SI (2021) Application of gray DEMATEL-ANP in green-strategic sourcing. Technol Soc 64:101524. https://doi.org/10.1016/j.techsoc.2020.101524
Munim ZH, Sornn-Friese H, Dushenko M (2020) Identifying the appropriate governance model for green port management: Applying Analytic Network Process and Best-Worst methods to ports in the Indian Ocean Rim. J Clean Prod 268:122156. https://doi.org/10.1016/j.jclepro.2020.122156
Nasir MH, Wen J, Nassani AA, Haffar M, Igharo AE, Musibau HO, Waqas M (2022) Energy security and energy poverty in emerging economies: a step towards sustainable energy efficiency. Front Energy Res 10:1–12. https://doi.org/10.3389/fenrg.2022.834614
Ozdemir D, Sharma M, Dhir A, Daim T (2022) Supply chain resilience during the COVID-19 pandemic. Technol Soc 68:101847. https://doi.org/10.1016/J.TECHSOC.2021.101847
Pal K, Yasar A-U-H (2020) Internet of things and blockchain technology in apparel manufacturing supply chain data management. Procedia Comput Sci 170:450–457. https://doi.org/10.1016/j.procs.2020.03.088
Pjanić, M. (2019). Economic effects of tourism on the world economy. SSRN Electronic Journal, ISSN 1556-5068, Elsevier BV, 291–305. 10.31410/tmt.2019.291
Qader AA, Zhang J, Ashraf SF, Syed N, Omhand K, Nazir M (2022) Capabilities and opportunities: linking knowledge management practices of textile-based SMEs on sustainable entrepreneurship and organizational performance in China. Sustainability 14(4):2219. https://doi.org/10.3390/SU14042219
Rehman SU, Elrehail H, Poulin M, Shamout MD, Alzoubi HM (2023) Green managerial practices and green performance: a serial mediation model. Int J Innov Stud 7(3):196–207. https://doi.org/10.1016/J.IJIS.2022.12.004
Rehman SU, Kraus S, Shah SA, Khanin D, Mahto RV (2021) Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. Technol Forecast Soc Chang 163:120481. https://doi.org/10.1016/J.TECHFORE.2020.120481
Rezaei J, Wang J, Tavasszy L (2015) Linking supplier development to supplier segmentation using Best Worst Method. Expert Systems with Applications 42(23):9152–9164
Rezaei J (2016) Best-worst multi-criteria decision-making method: Some properties and a linear model. Omega 64:126–130
Sahebi IG, Masoomi B, Ghorbani S (2020) Expert oriented approach for analyzing the blockchain adoption barriers in humanitarian supply chain. Technol Soc 63:101427. https://doi.org/10.1016/j.techsoc.2020.101427
Salahuddin M, Ali I, Sc M, Vink N, Gow J (2019) The effects of urbanization and globalization on CO 2 emissions : evidence from the Sub-Saharan Africa (SSA) countries. 2699–2709
Salimi N, Rezaei J (2016) Measuring efficiency of university-industry Ph. D. projects using best worst method. Scientometrics 109:1911–1938
Salimi N, Rezaei J (2018) Evaluating firms' R&D performance using best worst method. Evaluation and program planning 66:147–155
Samal SK (2019) Logistics and supply chain management. International Journal of Psychosocial. Rehabilitation 23(6):361–366. https://doi.org/10.37200/IJPR/V23I6/PR190779
Saurabh S, Dey K (2021) Blockchain technology adoption, architecture, and sustainable agri-food supply chains. J Clean Prod 284:124731. https://doi.org/10.1016/j.jclepro.2020.124731
Sun Y, Yesilada F, Andlib Z, Ajaz T (2021) The role of eco-innovation and globalization towards carbon neutrality in the USA. J Environ Manage 299:113568. https://doi.org/10.1016/J.JENVMAN.2021.113568
Tang, X. (2022). innovation and sustainability w e i v re In w e i v re.
Umar M, Khan SAR, Yusoff Yusliza M, Ali S, Yu Z (2022) Industry 4.0 and green supply chain practices: an empirical study. Int J Product Perform Manag 71(3):814–832. https://doi.org/10.1108/IJPPM-12-2020-0633/FULL/XML
van de Kaa G, Kamp L, Rezaei J (2017) Selection of biomass thermochemical conversion technology in the Netherlands: A best worst method approach. Journal of Cleaner Production 166:32–39
Vanhercke, B., Ghailani, D., Sabato, S., & Koch, M. (2021). Social policy in the European Union: state of play 2018. Facing the pandemic.
Walker, A., Vermeulen, W., … A. S.-J. of C., & 2021, undefined (2020). Sustainability assessment in circular inter-firm networks: an integrated framework of industrial ecology and circular supply chain management approaches. Elsevier. https://doi.org/10.1016/j.jclepro.2020.125457
Wang C, Zhang Q, Zhang W (2020) Corporate social responsibility, green supply chain management and firm performance: the moderating role of big-data analytics capability. Res Transp Bus Manag 37:100557. https://doi.org/10.1016/j.rtbm.2020.100557
Wang KH, Su CW, Lobonţ OR, Umar M (2021) Whether crude oil dependence and CO2 emissions influence military expenditure in net oil importing countries? Energy Policy 153:112281. https://doi.org/10.1016/j.enpol.2021.112281
Wang Y, Han X, Jin S (2023) MAP based modeling method and performance study of a task offloading scheme with time-correlated traffic and VM repair in MEC systems. Wirel Netw 29(1):47–68. https://doi.org/10.1007/S11276-022-03099-2/METRICS
Wang Z, Tang K (2020) Reorientation of collective negotiation in Chinese enterprises amid an uncertain context. J Chin Hum Resour Manag 11(1):22–33. https://doi.org/10.47297/wspchrm
Wu D, Song W (2022) Does green finance and ICT matter for sustainable development: role of government expenditure and renewable energy investment. Environ Sci Pollut Res 30(13):36422–36438. https://doi.org/10.1007/S11356-022-24649-3
Wu H, Jin S, Yue W (2022) Pricing policy for a dynamic spectrum allocation scheme with batch requests and impatient packets in cognitive radio networks. J. Syst Sci Syst Eng 31(2):133–149. https://doi.org/10.1007/S11518-022-5521-0/METRICS
Wu Q, Zhou L, Chen Y, Chen H (2019) An integrated approach to green supplier selection based on the interval type-2 fuzzy best-worst and extended VIKOR methods. Inform Sci 502:394–417. https://doi.org/10.1016/j.ins.2019.06.049

Xu R, Wang Y, Sun Y, Wang H, Gao Y, Li S, Guo L, Gao L (2023) External sodium acetate improved Cr(VI) stabilization in a Cr-spiked soil during chemical-microbial reduction processes: insights into Cr(VI) reduction performance, microbial community and metabolic functions. Ecotoxicol Environ Saf 251:114566. https://doi.org/10.1016/J.ECOENV.2023.114566

Yahman Y, Setyagama A (2022) Government policy in regulating the environment for development of sustainable environment in Indonesia. Environ Dev Sustain 1–12. https://doi.org/10.1007/S10668-022-02591-1/METRICS

Yan L, Yin-He S, Qian Y, Zhi-Yu S, Chun-Zi W, Zi-Yun L (2021) Method of reaching consensus on probability of food safety based on the integration of finite credible data on block chain. IEEE Access 9:123764–123776. https://doi.org/10.1109/ACCESS.2021.3108178

Yu Y, Huo B (2019) The impact of environmental orientation on supplier green management and financial performance: the moderating role of relational capital. J Clean Prod 211:628–639. https://doi.org/10.1016/j.jclepro.2018.11.198

Yusliza MY, Norazmi NA, Jabbour CJC, Fernando Y, Fawehinmi O, Seles BMRP (2019) Top management commitment, corporate social responsibility and green human resource management: a Malaysian study. Benchmarking 26(6):2051–2078. https://doi.org/10.1108/BIJ-09-2018-0283

Zastempowski M (2022) What shapes innovation capability in micro-enterprises? New-to-the-market product and process perspective. J Open Innov: Technol, Market, Complexity 8(1):59. https://doi.org/10.3390/JOITMC8010059

Zhou Q, Du M, Ren S (2022) How government corruption and market segmentation affect green total factor energy efficiency in the post-COVID-19 era: evidence from China. Front Energy Res 10:878065. https://doi.org/10.3389/FENRG.2022.878065/BIBTEX

Zhu X, Liao J, Chen Y (2021) Time-varying effects of oil price shocks and economic policy uncertainty on the nonferrous metals industry : from the perspective of industrial security. Energy Econ 97:105192. https://doi.org/10.1016/j.eneco.2021.105192

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