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Supply Chain Sustainability: Influencing Factors and Empirical Study from a Marxist Political Economy Perspective

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Abstract: Marxist political economy provides a theoretical framework for sustainable supply chains, while the implementation of sustainable supply chains embodies and deepens the practical application of Marxist principles. This paper studies supply chain sustainability from the perspective of Marxist political economy, proposing a novel analytical framework to address sustainability challenges. The primary research focuses on (1) Identifying Influencing Factors: Influencing factors of Marxist political economy and supply chain sustainability are categorized into four main areas: society and government, environment, economy, and the supply chain itself. Through classification analysis, 16 key factors influencing sustainable supply chain implementation are identified. (2) DEMATEL Analysis (Decision-Making Trial and Evaluation Laboratory Method): Data are gathered through investigations and questionnaires to construct a direct influence matrix. Subsequently, a decision test method quantitatively analyzes the interactions among these factors, resulting in a comprehensive influence matrix and a cause–effect diagram. To enhance the overall benefits of supply chain sustainability and foster sustainable development.

Keywords: supply chain sustainability; Marxist political economy; influencing factors; DEMATEL analysis

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1. Introduction

The supply chain encompasses the entire process from the procurement of raw materials to the delivery of the final product to the consumer, which includes participants, activities, information, resources, and technology, spanning raw material procurement, manufacturing, warehousing, logistics, sales, and distribution [1]. The primary goal of the supply chain is to enhance efficiency and reduce costs by optimizing resource allocation, facilitating seamless connections, and ensuring collaborative operations among all links, which include suppliers, manufacturers, distributors, retailers, and consumers. Supply chain sustainability involves the comprehensive integration of economic, environmental, and social sustainability goals across all aspects of the supply chain. This ensures the long-term, healthy operation of the supply chain and its positive contributions to society [2]. Supply chain sustainability typically focuses on the following aspects:

1. Economic Sustainability: Ensuring the economic and cost-effectiveness of the supply chain, which includes maintaining competitiveness and profitability through resource optimization, improved production efficiency, and innovation capacity [3].
2. Environmental Sustainability: Reducing the negative environmental impacts of supply chain activities [4], which involves minimizing carbon emissions, conserving energy, reducing waste, protecting the ecological environment, and promoting green production.
3. Social Sustainability: Ensuring the rights and welfare of all participants in the supply chain, which includes worker protection, community development, health and safety, and social equity [5].

Key factors in achieving supply chain sustainability include green procurement, energy conservation, emission reduction, circular economy practices, supply chain transparency, accountability, and social responsibility [6]. Integrating sustainability concepts and practices into supply chain management helps companies achieve economic goals while mitigating negative environmental impacts and promoting social equity and progress. However, modern supply chains have become increasingly complex due to globalization, leading to environmental damage, social injustice, and weak sustainability [7]. Marxist political economy, founded by Karl Marx and Friedrich Engels, critiques the capitalist mode of production and its social relations. Its main areas of research include the labor theory of value, surplus value theory, capital accumulation and reproduction, class struggle, and the relationship between social and production relations [8].

This paper innovatively applies the perspective of Marxist political economy to the study of supply chain sustainability. The relationship between the two variables and the comparison is presented as follows: Marxist political economy emphasizes the value created by workers and the exploitation they face in the production process [9]. Supply chain sustainability focuses on working conditions, wages, and benefits of workers, promoting fair labor practices and anti-exploitation measures [10]. Marxism analyzes how capitalists extract surplus value by exploiting workers and reinvesting this surplus to achieve capital accumulation [11]. Supply chain sustainability examines how to fairly distribute profits within the supply chain, reduce exploitation, and achieve coordinated economic and social development [12]. Marxism studies resource concentration and capital accumulation in capitalist production, leading to economic inequality and periodic crises [13]. Supply chain sustainability advocates rational resource use and a circular economy to reduce waste and promote sustainable development [14]. Marxist theory highlights the struggle between the working class and capitalists, advocating for workers' autonomy and fair distribution [15]. Supply chain sustainability promotes transparency, accountability, and fair governance to protect the interests of all stakeholders, including workers, society, and the environment [16].

Supply chain studies approach sustainability from varied perspectives, such as environmental impact [17], social responsibility [18], or economic efficiency [19]. These studies often highlight the benefits of sustainability, such as cost savings through resource efficiency, improved brand reputation, and enhanced resilience against disruptions. However, these empirical findings are often context-specific, making it challenging to generalize results across different industries and regions. This fragmented approach limits the ability to develop comprehensive strategies that address all facets of sustainability simultaneously. Another significant gap is the insufficient connection between sustainable supply chain research and economic theory. While some studies have attempted to link sustainability with economic concepts like externalities and market failures, these efforts are often superficial [20]. There is a need for more rigorous analysis that explores how sustainable practices can be economically justified beyond the immediate financial benefits to individual companies.

In contrast, Marxist research has traditionally offered a critical perspective on economic systems, focusing on the exploitation of labor and the unequal distribution of wealth [21]. While this theoretical lens provides valuable insights into the power dynamics within supply chains, it often remains disconnected from the practical realities of modern economic development. A key limitation is that much of the Marxist literature does not adequately address the complex, globalized nature of today's supply chains, nor does it offer actionable strategies for integrating Marxist principles with sustainable practices.

However, Marxist research does offer the advantage of a strong theoretical foundation that challenges the status quo and questions the inherent inequalities in capitalist systems. This critical approach can be beneficial in rethinking the objectives of sustainable supply chains, particularly in terms of social equity and labor rights. To move forward, there is a need for research that bridges Marxist theory with the practicalities of sustainable

supply chains, potentially offering new pathways for achieving sustainability that are both economically viable and socially just.

The corresponding relationship is shown in Figure 1. By combining Marxist political economy and supply chain sustainability studies, this paper aims to provide a new theoretical framework and solutions for addressing the complex economic and social problems in modern supply chains. This approach seeks to promote a fairer, greener, and more sustainable global supply chain system. From the perspective of Marxist political economy, supply chain sustainability is not only a prerequisite for realizing economic benefits but also an important manifestation of the unity of production relations and productivity. Achieving supply chain sustainability requires a multifaceted effort, including sustainable development concepts, international cooperation, strengthened macro-control, technological innovation, and industrial policies. These align with Marxist principles of correcting market failures through state intervention and promoting the rational allocation of social resources. In conclusion, understanding and coordinating the relationship between supply chain sustainability and economic benefits can be achieved through the following points:

1. Interaction between Production Mode and Ecosystem: Addressing the contradiction between economic interests and supply chain sustainability by transforming production modes, reflecting Marxist contradictions between productive forces and production relations.
2. Equitable Distribution and Use of Resources: Ensuring equitable resource distribution and usage to prevent overexploitation and environmental damage, aligning with Marxist ideals of eliminating exploitation and achieving fairness.
3. Long-term and Common Interests: Adhering to principles of long-term and common interests, balancing individual economic interests with supply chain sustainability, and embodying the Marxist idea of common prosperity.

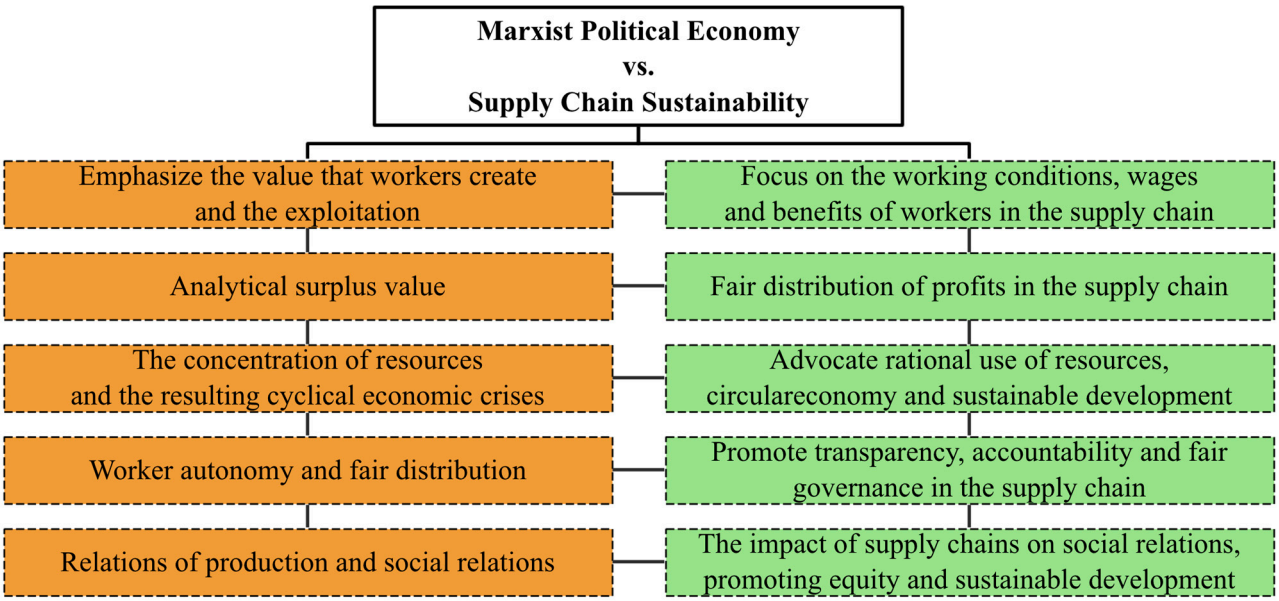

Figure 1. Marxist political economy and supply chain sustainability.

To achieve supply chain sustainability, it is essential to comprehensively utilize economic interests, policy tools, and technological innovation, guided by Marxist political economy, to explore suitable development paths and promote the coordinated development of economic interests and supply chain sustainability.

2. Theoretical Framework and Methods

This study identifies the influencing factors of Marxist political economy on sustainable supply chains through a literature analysis method, constructing an index system. The literature was searched on Google Scholar and PRISMA using "Marxist political economy" and "sustainable supply chain" as primary topics. Priority was given to high-quality journal papers and highly cited papers on these topics. By analyzing and refining the influencing factors based on scientific, representative, comprehensive, and practical principles, this study divides these factors into four primary categories: society and government, environment, economy, and the supply chain itself. These categories are further subdivided into 16 specific factors. These interrelated factors collectively influence the implementation of sustainable supply chains. Analyzing their relationships, identifying key factors, and applying them in sustainable supply chain management can effectively enhance overall benefits.

2.1. Social and Government Influencing Factors

1. Fairness of Resource Allocation (S1)

The fairness of resource allocation is crucial in a sustainable supply chain. Marxist political economy emphasizes fair resource distribution, contributing to the sustainable operation of the supply chain [22,23].

2. Protection of Labor Rights and Interests (S2)

Protecting labor rights is essential for sustainable development. Marxist political economy highlights labor interests, and implementing fair labor policies ensures the smooth progress of the supply chain [24,25].

3. Financial Support from the Government (S3)

Sustainable supply chains require significant financial support. Marxist political economy advocates government financial support, such as bonds and low-interest loans, to sustain supply chain operations [26,27].

4. Sound Laws and Regulations (S4)

Effective laws and regulations are vital for sustainable supply chains. According to Marxist political economy, governments should enact laws ensuring fair and sustainable resource use [28,29].

5. Effective Establishment of Contracts (S5)

Contracts bind the responsibilities and obligations within the supply chain. Marxist political economy stresses fair and rational contracts, which are essential for effective supply chain management [30,31].

6. Resource Conservation Awareness and Efforts (S6)

Rational resource utilization and conservation are keys to sustainability. Governments should promote policies and public awareness to enhance resource conservation efforts [32,33].

2.2. Environmental Factors

1. Resource Quality (S7)

Resource quality is critical for sustainable supply chains. Marxist political economy emphasizes sustainable resource use, necessitating continuous monitoring of resource quality to prevent pollution [34,35].

2. Environmental Pollution and Disasters (S8)

Environmental pollution can disrupt supply chains. Governments should establish robust emergency systems to prevent pollution and ensure sustainable resource use [36,37].

3. Ecological Balance (S9)

Supply chain operations may impact ecological balance. Governments should protect the environment and prevent ecological damage, aligning with Marxist principles [38,39].

2.3. Economic Factors

1. Ecological Compensation (S10)

Ecological compensation addresses environmental damage. Governments should implement policies to compensate for ecological damage, ensuring sustainability [40,41].

2. Financial Transfer (S11)

Financial transfers within the supply chain facilitate equitable resource distribution. Governments should ensure coordinated economic development through financial transfer mechanisms [42,43].

3. Green Development (S12)

Supply chains should embrace green development. Governments should promote green management systems and economic restructuring for sustainable development [44,45].

2.4. Supply Chain and Other Influencing Factors

1. Knowledge and Technology Level (S13)

High levels of knowledge and technology are essential for sustainable supply chains. Governments and enterprises should foster technological innovation to enhance supply chain efficiency [46,47].

2. Tightness between Node Members (S14)

Close cooperation among supply chain node members is vital for optimization. Governments should encourage effective communication and collaboration [48,49].

3. Guarantee Rate of Resource Quality and Time (S15)

Ensuring resource quality and timely delivery is crucial for efficient resource use and allocation [50,51].

4. Effective Incentive Mechanism (S16)

Providing effective incentives, such as financial rewards or tax rebates, encourages sustainable practices within supply chains [52,53].

By integrating the principles of Marxist political economy into the influencing factors of sustainable supply chains, a new index system is constructed. This provides a foundational basis for further research and the practical implementation of sustainable supply chain management.

3. DEMATEL Analysis

3.1. Implementation Steps of the DEMATEL Method

To analyze the key influencing factors of sustainable supply chain implementation through the lens of Marxist political economy, the DEMATEL method is employed. The specific steps are outlined below:

1. Identify the influencing factors: Identify the influencing factors of sustainable supply chains in Marxist political economy, as S1, S2, . . ., S16.
2. Describe the strength of influence: Describe the strength of influence of factor i on factor j, expressed by x_{ij}. The details are as follows:

$$x_{ij} = \begin{cases} 0,\ no\ effect \\ 1,\ a\ little\ effect \\ 2,\ some\ effect \\ 3,\ strong\ effect \end{cases},\ i = 1,2,\cdots,16,\ j = 1,2,\cdots 16 \tag{1}$$

3. Construct a direct influence matrix: Construct a direct influence matrix X according to the strength of the influence among various factors, as shown.

$$X = \begin{bmatrix} x_{1,1} & x_{1,2} & \cdots & x_{1,16} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,16} \\ \vdots & \vdots & \cdots & \vdots \\ x_{16,1} & x_{16,2} & \cdots & x_{16,16} \end{bmatrix} \tag{2}$$

4. Standardized direct influence matrix: normalized influence matrix Q is obtained. The specific steps are as follows:

$$Q = \frac{1}{d} \cdot X,\ d = \max_{1 \le i \le 16} \sum_{j=1}^{16} x_{ij} \tag{3}$$

5. To calculate the comprehensive influence matrix R, the formula is as follows:

$$R = Q(E - Q)^{-1} \tag{4}$$

where E is the identity matrix.

6. Calculate impact level G, impact level F, center level Z, and cause level M.

$$Z = G + F \tag{5}$$

$$M = G - F \tag{6}$$

3.2. DEMATEL Empirical Analysis of Marxist Political Economics

A total of 20 experts with a deep understanding of Marxist economics or sustainable supply chains were selected, including researchers and business managers. The survey was conducted over a period of two months in March and April 2024. The questionnaire design primarily consists of multiple-choice questions to facilitate quantitative analysis. The questionnaire data were organized and analyzed using Python. Through data collection through surveys, interviews, and questionnaires, the direct impact matrix of sustainable supply chain implementation in Marxist political economics is obtained. The construction of the direct impact matrix is shown in Table 1.

Table 1. The construction of the direct impact matrix.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
S1	0	3	2	2	2	1	2	2	1	1	2	2	2	1	1	2
S2	3	0	2	2	2	1	1	2	1	2	2	2	3	2	1	2
S3	2	2	0	3	2	1	2	2	2	1	3	2	3	1	2	2
S4	2	2	3	0	2	1	2	2	2	1	3	2	3	1	2	2
S5	2	2	2	2	0	2	1	2	1	2	2	2	2	3	2	2
S6	1	1	1	1	2	0	1	2	2	1	2	2	1	2	1	2
S7	2	1	2	2	1	1	0	3	2	2	2	2	3	2	2	2
S8	2	2	2	2	2	2	3	0	3	2	2	2	3	2	2	3
S9	1	1	2	2	1	2	2	3	0	2	2	2	3	2	2	2
S10	1	2	1	1	2	1	2	2	2	0	2	2	3	2	1	2
S11	2	2	3	3	2	2	2	2	2	2	0	3	3	2	2	2
S12	2	2	2	2	2	2	2	2	2	2	3	0	3	2	2	3
S13	2	3	3	3	2	1	3	3	3	3	3	3	0	3	2	3

Table 1. *Cont.*

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
S14	1	2	1	1	3	2	2	2	2	2	2	2	3	0	2	2
S15	1	1	2	2	2	1	2	2	2	1	2	2	2	2	0	2
S16	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	0

The normalization of the direct influence matrix Q needs to compute S first,

$$d = max(31, 32, 33, 32, 33, 26, 31, 39, 31, 27, 34, 37, 41, 29, 28, 36) = 41$$

Construct a standardized matrix Q,

$$q_{ij} = x_{ij}/41$$

The direct influence matrix Q of standardization can be obtained, as shown in Table 2.

Table 2. The direct influence matrix Q of standardization.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
S1	0.00	0.07	0.05	0.05	0.05	0.02	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.02	0.02	0.05
S2	0.07	0.00	0.05	0.05	0.05	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.07	0.05	0.02	0.05
S3	0.05	0.05	0.00	0.07	0.05	0.02	0.05	0.05	0.05	0.02	0.07	0.05	0.07	0.02	0.05	0.05
S4	0.05	0.05	0.07	0.00	0.05	0.02	0.05	0.05	0.05	0.02	0.07	0.05	0.07	0.02	0.05	0.05
S5	0.05	0.05	0.05	0.05	0.00	0.05	0.02	0.05	0.02	0.05	0.05	0.05	0.05	0.07	0.05	0.05
S6	0.02	0.02	0.02	0.02	0.05	0.00	0.02	0.05	0.05	0.02	0.05	0.05	0.02	0.05	0.02	0.05
S7	0.05	0.02	0.05	0.05	0.02	0.02	0.00	0.07	0.05	0.05	0.05	0.05	0.07	0.05	0.05	0.05
S8	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.00	0.07	0.05	0.05	0.05	0.07	0.05	0.05	0.07
S9	0.02	0.02	0.05	0.05	0.02	0.05	0.05	0.07	0.00	0.05	0.05	0.05	0.07	0.05	0.05	0.05
S10	0.02	0.05	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.00	0.05	0.05	0.07	0.05	0.02	0.05
S11	0.05	0.05	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.07	0.07	0.05	0.05	0.05
S12	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.00	0.07	0.05	0.05	0.07
S13	0.05	0.07	0.07	0.07	0.05	0.02	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.07	0.05	0.07
S14	0.02	0.05	0.02	0.02	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.00	0.05	0.05
S15	0.02	0.02	0.05	0.05	0.05	0.02	0.05	0.05	0.05	0.02	0.05	0.05	0.05	0.05	0.00	0.05
S16	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.05	0.05	0.05	0.07	0.07	0.05	0.05	0.00

For a more intuitive display, build a heat map on Python using matplotlib and seaborn libraries, as shown in Figure 2.

Calculate impact level G

G = [2.73183135, 2.93707412, 3.15093254, 3.15093254, 2.99015937, 2.31057632, 3.04826513, 3.50633825, 3.03823525, 2.75424013, 3.51146882, 3.42121845, 4.10243862, 3.01702548, 2.73624873, 3.42109914]

Calculate the impact level F

F = [2.73183135, 2.93707412, 3.15093254, 3.15093254, 2.99015937, 2.31057632, 3.04826513, 3.50633825, 3.03823525, 2.75424013, 3.51146882, 3.42121845, 4.10243862, 3.01702548, 2.73624873, 3.42109914]

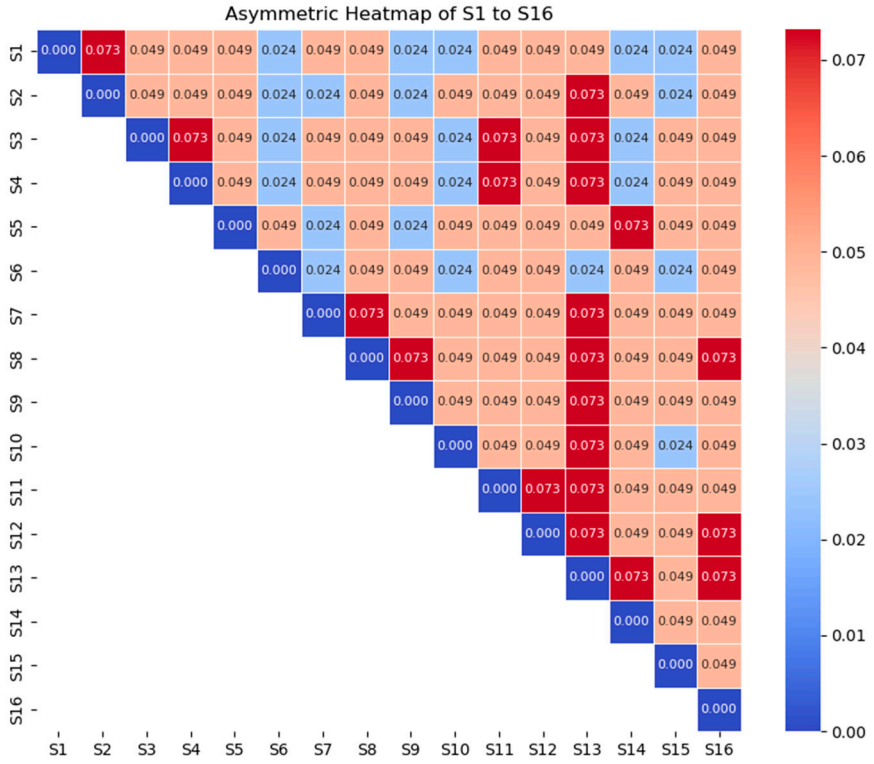

Figure 2. Heat map of influencing factors.

Calculate centrality Z

Z = [5.4636627, 5.87414824, 6.30186507, 6.30186507, 5.98031874, 4.62115263, 6.09653026, 7.01267651, 6.0764705, 5.50848027, 7.02293765, 6.84243691, 8.20487724, 6.03405095, 5.47249746, 6.84219828]

Calculate the cause degree M

$M = [0, 0, -8.8817842 * 10^{-16}, 0, 8.8817842 * 10^{-16}, 0, 0, 0, 4.4408921 * 10^{-16}, -4.4408921 * 10^{-16}, 8.8817842 * 10^{-16}, -4.4408921 * 10^{-16}, 0, -4.4408921 * 10^{-16}, -4.4408921 * 10^{-16}, 0]$

The specific values are summarized in Table 3.

Table 3. The specific values of factors.

Elements	*G*	*F*	*Z*	*M*
S1	2.731831	2.731831	5.463663	0
S2	2.937074	2.937074	5.874148	0
S3	3.150933	3.150933	6.301865	$-8.88 * 10^{-16}$
S4	3.150933	3.150933	6.301865	0
S5	2.990159	2.990159	5.980319	$8.88 * 10^{-16}$
S6	2.310576	2.310576	4.621153	0
S7	3.048265	3.048265	6.09653	0
S8	3.506338	3.506338	7.012677	0
S9	3.038235	3.038235	6.076471	$4.44 * 10^{-16}$
S10	2.75424	2.75424	5.50848	$-4.44 * 10^{-16}$
S11	3.511469	3.511469	7.022938	$8.88 * 10^{-16}$

Table 3. *Cont.*

Elements	*G*	*F*	*Z*	*M*
S12	3.421218	3.421218	6.842437	$-4.44 * 10^{-16}$
S13	4.102439	4.102439	8.204877	0
S14	3.017025	3.017025	6.034051	$-4.44 * 10^{-16}$
S15	2.736249	2.736249	5.472497	$-4.44 * 10^{-16}$
S16	3.421099	3.421099	6.842198	0

3.3. Analysis of Key Influencing Factors

The influence degree (G) indicates the extent to which a factor impacts other factors within the system. This factor drives changes in other factors and plays a critical role in shaping the overall dynamics of the system. The influenced degree (F) measures how much a factor is influenced by other factors in the system. A higher F value suggests that the factor is highly sensitive to changes in other factors. Centrality (Z) is the sum of G and F, representing the total involvement of a factor in the system. A higher Z value indicates that a factor is both influential and influenced, making it central to the system's overall operation. Cause degree (M) is the difference between G and F. It shows whether a factor is primarily a cause ($M > 0$) or an effect ($M < 0$) within the system. Factors with high G and positive M should be targeted for interventions, as they can induce significant changes in the system. Factors with high F and negative M might need monitoring and protection, as they are susceptible to external influences. Factors with high Z are critical nodes in the network and might represent areas where strategic management can optimize system-wide performance. Understanding the distribution of cause-and-effect factors (through M) helps in prioritizing which areas should be targeted for proactive vs. reactive strategies. According to the DEMATEL analysis, the key influencing factors in the sustainable supply chain implementation from a Marxist political economy perspective have been identified. The analysis also examines the centrality and causal relationships among these factors.

1. High Centrality Factors: Knowledge and Technology Level (S13): 8.2049, Financial Transfer (S11): 7.0229, Environmental Pollution and Other Disasters (S8): 7.0127. These factors exhibit the highest importance within the system, indicating which should receive priority attention and management.
2. Factors with Balanced Causality: Most factors have causal degrees close to zero, indicating they act as both causes and effects within the influence chain. This balance shows their dual role in affecting and being affected by other factors.
3. Positive Causation Degree Factors: Effective Establishment of Contracts (S5), Ecological Balance (S9), Optimization of Financial Transfer (S11). Factors with positive causality degrees positively impact the sustainability of the supply chain. Enhancing these factors can improve the coordination and stability of the entire system.

High centrality suggests which factors significantly influence the overall system's performance and sustainability. Given their obvious influence, efforts should be directed towards improving knowledge and technology levels (S13), financial transfer mechanisms (S11), and mitigating environmental pollution and disasters (S8). Balanced Approach to Causal Factors: allocate resources to factors that serve as both causes and effects to ensure a well-rounded improvement across the supply chain. Enhance Positive Causation Factors, focus on the effective establishment of contracts (S5), maintaining ecological balance (S9), and optimize financial transfer (S11) to reinforce the overall sustainability framework. By addressing these key factors, the sustainable development of supply chains can be effectively supported, aligning with the principles of Marxist political economy and promoting a more equitable and ecologically sound global economic system.

The study's reliance on the literature analysis and expert perspectives for identifying influencing factors may introduce biases. Future research could incorporate empirical data

from diverse geographical and industrial contexts to validate and refine the identified factors. Further research could explore the application of other analytical frameworks and methodologies to provide comparative insights and enhance the robustness of findings.

4. Conclusions

The factors with the highest influence and dependence values are S13 (Knowledge and Technology Level), S8 (Environmental Pollution and Disasters), and S11 (Financial Transfers); these factors are both heavily influencing other factors and are also highly dependent on them. They play central roles in the system, acting as both influencers and receivers of influence. S13 (Knowledge and Technology Level) stands out as the most critical factor with the highest centrality value ($Z = 8.204877$); it has the most significant overall effect on the sustainable supply chain. This underlines the importance of technological advancements and knowledge in achieving sustainable practices, aligning with Marxist views on the necessity of continuous innovation and the development of productive forces. Factors such as S13 (Knowledge and Technology Level), S8 (Environmental Pollution and Disasters), and S11 (Financial Transfers) are crucial for the overall functioning and sustainability of the supply chain. Conversely, factors like S6 (Resource Saving Awareness and Efforts) and S1 (Fairness in Resource Allocation), although important, have lower centrality values. While they are significant, their roles might be more specialized or localized within the broader network of influence. Most M values are very close to zero, suggesting that the factors in this system are highly interdependent, with no single factor overwhelmingly driving the others. This interdependence reflects the Marxist political economy's view of society as an interconnected system where economic, environmental, and social factors are tightly intertwined. S5 (Effective Establishment of Contracts in the Supply Chain) and S11 (Financial Transfers) show slight tendencies toward being causal factors; strong contracts and financial support might be foundational for the effective functioning of a sustainable supply chain.

The global nature of modern supply chains necessitates international cooperation and harmonized policies to address sustainability challenges effectively. The principles of Marxist political economy, with their emphasis on equitable resource distribution and social justice, offer a compelling framework for fostering such cooperation. This study explored the sustainability of supply chains through the lens of Marxist political economy and proposed a novel analytical framework for understanding and addressing sustainability challenges. The primary objectives included identifying influencing factors of supply chain sustainability, applying DEMATEL analysis to these factors, and providing insights for improving sustainable supply chain management. Sixteen specific factors that are integral to the sustainable operation of supply chains were identified and categorized into four primary groups: society and government, environment, economy, and the supply chain itself. The DEMATEL results revealed that knowledge and technology level (S13), financial transfer (S11), environmental pollution, and other disasters (S8) are the most critical factors. High centrality factors significantly influence the sustainability of supply chains and require prioritized attention. In conclusion, this study offers a comprehensive framework for understanding the complex interplay between economic, environmental, and social dimensions in supply chains by integrating the principles of Marxist political economy. This study contributes to the growing body of literature on sustainable supply chain management by integrating Marxist political economy perspectives and employing the DEMATEL method. The insights gained can inform both theoretical advancements and practical interventions aimed at promoting more equitable and ecologically sustainable supply chains.

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