JOURNAL OF MANAGEMENT AND BUSINESS SOLUTIONS

Identification and Prioritization of the Components Explaining Financial Supply Chain Management for the Sustainable Development of Industrial Small and Medium-Sized Enterprises

1. Sareh. Rahimi Waskasi : PhD student in Financial Engineering, Bab.C., Islamic Azad University, Babol, Iran.
2. Shiba. Masoumi*: Department of Industrial managment, Bab.C., Islamic Azad University, Babol, Iran.
3. Seyed Ali. Nabavi Chashmi: Department of Management, Bab.C., Islamic Azad University, Babol, Iran.
4. Kaveh. Azinfar: Department of Accounting, Bab.C., Islamic Azad University, Babol, Iran.

*corresponding author's email: shiba.masoumi@iau.ac.ir

ABSTRACT

The objective of this study was to identify and prioritize the components explaining financial supply chain management for the sustainable development of industrial small and medium-sized enterprises, and the research method was sequential qualitative. The participants in the identification phase included faculty members in the fields of financial engineering, financial management, industrial management, and business management at higher education institutions, senior and middle managers, and subject-matter experts in small and medium-sized enterprises across the country, as well as scholars and specialists in the field. In the prioritization phase, participants included faculty members in the aforementioned disciplines at higher education institutions and senior managers of small and medium-sized enterprises in Mazandaran Province. In the identification phase, 21 experts were selected using snowball sampling, and in the prioritization phase, 16 experts were selected through purposive sampling. For data analysis, the grounded theory method with the Corbin and Strauss (1998) approach was employed in the identification phase, using open, axial, and selective coding through semi-structured interviews. In the prioritization phase, the Delphi method based on the Helmer and Dalkey (1997) approach was applied over three rounds using an expert evaluation checklist in SPSS software. To establish validity and reliability in the identification phase, necessary assessments including credibility (expert review), confirmability (expert audit), and intersubjective agreement (0.81) were utilized. In the prioritization phase, the content validity of the expert evaluation checklist was confirmed in terms of clarity and comprehensibility by several academic and organizational experts, and its reliability was calculated and confirmed at 0.84 using the test–retest method. According to the results, the study's paradigmatic model comprised 11 main categories and 27 subcategories, including causal conditions (financial and credit constraints; structure and quality of the supply chain; environmental and institutional pressures; technological maturity and financial digitalization; and behavioral and managerial characteristics of firms), contextual conditions (structural characteristics of firms; social capital and communication networks; level of organizational culture and learning; infrastructure and support services; and market conditions and industry demand), the core category (central phenomenon) (financial supply chain integration and alignment with sustainable development principles), intervening conditions (government support and policymaking; alternative and innovative financial resources; predictability of the macroeconomic environment; maturity of the banking system and financial institutions; and flexibility of suppliers and customers), strategies (diversification of financing sources; digitalization of financial processes; strengthening participation among supply chain members; improvement of financial and credit risk management; and institutionalization of sustainable development principles), and consequences (improvement of financial performance and firm liquidity; enhancement of resilience and financial sustainability; strengthening of competitive advantage in the market; development of innovation and technological capabilities; and sustainable development and social responsibility), along with 118 indicators.

Keywords: Metacognitive beliefs, self-awareness, audit quality, professional judgment.

Article history:
Received 13 December 2025
Revised 17 April 2026
Accepted 20 April 2026
Published online 01 September 2026

How to cite this article:
Rahimi Waskasi, S., Masoumi, S., Nabavi Chashmi, S. A., & Azinfar, K. (2026). Identification and Prioritization of the Components Explaining Financial Supply Chain Management for the Sustainable Development of Industrial Small and Medium-Sized Enterprises. *Journal of Management and Business Solutions,* 4(5), 1-18. https://doi.org/10.61838/jmbs.287

Introduction

The increasing complexity of global markets, coupled with environmental concerns and resource constraints, has intensified the need for sustainable approaches in supply chain management, particularly within small and medium-sized enterprises (SMEs). These enterprises play a pivotal role in economic development, industrial growth, and employment generation; however, they often face significant structural and financial limitations that hinder their ability to adopt sustainable practices effectively. In recent years, the concept of financial supply chain management has emerged as a critical mechanism for optimizing financial flows, enhancing liquidity, and aligning operational efficiency with sustainability objectives. This approach not only integrates financial processes across supply chain actors but also contributes to the broader goals of sustainable development by balancing economic, environmental, and social dimensions (1, 2).

Sustainable supply chain management has evolved from a traditional cost-efficiency perspective to a multidimensional paradigm encompassing environmental stewardship, social responsibility, and long-term economic viability. The integration of sustainability principles into supply chain operations requires systemic coordination among stakeholders, supported by robust financial infrastructures and innovative financing mechanisms. Studies have emphasized that achieving sustainability in supply chains necessitates the alignment of financial strategies with operational and environmental goals, thereby ensuring resilience and adaptability in dynamic market conditions (3, 4). In this context, financial supply chain management serves as a strategic enabler that facilitates resource allocation, risk mitigation, and value creation across the supply chain network.

One of the critical challenges faced by industrial SMEs is the limitation in accessing financial resources, which restricts their capacity to invest in sustainable technologies and practices. Financial constraints, coupled with information asymmetry and weak credit structures, often lead to inefficiencies in supply chain operations and reduce competitiveness. Addressing these challenges requires the development of integrated financial frameworks that enhance transparency, improve creditworthiness, and enable SMEs to leverage diverse financing sources, including innovative and alternative financial instruments (5, 6). Moreover, the role of financial institutions and government policies becomes crucial in facilitating access to capital and supporting sustainable supply chain initiatives.

Technological advancements have significantly transformed the landscape of supply chain management, offering new opportunities for improving efficiency and sustainability. The adoption of digital technologies such as big data analytics, artificial intelligence, blockchain, and enterprise resource planning systems has enabled firms to optimize financial flows, enhance decision-making, and improve transparency across the supply chain. These technologies contribute to the digitalization of financial processes, thereby reducing transaction costs and increasing operational agility. The integration of digital technologies within financial supply chains has been identified as a key driver of sustainable performance, particularly in manufacturing sectors of developing economies (7, 8).

In addition to technological factors, organizational and behavioral dimensions play a significant role in shaping the effectiveness of financial supply chain management. Managerial competencies, strategic orientation, and organizational culture influence the adoption and implementation of sustainable practices. Firms with a strong commitment to sustainability and a proactive approach to risk management are more likely to achieve superior performance outcomes. Furthermore, the development of human resources and organizational capabilities is essential for fostering innovation and supporting the transition toward sustainable supply chain systems (6, 9).

The importance of social capital and collaborative networks in supply chain management cannot be overlooked. Effective communication and trust among supply chain partners facilitate information sharing, reduce uncertainties, and enhance coordination. These factors are particularly important in financial supply chain management, where the alignment of financial and operational processes requires a high degree of cooperation among stakeholders. Strengthening social networks and institutional support mechanisms can significantly improve the resilience and sustainability of supply chains, especially in the context of SMEs operating in volatile environments (10, 11).

Environmental and institutional pressures also play a crucial role in shaping supply chain practices. Regulatory frameworks, environmental standards, and market expectations drive firms to adopt sustainable approaches and integrate environmental considerations into their operations. The increasing emphasis on corporate social responsibility and environmental accountability has compelled organizations to redesign their supply chain strategies to minimize environmental impact and enhance social value. These pressures, while challenging, also create opportunities for innovation and competitive differentiation in the marketplace (12, 13).

Another critical dimension of sustainable supply chain management is the concept of resilience, which refers to the ability of supply chains to withstand disruptions and recover from adverse events. The integration of financial resilience strategies, such as diversification of financing sources and risk-sharing mechanisms, enhances the stability and sustainability of supply chains. Resilient supply chains are better equipped to manage uncertainties and maintain operational continuity, thereby contributing to long-term sustainability objectives (10, 11).

The emergence of Management 4.0 has further accelerated the transformation of supply chain systems by integrating advanced technologies and innovative management practices. This paradigm emphasizes the use of digital tools and data-driven approaches to enhance decision-making, improve efficiency, and achieve sustainability goals. The adoption of Management 4.0 principles in financial supply chain management enables firms to leverage technological capabilities and optimize resource utilization, thereby enhancing overall performance (14).

Despite the growing body of literature on sustainable supply chain management, there remains a significant gap in understanding the specific components and mechanisms through which financial supply chain management contributes to sustainable development in industrial SMEs. Existing studies have primarily focused on individual aspects such as green supply chain practices, technological adoption, or risk management, without providing a comprehensive framework that integrates these elements into a cohesive model. Furthermore, the contextual factors influencing the effectiveness of financial supply chain management, particularly in developing economies, require further investigation (2, 15).

Given these considerations, it is essential to develop a systematic and comprehensive model that identifies and prioritizes the key components of financial supply chain management for sustainable development. Such a model can provide valuable insights for policymakers, practitioners, and researchers, enabling them to design effective strategies for enhancing sustainability and competitiveness in industrial SMEs. By integrating financial, technological, organizational, and environmental dimensions, this study aims to contribute to the advancement of knowledge in the field of sustainable supply chain management and support the development of resilient and sustainable industrial systems (1, 16).

Therefore, the aim of this study is to identify and prioritize the components explaining financial supply chain management for the sustainable development of industrial small and medium-sized enterprises.

Methods and Materials

The research method was sequential qualitative. In the model design phase, the grounded theory method with the systematic approach of Corbin and Strauss (1998) was applied, utilizing open, axial, and selective coding. In the validation phase, the Delphi method based on the approach of Helmer and Dalkey (1997) was employed.

In the qualitative phase, experts and specialists were engaged to ensure the credibility of the interviews. Participants in the identification phase consisted of three groups: academic experts, including faculty members in financial engineering, financial management, industrial management, and business management at universities and higher education institutions; organizational experts, including senior and middle managers as well as specialized professionals in small and medium-sized enterprises across the country; and subject-matter experts in supply chain, financing, financial supply chain management, and sustainable development. The inclusion criteria for participants in the qualitative phase included having academic qualifications related to supply chain, financial supply chain management, and sustainable development, possessing scholarly outputs such as books, articles, or research projects on the research topic, and having executive experience in small and medium-sized enterprises across the country. Sampling in this phase was conducted using the snowball technique among key informants. The selection and data collection process continued until theoretical saturation was achieved, defined as the point at which no new insights emerged from the analysis of the final interviews. The characteristics of the 21 experts are presented in Table 1.

Table 1. Demographic Characteristics of Interview Participants

No.	Gender	Field of Study	Degree	Area of Expertise	Work Experience	Organizational Position
1	Male	Accounting	PhD	Financial analysis	22 years	Financial Deputy of an industrial company
2	Male	Financial Management	PhD Candidate	Insurance and claims management	13 years	Senior financial expert in insurance and industrial company
3	Male	Financial Engineering	PhD	Management and organization	12 years	Ministry of Science, Research and Technology
4	Male	Industrial Management	MSc	Industrial equipment	10 years	Financial engineer in an industrial company
5	Male	Financial Engineering	PhD Candidate	Data analytics and AI	10 years	Data analyst and backend developer
6	Female	Financial Management	PhD	Financial planning	8 years	Financial manager of Neka Choob
7	Female	Financial Management	MSc	Accounting	15 years	Accounting manager
8	Male	Accounting	PhD	Financial reporting	10 years	University lecturer and bank financial supervisor
9	Male	Accounting	PhD Candidate	Tax and accounting software	24 years	Judicial accountant
10	Male	Economics	PhD	Cost management	23 years	Ministry of Science, Research and Technology
11	Female	Industrial Management	PhD	Internal management	9 years	Ministry of Science, Research and Technology
12	Male	Industrial Management	PhD	Industrial investment	16 years	Industrial company manager
13	Male	Accounting	MSc	Costing	13 years	Financial expert at Bahman Steel
14	Male	Economics	PhD	Financial markets	16 years	Islamic Azad University
15	Male	Financial Management	PhD Candidate	SME management	7 years	Factory supervisor
16	Female	Financial Engineering	PhD Candidate	Production planning	22 years	Internal manager of an industrial company
17	Male	Financial Engineering	MSc	Business development	13 years	IT expert in an industrial company

18	Male	Industrial-Financial Management	PhD	Quality control	21 years	Internal manager of clothing manufacturing
19	Female	Accounting	PhD Candidate	Tax affairs	8 years	Financial expert in carpet production
20	Male	Financial Engineering	PhD	Financial accounting and reporting	17 years	Accounting manager
21	Female	Industrial-Financial Management	PhD	Industrial management	22 years	Islamic Azad University

The sampling method in the prioritization phase was non-probabilistic purposive sampling. A total of 16 experts were selected from among participants in this phase, including faculty members in financial engineering, financial management, industrial management, and business management at higher education institutions, as well as senior managers of small and medium-sized enterprises in Mazandaran Province.

A semi-structured interview was used as the data collection instrument in the identification phase, while an expert evaluation checklist was employed in the prioritization phase. To assess validity and reliability in the identification phase, procedures including credibility (expert review), confirmability (re-audit by experts), and intersubjective agreement (0.81) were applied. For validity assessment, transcripts of five initial interviews along with the preliminary coding derived from them were provided to the respective interviewees to evaluate the interpretations and inferences made by the researcher. Necessary revisions were implemented to ensure alignment with participants' intended meanings. For reliability assessment, the derived categories were returned to several initial participants for review and confirmation, and suggested modifications were incorporated.

In the prioritization phase, the content validity of the expert evaluation checklist was confirmed in terms of clarity, comprehensibility, and transparency by several academic and organizational experts, and necessary revisions were applied. To assess reliability, the test–retest method was employed. The checklist was administered to 10 participants in two separate rounds with a two-week interval. The correlation coefficient between the two sets of results was calculated as 0.84 using SPSS software, confirming the reliability of the instrument.

The data analysis method in the qualitative identification phase followed grounded theory with the Corbin and Strauss (1998) approach. In grounded theory, each segment of data is analyzed immediately after collection in a parallel process. The researcher then derives guidelines from the initial data analysis to guide subsequent data collection. These guidelines may emerge from underdeveloped categories, informational gaps, or individuals with deeper insights into the phenomenon. This iterative, zigzag process of data collection and analysis continues until category saturation is achieved (Creswell, 2023). In grounded theory, data analysis consists of three coding stages: open coding, axial coding, and selective coding (Corbin & Strauss, 2024).

The data analysis method in the prioritization phase involved validating the components identified in the qualitative phase by determining their relative importance in explaining the model. This was conducted through expert surveys using the Delphi technique and descriptive statistical analysis in SPSS software. The expert checklist was administered over three rounds. The Delphi method is a qualitative research technique used to achieve consensus in group decision-making (Sadeghian et al., 2023). In practice, it involves a series of sequential questionnaires with controlled feedback aimed at reaching agreement among a group of experts on a specific issue (Rahmani et al., 2020). In this study, the Delphi method was conducted in three rounds, and the findings from each round were reported separately. The researcher presented the components of the five categories—causal conditions, contextual conditions, intervening conditions, strategies, and outcomes—to the experts in a five-point Likert-scale checklist ranging from least important (1) to most important (5). The time interval between each Delphi

round was one week. The second round was conducted one week after the first, and the third round followed in the subsequent week. In total, the Delphi process was completed in three rounds.

Findings and Results

A. Qualitative Section – Identification

The central focus of the study was the exploration and identification of influencing factors related to the main categories, subcategories, and indicators of the model of "financial supply chain management for the sustainable development of industrial small and medium-sized enterprises" as the core concept. To achieve this objective, the main categories, subcategories, and indicators were derived through open coding (in two stages: initial and secondary coding), axial coding, and selective coding, based on data obtained from the content analysis of in-depth and exploratory interviews with key experts, followed by refinement of conceptual codes. Accordingly, in the first step of open coding, the data were examined at the level of sentences and phrases for each interview, and conceptual codes were extracted from the interview transcripts. In the subsequent stage, through refinement and reduction, subcategories and indicators were organized within main categories and continuously reviewed for proper labeling. To ensure appropriate organization of each main category and subcategory, the interview transcripts were re-examined, and this process was conducted through iterative review of indicators until logical saturation was achieved. Open and axial coding were terminated once a meaningful classification was established after multiple iterations of transcript analysis.

In the first step of open coding (initial coding phase), based on the systematic approach of Corbin and Strauss (1998), a total of 417 conceptual codes were identified. In the next stage, duplicate codes were removed, resulting in the elimination of 299 codes and the retention of 118 final codes. In the secondary coding phase of open coding, subcategories were determined. The objective of this phase was to establish relationships among the generated indicators, typically based on the paradigmatic model. Table 2 presents the results of subcategory identification.

Table 2. Results of Subcategory Identification

No.	Subcategory	Indicators
1	Organizational Culture and Learning Level: openness to change, support for innovation, trust and transparency, continuous learning (4 indicators)	Creating an open and participatory organizational culture; strengthening the organization's inclination toward continuous learning; increasing transparency and trust in organizational culture; promoting a sustainable and responsible organizational culture
2	Financial and Credit Constraints: liquidity shortages, limited access to loans and credit lines, weak capital structure, lack of financial transparency (5 indicators)	Access to short-term financial resources; adequacy of internal capital; transparency and quality of financial statements; dependence on informal financing sources; credit rating limitations
3	Sustainable Development and Social Responsibility: environmental performance improvement, enhanced social responsibility, transparent sustainability reporting (4 indicators)	Improvement of environmental performance; increased commitment to social responsibility; transparency in sustainability reporting; investment in green projects
4	Macroeconomic Environment Predictability: inflation, exchange rate, trade policies, macro-financial environment (5 indicators)	Exchange rate stability; inflation control; transparency of macroeconomic policies; predictability of trade regulations; political-economic stability
5	Innovation and Technological Capability Development (4 indicators)	Investment in financial technologies; development of new products; use of digital technologies; enhancement of R&D capabilities
6	Social Capital and Communication Networks (4 indicators)	Engagement with associations; participation in industrial clusters; informal managerial relationships; strengthening trust in networks
7	Competitive Advantage Enhancement (5 indicators)	Market share growth; improved competitive position; responsiveness to market changes; product/service quality improvement; customer acquisition capability
8	Alternative and Innovative Financial Resources (4 indicators)	Venture capital utilization; crowdfunding platforms; leasing and factoring tools; access to innovative funds

9	Financial Resilience and Sustainability Enhancement (4 indicators)	Crisis management capability; operational continuity under uncertainty; reduced financial failure risk; financial flexibility
10	Infrastructure and Support Services (4 indicators)	Financial advisory services; insurance and credit guarantees; innovation centers; government and non-governmental support networks
11	Financial Performance and Liquidity Improvement (5 indicators)	Reduced financial costs; increased profitability; improved cash flow; enhanced working capital efficiency; improved debt repayment capacity
12	Supply Chain Structure and Quality (4 indicators)	Trust and transparency among partners; contract stability; risk-sharing mechanisms; bargaining power
13	Institutionalization of Sustainable Development Principles (4 indicators)	Integration of sustainability criteria; green investments; responsible financing; transparent sustainability reporting
14	Firm Structural Characteristics (5 indicators)	Firm size; ownership type; organizational structure; operational history; structural flexibility
15	Financial and Credit Risk Management Improvement (4 indicators)	Financial early warning systems; credit insurance; hedging tools; continuous risk assessment
16	Behavioral and Managerial Characteristics (4 indicators)	Risk-taking attitudes; commitment to sustainability; strategic financial perspective; managerial financial expertise
17	Supply Chain Member Participation Enhancement (4 indicators)	Long-term financial contracts; financial information sharing; trust-building mechanisms; joint financial institutions
18	Banking System and Financial Institution Maturity (4 indicators)	SME-focused banking services; financial innovation tools; service efficiency; institutional support
19	Financial Process Digitalization (4 indicators)	Digital payment platforms; blockchain applications; ERP systems; financial process automation
20	Market and Industry Demand Conditions (4 indicators)	Demand stability; market competition; industry life cycle; demand fluctuations
21	Government Support and Policymaking (4 indicators)	SME credit policies; regulatory frameworks; guarantee programs; access facilitation
22	Environmental and Institutional Pressures (5 indicators)	Government and central bank policies; tax and accounting regulations; inflation pressures; sustainability requirements; policy incentives
23	Diversification of Financing Sources (6 indicators)	Banking resources; venture capital; capital market instruments; factoring; crowdfunding; hybrid financing
24	Supplier and Customer Flexibility (4 indicators)	Flexible payment terms; liquidity cooperation; crisis resilience; indirect financial support
25	Financial Supply Chain Integration (4 indicators)	Cash flow coordination; financial information sharing; joint risk management; cost reduction through collaboration
26	Alignment with Sustainable Development Principles (5 indicators)	Integration of sustainability criteria; green investments; social responsibility financing; transparent reporting; sustainable financial instruments
27	Technological Maturity and Financial Digitalization (5 indicators)	Use of ERP systems; fintech adoption; digital platforms; automation; system integration

Second Step: Axial Coding

Based on the systematic approach of Strauss and Corbin (1998), in axial coding, the developed subcategories are classified into broader groups referred to as main categories. Table 3 presents the results of axial coding. At this stage, the 118 final codes, which had been organized into 27 subcategories, were placed under 11 main categories.

Table 3. Results of Axial Coding

No.	Main Category	Subcategory
1	Financial–Structural	Financial and credit constraints; supply chain structure and quality; environmental and institutional pressures
2	Managerial–Technological	Technological maturity and financial digitalization; behavioral and managerial characteristics of the firm
3	Structural–Market	Structural characteristics of the firm; market and industry demand conditions
4	Institutional–Cultural	Social capital and communication networks; level of organizational culture and learning; infrastructure and support services
5	Financial Supply Chain Management Toward Sustainable Development	Financial supply chain integration; alignment with sustainable development principles
6	Institutional–Economic	Government support and policymaking; predictability of the macroeconomic environment; maturity of the banking system and financial institutions

7	Innovative–Market	Alternative and innovative financial resources; flexibility of suppliers and customers
8	Technological–Operational	Diversification of financing sources; digitalization of financial processes; improvement of financial and credit risk management
9	Institutional–Sustainability	Strengthening the participation of supply chain members; institutionalization of sustainable development principles
10	Economic–Competitive	Improvement of the firm's financial performance and liquidity; enhancement of competitive advantage in the market; strengthening financial resilience and sustainability
11	Technological–Social	Development of innovation and technological capabilities; sustainable development and social responsibility
12	11 main categories	27 subcategories

The final results obtained from the qualitative analysis at the end of axial coding are presented in Table 4.

Table 4. Classification of Main Categories, Subcategories, and Indicators of the Financial Supply Chain Management Model for the Sustainable Development of Industrial Small and Medium-Sized Enterprises

No.	Main Category	Number of Subcategories	Subcategory	Number of Indicators
1	Financial–Structural	3	Financial and credit constraints; supply chain structure and quality; environmental and institutional pressures	14
2	Managerial–Technological	2	Technological maturity and financial digitalization; behavioral and managerial characteristics of the firm	9
3	Structural–Market	2	Structural characteristics of the firm; market and industry demand conditions	9
4	Institutional–Cultural	3	Social capital and communication networks; level of organizational culture and learning; infrastructure and support services	12
5	Financial Supply Chain Management Toward Sustainable Development	2	Financial supply chain integration; alignment with sustainable development principles	9
6	Institutional–Economic	3	Government support and policymaking; predictability of the macroeconomic environment; maturity of the banking system and financial institutions	13
7	Innovative–Market	2	Alternative and innovative financial resources; flexibility of suppliers and customers	8
8	Technological–Operational	3	Diversification of financing sources; digitalization of financial processes; improvement of financial and credit risk management	14
9	Institutional–Sustainability	2	Strengthening the participation of supply chain members; institutionalization of sustainable development principles	8
10	Economic–Competitive	3	Improvement of the firm's financial performance and liquidity; enhancement of competitive advantage in the market; strengthening financial resilience and sustainability	14
11	Technological–Social	2	Development of innovation and technological capabilities; sustainable development and social responsibility	8
12	11 main categories	27 subcategories	27 subcategories	118 indicators

Third Step: Selective Coding and Placement of Subcategories within the Paradigmatic Model

Based on the systematic approach of Strauss and Corbin (1998), after the completion of open and axial coding, the subcategories are placed within the paradigmatic model during the selective coding stage. The 27 subcategories, organized under 11 main categories, were classified into the six main components of the paradigmatic model, namely causal conditions, intervening conditions, contextual conditions, central phenomenon, strategies, and consequences. Table 5 presents the final model, showing the placement of the 27 subcategories within the six main components of the paradigmatic model.

Table 5. Classification of Main Components, Categories, Subcategories, and Indicators of the Final Model

No.	Main Component	Main Category	Subcategory	Number of Indicators
1	Causal Conditions	Financial–Structural	Financial and credit constraints; supply chain structure and quality; environmental and institutional pressures	14
2	Causal Conditions	Managerial–Technological	Technological maturity and financial digitalization; behavioral and managerial characteristics of the firm	9
3	Contextual Conditions	Structural–Market	Structural characteristics of the firm; market and industry demand conditions	9
4	Contextual Conditions	Institutional–Cultural	Social capital and communication networks; level of organizational culture and learning; infrastructure and support services	12
5	Central Phenomenon	Financial Supply Chain Management Toward Sustainable Development	Financial supply chain integration; alignment with sustainable development principles	9
6	Intervening Conditions	Institutional–Economic	Government support and policymaking; predictability of the macroeconomic environment; maturity of the banking system and financial institutions	13
7	Intervening Conditions	Innovative–Market	Alternative and innovative financial resources; flexibility of suppliers and customers	8
8	Strategies	Technological–Operational	Diversification of financing sources; digitalization of financial processes; improvement of financial and credit risk management	14
9	Strategies	Institutional–Sustainability	Strengthening the participation of supply chain members; institutionalization of sustainable development principles	8
10	Consequences	Economic–Competitive	Improvement of the firm's financial performance and liquidity; enhancement of competitive advantage in the market; strengthening financial resilience and sustainability	14
11	Consequences	Technological–Social	Development of innovation and technological capabilities; sustainable development and social responsibility	8
12	Main components of the paradigmatic model	11 main categories	27 subcategories	118 indicators

After completing the qualitative phase and identifying the main categories, subcategories, and indicators, the paradigmatic model of financial supply chain management for the sustainable development of industrial small and medium-sized enterprises is presented in Figure 1.

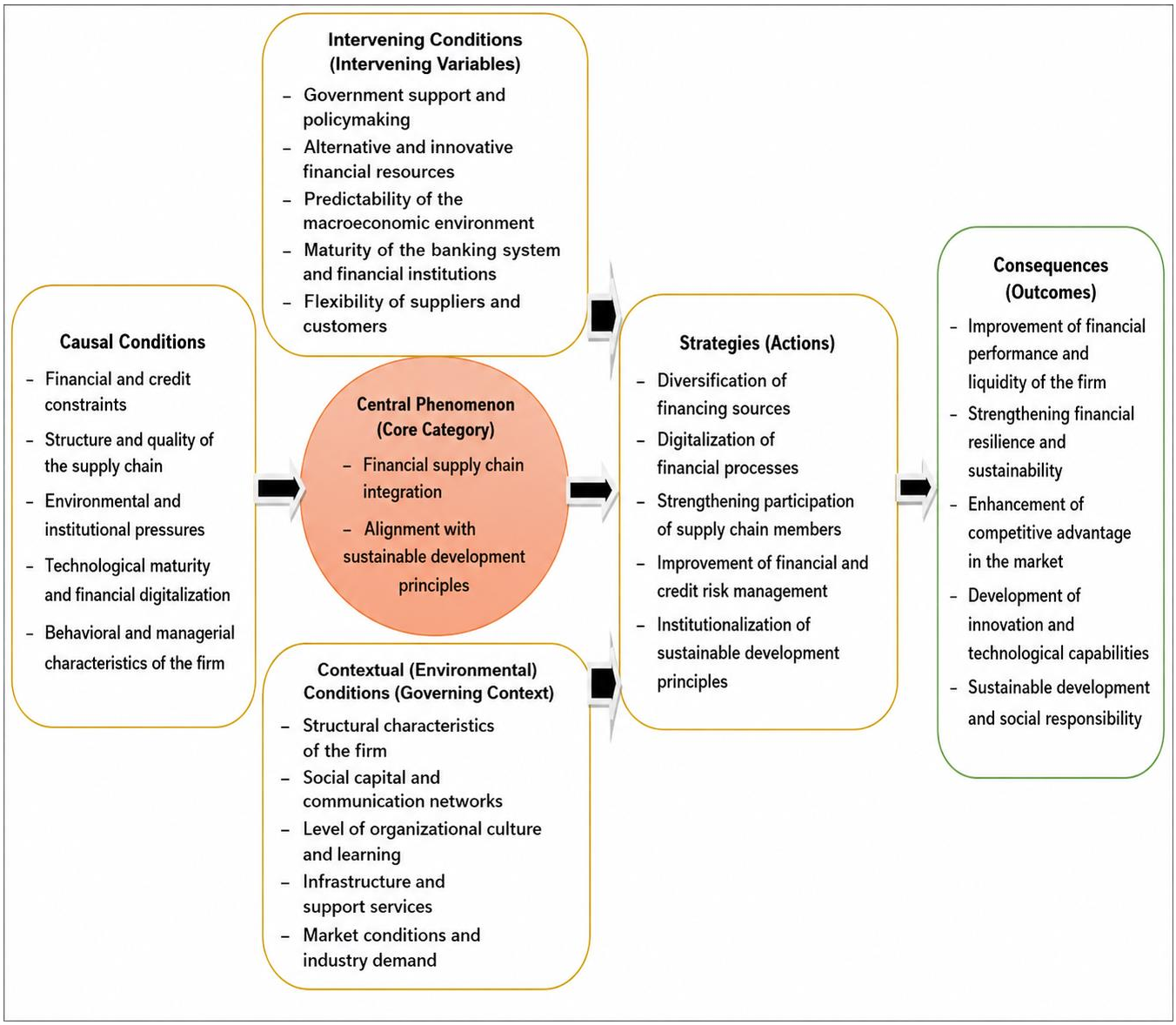

Figure 1. The Paradigmatic Model of the Study

B. Ranking Section

Causal Conditions: In the first Delphi round, the highest importance was assigned to supply chain structure and quality, with a mean of 3.96 and a standard deviation of 0.73, while the lowest importance was assigned to the behavioral and managerial characteristics of the firm, with a mean of 3.74 and a standard deviation of 0.78. In the second Delphi round, the highest importance was assigned to technological maturity and digitalization, with a mean of 3.79 and a standard deviation of 0.62, while the lowest importance was assigned to the behavioral and managerial characteristics of the firm, with a mean of 3.54 and a standard deviation of 0.73. In the third Delphi round, the highest importance was assigned to supply chain structure and quality, with a mean of 3.88 and a standard deviation of 0.96, while the lowest importance was assigned to the behavioral and managerial characteristics of the firm, with a mean of 3.70 and a standard deviation of 0.61. Kendall's coefficient of concordance for the third-round responses was 0.915, which represented only an 8.66% increase compared with the second round, where it was 0.842. Therefore, the degree of agreement among the working group members did not show a substantial increase between the two consecutive rounds. After completing the qualitative phase and validation process, the final

components explaining causal conditions, following three rounds of the qualitative Delphi technique, included five components: financial and credit constraints, supply chain structure and quality, environmental and institutional pressures, technological maturity and financial digitalization, and behavioral and managerial characteristics of the firm. From the experts' perspective, these components demonstrated acceptable and desirable validity.

Contextual Conditions: In the first Delphi round, the highest importance was assigned to social capital and communication networks, with a mean of 3.93 and a standard deviation of 0.69, while the lowest importance was assigned to market and industry demand conditions, with a mean of 3.79 and a standard deviation of 0.80. In the second Delphi round, the highest importance was assigned to the level of organizational culture and learning, with a mean of 3.83 and a standard deviation of 0.96, while the lowest importance was assigned to infrastructure and support services, with a mean of 3.74 and a standard deviation of 0.87. In the third Delphi round, the highest importance was assigned to the level of organizational culture and learning, with a mean of 3.88 and a standard deviation of 0.72, while the lowest importance was assigned to infrastructure and support services, with a mean of 3.66 and a standard deviation of 0.51. Kendall's coefficient of concordance for the third-round responses was 0.884, which represented only a 7.67% increase compared with the second round, where it was 0.821. Therefore, the degree of agreement among the working group members did not show a substantial increase between the two consecutive rounds. After completing the qualitative phase and validation process, the final components explaining contextual conditions, following three rounds of the qualitative Delphi technique, included five components: structural characteristics of the firm, social capital and communication networks, level of organizational culture and learning, infrastructure and support services, and market and industry demand conditions. From the experts' perspective, these components demonstrated acceptable and desirable validity.

Intervening Conditions: In the first Delphi round, the highest importance was assigned to alternative and innovative financial resources, with a mean of 3.85 and a standard deviation of 0.81, while the lowest importance was assigned to supplier and customer flexibility, with a mean of 3.70 and a standard deviation of 0.79. In the second Delphi round, the highest importance was assigned to government support and policymaking, with a mean of 3.77 and a standard deviation of 0.92, while the lowest importance was assigned to supplier and customer flexibility, with a mean of 3.61 and a standard deviation of 0.72. In the third Delphi round, the highest importance was assigned to government support and policymaking, with a mean of 4.07 and a standard deviation of 0.54, while the lowest importance was assigned to supplier and customer flexibility, with a mean of 3.80 and a standard deviation of 0.74. Kendall's coefficient of concordance for the third-round responses was 0.902, which represented only a 7.25% increase compared with the second round, where it was 0.841. Therefore, the degree of agreement among the working group members did not show a substantial increase between the two consecutive rounds. After completing the qualitative phase and validation process, the final components explaining intervening conditions, following three rounds of the qualitative Delphi technique, included five components: government support and policymaking, alternative and innovative financial resources, predictability of the macroeconomic environment, maturity of the banking system and financial institutions, and supplier and customer flexibility. From the experts' perspective, these components demonstrated acceptable and desirable validity.

Strategies: In the first Delphi round, the highest importance was assigned to improving financial and credit risk management, with a mean of 3.91 and a standard deviation of 0.93, while the lowest importance was assigned to strengthening the participation of supply chain members, with a mean of 3.60 and a standard deviation of 0.96. In the second Delphi round, the highest importance was assigned to improving financial and credit risk management,

with a mean of 3.97 and a standard deviation of 0.87, while the lowest importance was assigned to digitalization of financial processes, with a mean of 3.82 and a standard deviation of 0.76. In the third Delphi round, the highest importance was assigned to diversification of financing sources, with a mean of 3.98 and a standard deviation of 0.64, while the lowest importance was assigned to strengthening the participation of supply chain members, with a mean of 3.81 and a standard deviation of 0.56. Kendall's coefficient of concordance for the third-round responses was 0.859, which represented only a 9.01% increase compared with the second round, where it was 0.788. Therefore, the degree of agreement among the working group members did not show a substantial increase between the two consecutive rounds. After completing the qualitative phase and validation process, the final components explaining strategies, following three rounds of the qualitative Delphi technique, included five components: diversification of financing sources, digitalization of financial processes, strengthening the participation of supply chain members, improvement of financial and credit risk management, and institutionalization of sustainable development principles. From the experts' perspective, these components demonstrated acceptable and desirable validity.

Consequences: In the first Delphi round, the highest importance was assigned to sustainable development and social responsibility, with a mean of 3.96 and a standard deviation of 0.59, while the lowest importance was assigned to the development of innovation and technological capabilities, with a mean of 3.74 and a standard deviation of 0.64. In the second Delphi round, the highest importance was assigned to improving the firm's financial performance and liquidity, with a mean of 3.85 and a standard deviation of 0.68, while the lowest importance was assigned to enhancing competitive advantage in the market, with a mean of 3.62 and a standard deviation of 0.85. In the third Delphi round, the highest importance was assigned to sustainable development and social responsibility, with a mean of 4.03 and a standard deviation of 0.65, while the lowest importance was assigned to the development of innovation and technological capabilities, with a mean of 3.86 and a standard deviation of 0.80. Kendall's coefficient of concordance for the third-round responses was 0.903, which represented only a 7.62% increase compared with the second round, where it was 0.839. Therefore, the degree of agreement among the working group members did not show a substantial increase between the two consecutive rounds. After completing the qualitative phase and validation process, the final components explaining consequences, following three rounds of the qualitative Delphi technique, included five components: improvement of the firm's financial performance and liquidity, strengthening financial resilience and sustainability, enhancement of competitive advantage in the market, development of innovation and technological capabilities, and sustainable development and social responsibility. From the experts' perspective, these components demonstrated acceptable and desirable validity. According to the results of the three Delphi rounds conducted to rank the qualitative findings, the 27 components of the study's paradigmatic model were confirmed. Table 6 presents the results of the third Delphi round from the experts' perspective.

Table 6. Respondents' Opinions on the Components Explaining Financial Supply Chain Management for the Sustainable Development of Industrial Small and Medium-Sized Enterprises: Third Delphi Round

Components	Number of Responses	Minimum	Maximum	Mean	Standard Deviation	Importance Rank
Causal Conditions						
Financial and credit constraints	16	1.00	5.00	3.81	0.91	3
Supply chain structure and quality	16	2.00	5.00	3.88	0.96	1
Environmental and institutional pressures	16	2.00	5.00	3.78	0.83	4
Technological maturity and financial digitalization	16	2.00	5.00	3.82	0.75	2
Behavioral and managerial characteristics of the firm	16	1.00	5.00	3.70	0.61	5
Contextual Conditions						
Structural characteristics of the firm	16	1.00	5.00	3.73	0.63	4
Social capital and communication networks	16	2.00	5.00	3.85	0.84	2
Level of organizational culture and learning	16	2.00	5.00	3.88	0.72	1
Infrastructure and support services	16	2.00	5.00	3.66	0.51	5
Market and industry demand conditions	16	1.00	5.00	3.82	0.90	3
Intervening Conditions						
Government support and policymaking	16	2.00	5.00	4.07	0.54	1
Alternative and innovative financial resources	16	1.00	5.00	3.98	0.91	2
Predictability of the macroeconomic environment	16	2.00	5.00	3.82	0.70	4
Maturity of the banking system and financial institutions	16	1.00	5.00	3.91	0.83	3
Supplier and customer flexibility	16	1.00	5.00	3.80	0.74	5
Strategies						
Diversification of financing sources	16	2.00	5.00	3.98	0.64	1
Digitalization of financial processes	16	2.00	5.00	3.83	0.79	4
Strengthening the participation of supply chain members	16	1.00	5.00	3.81	0.56	5
Improvement of financial and credit risk management	16	2.00	5.00	3.92	0.93	2
Institutionalization of sustainable development principles	16	1.00	5.00	3.89	0.66	3
Consequences						
Improvement of the firm's financial performance and liquidity	16	2.00	5.00	3.92	0.61	3
Strengthening financial resilience and sustainability	16	1.00	5.00	3.96	0.88	2
Enhancement of competitive advantage in the market	16	2.00	5.00	3.89	0.97	4
Development of innovation and technological capabilities	16	2.00	5.00	3.86	0.80	5
Sustainable development and social responsibility	16	1.00	5.00	4.03	0.65	1

Discussion and Conclusion

The findings of the present study provide a comprehensive and structured understanding of the components explaining financial supply chain management for the sustainable development of industrial small and medium-sized enterprises. The results, derived from a rigorous qualitative process and validated through the Delphi technique, indicate that financial supply chain management is a multidimensional construct influenced by causal, contextual, and intervening conditions, and operationalized through specific strategies that ultimately lead to measurable outcomes. The identification of 27 subcategories organized within 11 main categories and integrated

into a paradigmatic model highlights the complexity and interdependence of financial, technological, organizational, and environmental factors in achieving sustainable development within SMEs.

With respect to causal conditions, the study demonstrates that financial and credit constraints, supply chain structure and quality, environmental and institutional pressures, technological maturity and financial digitalization, and behavioral and managerial characteristics of firms are critical determinants of financial supply chain effectiveness. Among these, supply chain structure and quality consistently ranked as one of the most influential components across Delphi rounds, indicating that trust, transparency, and coordination among supply chain partners are essential for optimizing financial flows. This finding aligns with prior research emphasizing the role of supply chain integration and collaboration in enhancing sustainability and operational performance (1, 2). Additionally, the significance of financial constraints underscores the persistent challenges faced by SMEs in accessing formal financing, which limits their capacity to invest in sustainable initiatives, a finding consistent with earlier studies on financial barriers in sustainable supply chains (5, 6).

Technological maturity and digitalization emerged as another key causal factor, reflecting the growing importance of digital transformation in financial supply chain management. The integration of technologies such as big data analytics, artificial intelligence, and digital platforms facilitates transparency, reduces transaction costs, and enhances decision-making capabilities. This result is in line with previous studies demonstrating the positive impact of digital technologies on sustainable supply chain performance and financial efficiency (7, 8). Moreover, the relatively lower ranking of behavioral and managerial characteristics, although still significant, suggests that while managerial capabilities are important, structural and technological factors may play a more dominant role in shaping financial supply chain outcomes in the context of SMEs.

In terms of contextual conditions, the findings reveal that organizational culture and learning, social capital and communication networks, structural characteristics of firms, infrastructure and support services, and market conditions significantly influence the implementation of financial supply chain strategies. Notably, organizational culture and learning consistently received high importance rankings, indicating that a culture supportive of innovation, transparency, and continuous improvement is essential for adopting sustainable financial practices. This finding corroborates earlier research highlighting the role of organizational capabilities and learning in driving sustainable supply chain performance (3, 9). Similarly, the importance of social capital and networks reflects the need for strong relational ties and collaboration among stakeholders, which facilitate information sharing and reduce uncertainty, consistent with findings reported in resilience-oriented supply chain studies (10, 11).

The analysis of intervening conditions further emphasizes the role of external support mechanisms and environmental stability in shaping financial supply chain outcomes. Government support and policymaking emerged as the most influential intervening factor, highlighting the critical role of regulatory frameworks, financial incentives, and institutional support in enabling SMEs to access financial resources and adopt sustainable practices. This finding is consistent with previous research underscoring the importance of policy interventions and institutional support in promoting sustainable supply chain management (12, 13). Additionally, the significance of alternative and innovative financial resources indicates the growing relevance of non-traditional financing mechanisms such as crowdfunding, venture capital, and fintech solutions in addressing the financing needs of SMEs. These findings align with recent studies emphasizing the role of financial innovation in enhancing supply chain sustainability and resilience (4, 16).

The strategic dimension of the model highlights the importance of diversification of financing sources, digitalization of financial processes, strengthening participation among supply chain members, improving financial and credit risk management, and institutionalizing sustainable development principles. Among these, diversification of financing sources emerged as the most important strategy, reflecting the need for SMEs to reduce dependency on single financing channels and enhance financial flexibility. This result is supported by previous studies that identify diversified financing as a key factor in improving financial resilience and sustainability (1, 5). Furthermore, the emphasis on digitalization of financial processes reinforces the role of technology in enabling efficient and transparent financial management, consistent with the principles of Management 4.0 and digital supply chain transformation (14).

The outcomes identified in the study—improvement of financial performance and liquidity, strengthening financial resilience and sustainability, enhancement of competitive advantage, development of innovation and technological capabilities, and sustainable development and social responsibility—reflect the comprehensive benefits of effective financial supply chain management. The prominence of sustainable development and social responsibility as the highest-ranked outcome indicates that financial supply chain practices not only contribute to economic performance but also support broader societal and environmental objectives. This finding is in line with prior research emphasizing the integration of sustainability into supply chain strategies as a driver of long-term value creation (2, 3). Moreover, the relationship between financial performance and sustainability outcomes highlights the synergistic effects of integrating financial and operational strategies within the supply chain, as also noted in studies on green supply chain management (7, 16).

Overall, the findings of this study contribute to the existing literature by providing a holistic and empirically validated model that integrates multiple dimensions of financial supply chain management. The use of grounded theory and the Delphi technique ensures the robustness and credibility of the results, while the identification and prioritization of components offer practical insights for decision-makers. The study extends previous research by explicitly linking financial supply chain management to sustainable development outcomes in the context of industrial SMEs, thereby addressing a critical gap in the literature.

The findings also highlight the dynamic interplay between internal and external factors in shaping financial supply chain outcomes. While internal capabilities such as organizational culture, technological readiness, and managerial competencies are essential, external factors such as government policies, market conditions, and institutional pressures play a significant moderating role. This interplay underscores the need for a systemic and integrated approach to financial supply chain management, as suggested in earlier conceptual frameworks of sustainable supply chain management (4, 13). Furthermore, the study emphasizes the importance of adaptability and resilience in navigating the uncertainties of the business environment, reinforcing the relevance of resilience-oriented strategies in achieving sustainable performance (10, 11).

Another important implication of the findings is the recognition of digital transformation as a central enabler of sustainable financial supply chain management. The integration of digital technologies not only enhances efficiency and transparency but also facilitates the adoption of innovative financing mechanisms and risk management practices. This aligns with the emerging paradigm of data-driven and technology-enabled supply chain management, which has been identified as a key driver of sustainability and competitiveness in recent studies (8, 14). The findings suggest that SMEs should prioritize investments in digital infrastructure and capabilities to fully leverage the benefits of financial supply chain management.

Despite the significant contributions of this study, several limitations should be acknowledged. The research is based on qualitative data and expert opinions, which may be subject to biases and limitations in generalizability. The sample size, although adequate for qualitative analysis, may not fully capture the diversity of perspectives across different industries and regions. Additionally, the study focuses on industrial SMEs, which may limit the applicability of the findings to other sectors. Future research could address these limitations by employing quantitative methods, larger sample sizes, and cross-sectoral comparisons to validate and extend the proposed model.

Future research should explore the application of the proposed model in different industrial and geographical contexts to assess its generalizability and adaptability. Longitudinal studies could provide insights into the dynamic evolution of financial supply chain practices and their impact on sustainability outcomes over time. Furthermore, integrating advanced analytical techniques such as structural equation modeling or machine learning could enhance the predictive power and explanatory capacity of the model. Researchers may also investigate the role of emerging technologies, such as blockchain and artificial intelligence, in further transforming financial supply chain management and enabling sustainable development.

From a practical perspective, the findings of this study offer valuable guidance for managers, policymakers, and stakeholders involved in supply chain management. Firms should focus on strengthening supply chain integration, enhancing financial transparency, and diversifying financing sources to improve resilience and sustainability. Policymakers should design supportive regulatory frameworks and financial incentives to facilitate access to capital and encourage the adoption of sustainable practices among SMEs. Additionally, investments in digital technologies and capacity building are essential for enabling firms to effectively implement financial supply chain strategies. By adopting a holistic and integrated approach, organizations can enhance their competitiveness, resilience, and contribution to sustainable development.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

1. Amiri A, Heidari SA, Mirabi VR. Value-added model of the petrochemical industry supply chain with a sustainable development approach. Quarterly Journal of Value Creation in Business Management. 2024;4(3):366-88. doi: 10.61838/kman.jtesm.3.2.13.

2. Chaudhuri R, Singh B, Agrawal AK, Chatterjee S, Gupta S, Mangla SK. A TOE-DCV approach to green supply chain adoption for sustainable oper ations in the semiconductor industry. International Journal of Production Economics. 2024;275:109327. doi: 10.1016/j.ijpe.2024.109327.

3. Pakfetrat H, Behboudi O. Green Entrepreneurship on Green Supply Chain Management and Sustainable Performance: An Analysis of the Role of Market Orientation and Knowledge Management Orientation in Mashhad Municipality. Green Development Management Studies. 2023;2(1):139-57.

4. Chakraborty A, Al Amin M, Baldacci R. Analysis of internal factors of green supply chain management: An interpretive structural modeling approach. Cleaner Logistics and Supply Chain. 2023;7:100099. doi: 10.1016/j.clscn.2023.100099.

5. Tarighi R, Razavi SMH. Designing a Risk Management Model for the Sustainable Supply Chain in Iran's Football Club Industry. Sport Management and Development. 2024.

6. Khodadadi Didani HR, Sargolzaei A, Pour Shahabi V. Designing and validating a human resource development model to achieve sustainability in the supply chain in the shipping industry. Supply Chain Management. 2024;26(83):1-15.

7. Rashid A, Baloch N, Rasheed R, Ngah AH. Big data analytics-artificial intelligence and sustainable performance through green supply chain practices in manufacturing firms of a developing country. Journal of Science and Technology Policy Management. 2025;16(1):42-67. doi: 10.1108/JSTPM-04-2023-0050.

8. Rashid A, Baloch N, Rasheed R, Ngah AH. Big data analytics-artificial intelligence and sustainable performance through green supply chain practices in manufacturing firms of a developing country. Journal of Science and Technology Policy Management. 2024.

9. Seyed Nejad Fahim SR. Analyzing the Role of Strategic Management Accounting in Sustainable Supply Chain Management (Case Study: Food Manufacturing Companies in Gilan Province). Green Development Management Studies. 2024.

10. Darom NA, Hishamuddin H. Impacts of Resilience Practices on Supply Chain Sustainability. In: Paul SK, Agarwal R, Sarker RA, Rahman T, editors. Supply Chain Risk and Disruption Management: Latest Tools, Techniques and Management Approaches. Singapore: Springer Nature Singapore; 2023. p. 231-44.

11. Shishehbori A. Presenting a Resilient Supply Chain Management and Its Impact on Sustainable Supply Chain Performance Using Data-Based Method. Studies of Management and Sustainable Development. 2023;3(1):49-70.

12. Salahi N, Sobhani Pour SMR. Investigating the impact of green supply chain management on company performance considering environmental turbulence as a mediating variable (Case study: Food industries of Qom Province). 2023.

13. Jiang M, Jia F, Chen L, Xing X. Technology adoption in socially sustainable supply chain management: T owards an integrated conceptual framework. Technological Forecasting and Social Change. 2024;206:123537. doi: 10.1016/j.techfore.2024.123537.

14. Haleem A, Javaid M, Singh RP, Suman R, Khan S. Management 4.0: Concept, applications and advancements. Sustainable Operations and Computers. 2023;4:10-21.

15. Didehgah Seyed Amir A, Sohrabi T. A model for the management of emerging technology development focused on the sustainability of supply chains in the agricultural industry. Journal of Technology Development Management. 2023;11(4):134-74.

16. Amouei MA, Valmohammadi C, Fathi K. Developing and validating an instrument to measure the impact of digital supply chain activities on sustainable performance. Journal of Enterprise Information Management. 2023;36(4):925-51. doi: 10.1108/JEIM-12-2021-0520.