Sustainable Policies for Supply Chain During the Digital Economic Crisis Due to Epidemics

Yong Su (suyongsam@sina.com)
Law and Public management School

Qinghua Fu
Wuhan University

Ashutosh Sharma
Southern Federal University

Awais Khan Jumani
Ilma University

Research Article

Keywords: supply chain, epidemic, economic crisis, sustainable policy

DOI: https://doi.org/10.21203/rs.3.rs-804189/v1

Sustainable Policies for Supply Chain During the Digital Economic Crisis Due to Epidemics

Yong Su[1,2*], Qinghua Fu[3], Ashutosh Sharma[4], Awais Khan Jumani[5]

[1]Law and Public Management School, 614000, Leshan, Sichuan, China
[2]wuhan University Institute of Boundary And Ocean, 430072, Wuhan, Hubei, china
[3]economics and Management School of Wuhan University, 430072, Wuhan, Hubei, China
[4]institute of Computer Technology and Information Security, Southern Federal University,
[5]ILMA University Karachi, Sindh, Pakistan

[1]suyongsam@Sina.Com（password： 1986ENGLISH-sam）
[2]2016101050084@whu.edu.cn
[3]Qinghua_Fu8549@outlook.com (password ： Smart@12345)
[4]ashutosh@sfedu.ru
[5]awaisjumani@yahoo.com

Abstract

One of the most exciting issues in the digital economy has been sustainability supply chain management. There are many articles on this area and several different viewpoints. This work focuses on assessing the sustainability of supply chain management based on two main measurements. Firstly, the value of ecological, environmental, and social measurement indicators and the extent of the challenge in collecting information. The objective of this article is to improve the precision of the assessment. A Sustainable Policies for Supply Chain Management (SP-SCM)is proposed in this article. The suggested framework is a synthesis of quality function deployment (QFD) with plithogenic set grouping processes.A summation function is applied: the perception of the decision-maker of criteria required to assess the viability of the supply chain, the measurement criteria dependent on the specifications, and the difficulties in collecting details. This research submitted a real-world test case on the sugar industry to test the proposed framework. In evaluating the sustainability of the supply chain policy, the findings revealed the performance efficiency of the proposed system.

Keywords – supply chain, epidemic, economic crisis, sustainable policy

1. Introduction to supply chain

The sustainability of the supply chain (SC) has long become one of the foremost exciting and evolving fields of supply chain management. Researchers have helped to understand the significance of the competitiveness of the supply chain management by influencing industrial practices on climate warming and environmental resource use [1]. Increased competitiveness, globalization, technological innovation, and high consumer demands make each supply chain a considerable objective in any region—a sustainable supply chain. The resilience of the supply chain can be defined as a capacity for operations to maintain economic, environmental, and social wellbeing in the long run [2].

Managing supply chain practices to increase sustainability by considering environmental effects and social factors could become a common concept of supply chain management. The long-term performance and successes of the whole supply chain management are thus guaranteed by supply chain sustainability [3]. The longevity of the supply chain has become an essential target for businesses under the complexity aspect. It is that calculating the sustainability of the supply chain requires identifying potential business choices under different circumstances [4].

A fascinating subject focusing on the economic, health, and environmental scale measurementsare the sustainability assessment of the supply chain. Monitoring the supply chain's performance drives companies towards risk reduction and the following recommendations [5]. The benefits of sustainability assessment of the supply chain are cost savings, increased skills, comparative benefits, and organizational efficiency improvement. The complexities of calculating productivity in the supply chain include lack of inter-organizational benchmarks for management and organizations, diversity of targets and interventions to generate organizations, and difficulties in non-traditional data collection to minimize the SC output [6].

Several studies in the sustainable development of the supply chain include risk and evaluation of resilience of the supply chain, research articles, statistical modeling for efficient supply chain operations, and decision-making systems for the sustainable supply chain [7]. Assessing sustainability in the supply chain is a challenge with multiple decision-making parameters. The measurement metrics should be the criterion, and alternatives should be chosen based onspecific metrics. Some of the drawbacks of SC sustainability analyses are, for example, that authors do not find it hard to locate information for measuring various indicators [8].

Furthermore, only a few research use language variables to assess the metrics, which results in less attention to insecurity or lack of detail. There is a question of preferences of the decision-maker and level of conflict between indicators, which results in less precision [9]. Silvestre et al. suggested a structure for creating the environmental supply chain in the industry [10]. In this study, most of these constraints addressed via the proposed model, which helps pick and weigh the indicators for the supply chain. The framework suggests it builds on integratingplithogenic set grouping activities and the quality functions deployment (QFD).

QFD is one of the foremost common strategies for improving consumer quality. This tool blends all consumer demands in any product area and converts them into technical specifications to fulfillthe standards [11]. QFD has excellent success in many areas, including building systems, calculatingthe quality of service, advancing industries, product growth, and supply selection issues.

Plithogeny relates to the formation of new categories by developing various old entities, conflicting or noncontradictory. Nayak et al. [12] have been introduced as a neutrosophy generalization. A plithogenicset is a collection whose components are characterized by their attributes' attributes, like a generalization of crisp, fuzzy, intuitive, and neutrosophic sets.Each quality has its degree of inconsistency $c(v_j, v_D)$ values between v_j and the (most significant) v_DSuperior value of the dependent variable. The degree of contradiction between parameters helps the model to achieve more precise outcomes. The plithogenic set package, logic, likelihood, and statistics that Rostamzadeh et al. have implemented were generalized from the multimedia, logic, probability, and statistical [13].

The main contributions of the article

- a synthesis of quality function deployment (QFD) with plithogenic set grouping processes
- decision-maker criteria for the evaluation indicators
- measurement criteria dependent variables

The rest of the research as follows. Section 2 deals with the background and literature of the sustainable supply chain. The proposed Sustainable Policies for Supply Chain Management (SP-SCM) is designed and implemented in section 3. The software analysis and performance evaluation are discussed in section 4. The conclusion and future scope are illustrated in section 5.

2. Background to sustainable supply chain

This section classifies the extensive literature survey into two subsections. The first subsection includes the most significant observations with respective works on sustainable supply chain and epidemic have been included. Secondly, the supply chain management frameworks by various researchers have been included.

2.1 Sustainable Supply Chain (SSC) and epidemic

A long-term, diverse mechanism and obstacles for the supply chain partners, resilience is generally regarded as "growth that meets the current issues without sacrificing the capacity for subsequent generations to fulfill the necessities." They have to meet intertwined societal, environmental, and financial goals in the supply chain to establish resilience [14]. Thus, SSC aims to lessen the detrimental effects of activities within the supply chain and enhance organizations' cultural, economic, and environmental efficiency. Corporate companies have started integrating SSC to improve their brand value and credibility.

SSC mitigates uncertainties and threats, such as environmental damage and labor constraints, enhancing market continuity, limiting manufacturing and delivery delays and prices [15]. But many developing economies do not currently have the skills to adapt and incorporate sustainable activities successfully; this is mainly because sustainability science remains underdefined, implemented, and implemented.The above remarks explicitly illustrate the need to address sustainability in the supply chain (SC)s to ensure equity and create opportunities for resilience in developing countries [16]. Growing instability and SSC-related uncertainties have focused on the economy in numerous developed countries, given its competitive markets.

Inappropriate management problems result in significant disruptions in systems and thus economies in the supply chain. It will lead to irreversible disruption to the economy. In several supply chains worldwide, the epidemic led to significanttrouble [17]. These disruptions have a considerable negative impact on sales income, investment returns, procurement plans, brand reputation, availability of products, stakeholder and consumer wellbeing, logistics operation, and supply chain efficiency.

These adverse effects are triggered immediately, from procurement, manufacture, delivery, or distribution, by unavailable supply chain elements [18]. Consequently, supervision of the supply chain operations was particularly complicated since some stages of the supply chain functions were halted.It is impossible to tackle an epidemic with supply chain policies and procedures built for a smooth functioning market climate [19]. Supply chain administrators must now revise policies and procedures for the supply chain. In reality, businesses are fighting in the aftermath of the outbreak to create an SSC far beyond competitiveness. Industry administrators need to follow strategies that contribute to SSC strategies robustlysuggested by Li et al. [20].

Different countries and organizations are focused on helping workers impacted by vaccines, medicines, and effective health care programs to protect their workers and collectively attempt to decrease the harmful impacts of international health. There is aprovision of sufficient personal protection equipment (PPE), including fans, caps, face guards, gowns, hand gloves, and cleaning products [21]. While very few enterprises impacted in the economic emergency have provided a socially distant working climate, population lockdown and alienation have posed obstacles to social survival to avoid disseminating deadly epidemics, extreme deprivation, and economic instability.

The epidemic results have shown that SC's failure tolerance must be re-examined based on survival or viability suggested by Gautam et al. [22]. It should be done to avoid SC and the economic system's failure andefficiently provide products and services. In light of the above difficulties, research on the supply chain must discuss primary factors and their relationship to tackle an epidemic.

2.2 Supply Chain management

As business situations and customers are quickly evolving, the development of end products and services without SSC is unfeasible, and ecological and social problems are changing [23]. The implementation of the SSC will depend on several of the organization's vital indicators (drivers). These operators can make a significant contribution to efficient SSC delivery and can also increase performance and reactivity.

Drivers are also aware that businesses can help to assess their sustainable production SSC interventions [24]. In reality, due to numerous pressures and understanding of vendor cooperation and sourcing tactics, improvements in customer demand and perceptiveness, regulatory enhancements, and the values and policies of organizations, many businesses are beginning to put greater focus on implementing sustainability drivers.

SSC drivers guarantee optimal efficiency both operationally and economically, risk control, rapid reactions to unpredictable conditions, meet demands for profitability, and achieve sustainable activities [25]. The core sustainability factors for the effective adoption of SSC have not received adequate attention in developing economies. The drivers of resilience in dealing with the impact of disasters or epidemics on supply chains must also be investigated. These drivers enable firms to develop sustainable strategies and improve their overall quality in sustainability.

Based on the literature survey, it is found that the available supply chain has some problems in identification and management. A Sustainable Policies for Supply Chain Management (SP-SCM) is proposed to overcome those problems.

3. Proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Continuous growth in the global economy, a strong positive influence on the degree of worldwide welfare, and even a very close relationship with the social forces negatively impact natural factors. The transport industry influences the economic development of a country. It is the significance of the principle of supply chain management practices. Sustainable development as a research area in the production process itself is identified, and three critical financial, environmental and social considerations must be met to ensure sustainability. The following four reasons include the effectiveness or inability to execute a business strategy:

1. Approach of the appropriate firm to compete with companies.

2. Strategy for the supply chain.

3. How to connect business model and strategy for the supply chain.

4. How sustainability will be made feasible.

Supply chain strategy was prominent in the manufacturing and sales development business interests. In implementing the supply chain operations, the essential issue is how it will satisfy consumer requirements. They are very volatile, organizational, and the supply chain's production needs are adapted to and facing up to environmental problems. The corporation typically takes five scopes of judgment.The operation of the supply chain:

1. How does manufacturing apply to any commodity the consumer wants? How quality or

type of goods must be manufactured and when generated?

2. Inventory, which objects in several individual items should be rescued? How much are the standards for raw, semi-finished, and completed products?

3. Where could a manufacturing plant and warehouses be located? Where are the most cost-effective manufacturing plant and storage facilities?

4. Transport, how products or equipment travel from one chain to the next?

5. Knowledge, how much data can be gathered and shared?

6. How quickly and precisely can communication and policymakers have information?

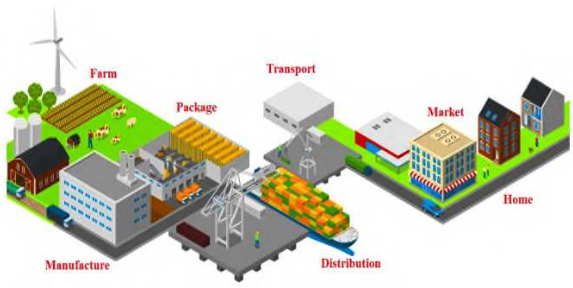

Fig.1. Sustainable supply chain architecture

Fig.1 shows the sustainable supply chain architecture. It contains modules such as farm area, manufacture area, package area, distribution area, transport area, market area, and home. This article proposes a model for assessing the sustainability measurements of the supply chain based on the implementation of efficiency feature rollout and plithogenic set grouping. It incorporates the advantages of the QFD approach to link consumer specifications with the architecture and plithogenic set aggregate operator functions. The utility of this system benefits from the plithogenic grouping process since it guarantees more precise outcomes and takes account in other experiments of the same issue of the level of uncertainty.

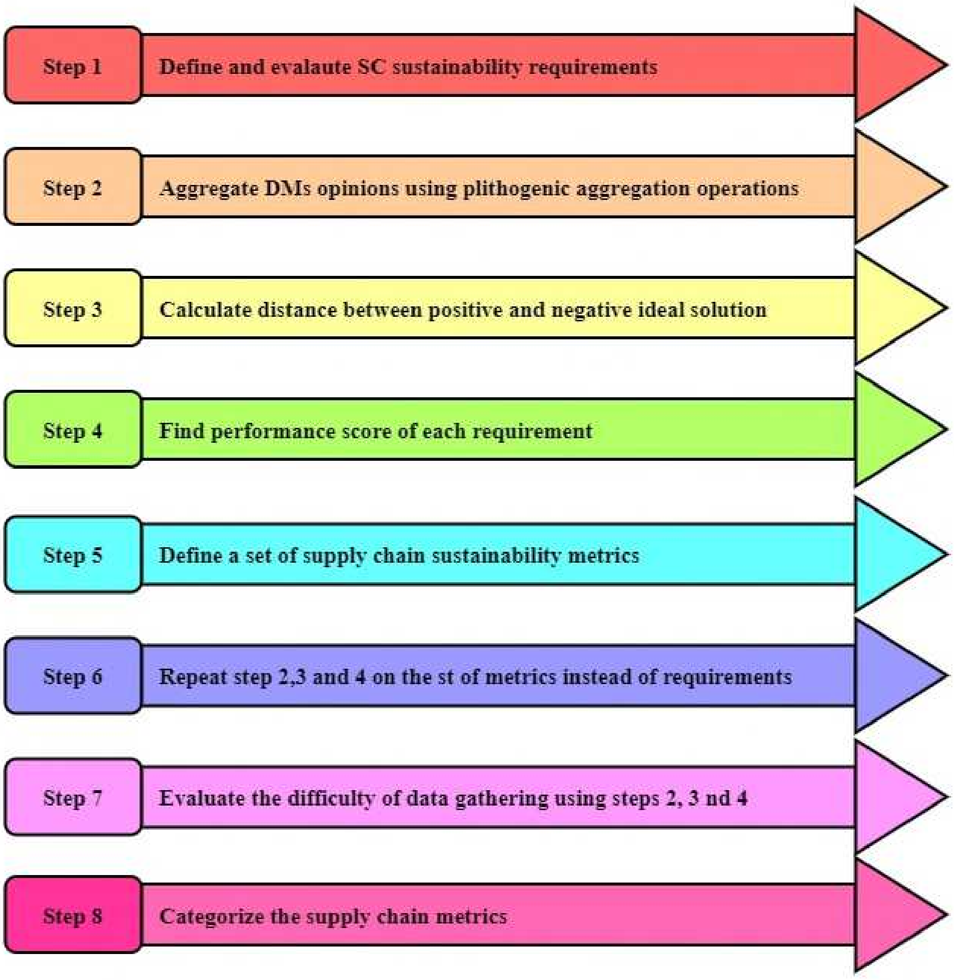

Fig.2. The workflow of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Fig.2 shows the workflow of the proposed Sustainable Policies for Supply Chain Management (SP-SCM). The proposed framework is divided into eight stages, and each step is explained below.

Step 1: The first step is to define a set of criteria for evaluating the viability of the supply chain. The most common sustainability assessment criteria of the supply chain or decision-making (DM)focus on their strategies and other specifications. These criteria should represent a so-called threeindicators economic, social, and environmental function.

- The policymakers calculate the value of each specification using language terminology dependent on the supply chain management.

- To explain the evaluation of each specification by the DM, the language level is set. In this system, the level is proposed as a neutrosophic triangular function.

Step 2: The views of the decision-maker are grouped on the level of conflict of each necessity by plithogenic grouping activities. The precision of the findings improves with this step.

- Find the level of contradictions c of the prevailing specification.

- The intersection of the plithogenicneutrosophic set is expressed in Equation (1):

$$\left((a_{i1}, a_{i2}, a_{i3}), 1 \leq i \leq n\right) \wedge p(b_{i1}, b_{i2}, b_{i3}), 1 \leq i \leq n) = ((a_{i1} \wedge_F b_{i1}, (a_{i2} \wedge_F b_{i2}) + a_{i3} V_F b_{i3}))), 1 \leq i \leq n \tag{1}$$

a_{ij} *and* b_{ij} are denoted the economic and environmental factors of the product. Λ_F *and* $\mathrm{V}_F$are denoted thenormalized average and vector function. In the following expression, the neutrosophic amount is turned into a narrow amount and is expressed in Equation (2)

$$S(a) = \frac{1}{8}(a_1 + b_1 + c_1) \times (2 + \propto - \theta - \beta) \tag{2}$$

$S(a)$ is denoted the neutrosophic function. $a_1, b_1 and\ c_1$ are denotedas the ecological, environmental, and social indicators of the product. $\propto \theta, and\ \beta$ are the respective directional constant of the ecological, environmental, and social indicators.

Step 3: The gap of each criterion from the best and worst answers is identified to determine the best demand considering the collection of parameters.

- The ideal S^+ (positive) answer and the ideal S^- answer (negative) requires description.

- The lower limit (best possible answer) in price specificationsis wanted; the most significant value is the negative answer. Conversely, the peak value is positive, and the lower one is negative in terms of benefit criteria.

- The Euclidean Distance equation is used to distinguish between each specification and the optimal positive and negative answers illustrated in Equations (3) and (4).

$$D_i^+ = \left[\sum_{j=1}^{m} \left(V_i - V_j^+\right)^2\right]^{0.5} \tag{3}$$

$$D_i^- = \left[\sum_{j=1}^{m} \left(V_i - V_j^-\right)^2\right]^{0.5} \tag{4}$$

$D_i^+ \ and\ D_i^-$ are the Euclidian distance of the optimal positive and negative answers. V_i is denoted as the vector value of the particular product. $V_j^+ \ and\ V_j^-$are the vector distance of the optimal positive and negative answers.

- The best approach is the lowest distance from the optimal positive $S^+$the solution, while the worst approach is the optimal negative S^-.

Step 4: Any specification is weighed based on the formula in the performance rating is expressed in Equation (5).

$$P_i = \frac{s_i^-}{s_i^+ - s_i^-} \tag{5}$$

$s_i^+ \ and\ s_i^-$ are denoted the optimal positive and negative answers of the sustainable supply chain indicator. P_i is denoted the performance rating of the system.

- The results are standardized to determine the weight of each condition that fulfills two limitations of $0 \leq w_i \leq 1$ and $\sum w_i = 1$.

Step 5: By examining the currently chosen conditions of step 1, the decision-makers identify a mixture of steps. Some economic measures include cost savings, acquisition expenses, environmental benefits, quality of operation, or revenue. Ecological indicators include environmental regulations, waste collection, emissions of air pollutants, waste products, and water use. After this, socioeconomic decreases have working environments, job happiness, ties with the administration, employee education, and lifestyle.

- The DMs describe the relationship between each indicator and linguistically illustrate each necessity.

Step 6: The assessment metrics are repeated in steps 2–4. The plithogenic aggregation procedure, as in Step 2, combines the opinions of all policymakers on given metrics. Equations (2) and (3) are then used to determine the interval between best and worst answers for any metric. Due to the results as in Equation (4), the value of each indicator is calculated.

Step 7: Discuss the shortcomings of other experiments that do not consider the complexity of the collection of data of each parameter. In this stage, the complexity of the three dimensions in terms of accessibility of data, human capital, and time for evaluation, and other necessary resources are assessed.

The evaluation metrics data collection based on the linguistic parameters is tested on the three dimensions described.

- The evaluation based on the level of contradiction to achieve outcomes consistency is grouped, and its little value is then sought.

- Their data collection problem success ranking is dependent on the distance between positive and negative solutions.

Stage 8: In this final section, the objective is to classify the number of sustainable practices in the supply chain.

- The level of efficiency in Step 4 (the value of each metric) is standardized in the manner suggested in Equation and Step 7 (the complexity of data collection). The standardized value is expressed in Equation (6)

$$v_n = \frac{1}{1+e^{-\frac{v-\bar{v}}{\sigma v}}} \tag{6}$$

The standardized value is v_n ,$v - \bar{v}$ is the average, the default variance of is σ_v.The outcome of sustainability assessment measurements in the supply chain is classified by the significance and complexity of data collection.

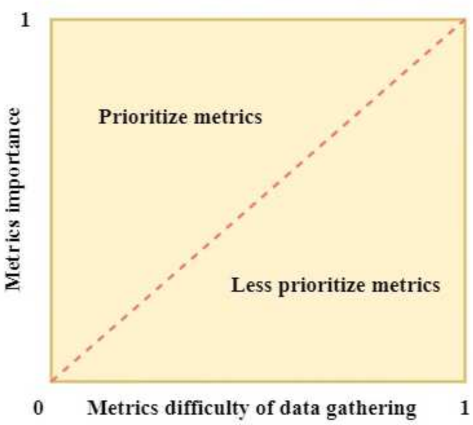

Fig.3. Important metrics classification of the proposed framework

Fig.3 shows the essential metrics classification of the proposed framework. The graph is plotted for the metric difficulty of data gathering to metrics importance. The normalized value is plotted in the above chart. The low prioritize metrics will locate at the lower part of the graph, and higher prioritized metrics are situated on the top of the graph.

Quality function deployment (QFD)

Quality function deployment (QFD), rather than just quality management in production systems, measures quality for enhancement and development. The QFD approach is the relationship between consumer voice and conception requirements to answer these demands efficiently. QFD components are shown below:

• Region (1): The cliental needs (what region) consisting of two variables: the client's needs and the value of the independent variables.

• Region (2): Consistency or design features (how region) consist of two sections: design requirements and production method.

• Region (3): connection of consumer needs to design parameters (what vs. region) $C_{ij} = \{0,1,3,\cdots,9\}$.

• Region (4): This area combines the importance, approval, and score of the concept requirement is expressed in Equation (7)

$$S_j = \sum_{i=0}^{I} \propto_i * C_{ij} \tag{7}$$

The weight of the system is denoted as $\propto_i$ and the combination of importance and approval is expressed as C_{ij}. The score of the proposed system is denoted as S_j.

• Region (5): the contrast and meeting of client's requirements between the commodity and competitors.

• Region (6): the contrast and the impact of the change between model descriptions.

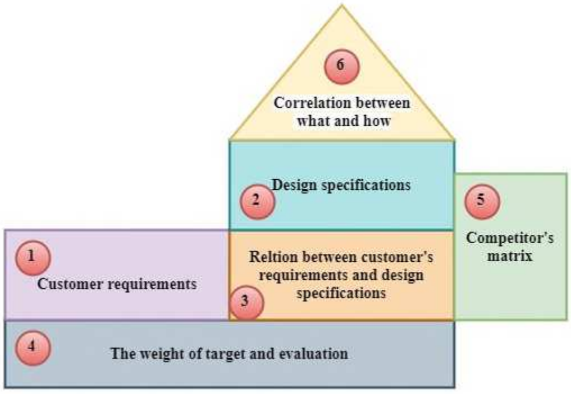

Fig.4. QFD architecture of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Fig.4 shows the QFD architecture of the proposed Sustainable Policies for Supply Chain Management (SP-SCM). The architecture is divided into six regions. The regions contain customer requirements, design specifications, the relation between customer's needs and design specifications, weight of target and evaluation, competitor's matrix, correlation index, etc. These indicators are used in the proposed system design.

Case study

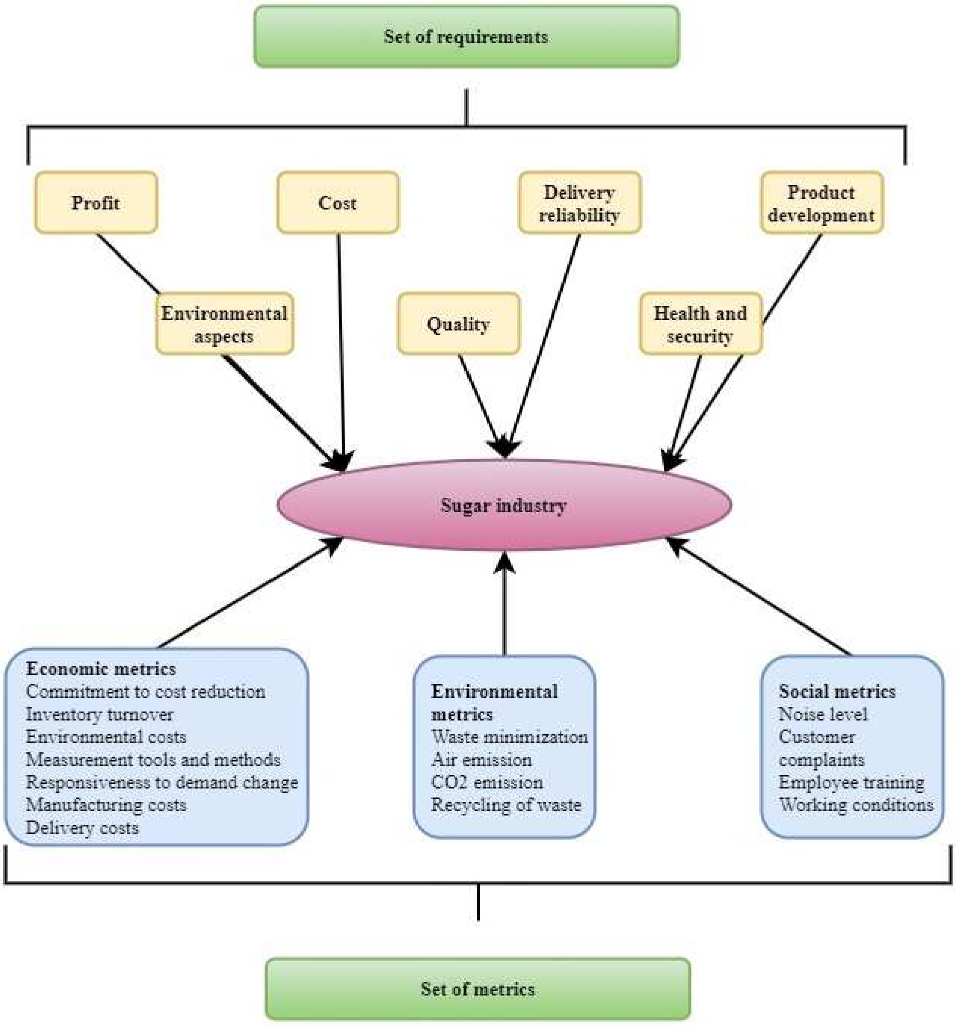

Fig.5. The architecture of the proposed Sustainable Policies for Supply Chain Management (SP-SCM) in the sugar industry

Fig.5 shows the architecture of the proposed Sustainable Policies for Supply Chain Management (SP-SCM) in the sugar industry. A framework for the sugar industry to evaluate the overall viability of the supply chain has highlighted the developed framework. One of the most significant economic foundations is the sugar industry. In this framework, the viability of sugar industries was assessed by four decision-makers (DMs) who had experienced solving such situations. They have expertise in production (DM1), quality management (DM2), financing (DM3), and acquisition (DM4).

The primary aim of this scenario is to assess the sustainability indicators of the sugar production supply chain based on its importance and level of data collection. Initially, a set of seven criteria were defined by the critical representatives for sustainability assessment of the sugar industry. It includes profit (R1), expense (R2), assurance (R3), development of products (R4), environmental issues (R5), consistency of products (R6), health and safety (R7).

- The specifications of the DMs are calculated as a triangular neutrosophic value based on linguistic parameters.
- As discussed in Step 2, all decision-makers judgments on conditions depend on each of them. Aplithogenic accumulation process is used for combined contradiction grades.
- The accumulation outcomes and their crisp quality are then found by Equation (2) and Equation (3).
- Steps 3,4 and Euclidean length as in Equations (4) show the size of the perfect positive and negative answers; a level of efficiency is calculated in Equation (5) to find the linear function of the seven conditions.
- Regarding the environmental and social dimensions, the decision-makers identify several sustainable supply chain indicators. The DMs then test them based on linguistic parameters.
- The drawbacks of neglecting each metric's difficulties in collecting data are discussed. In this phase, decision-makers analyze the problems in three areas: access to knowledge, human services and appraisal time, and other services.
- The assessments of policymakers were grouped with a plithogenic grouping. To determine the length of any metric between the ideal positive and the optimal negative answer, equations (3) and (4) are included. Equation (5) was then utilized for calculating the degree of efficiency.
- Equation (6) finally standardized the efficiency rating, which applies to metrics and data collection difficulties.
- It indicates the supply chain for the sugar industry sustainable indicators delivery, classified by the four-decision producer in three priority metrics and fewer priority indicators.

The proposed Sustainable Policies for Supply Chain Management (SP-SCM) is designed and evaluated in this section. The proposed framework contributes a synthesis of quality function deployment (QFD) with plithogenic set grouping processes, decision-maker criteria for the evaluation indicators, and measurement criteria dependent variables.

4. Software analysis and performance evaluation

The proposed system for the sugar industry to evaluate the overall viability of the supply chain has highlighted the developed framework. One of the most significant economic foundations is the sugar industry. In this framework, the viability of sugar industries was assessed by four decision-makers (DMs) who had experienced solving such situations. They have expertise in production (DM1), quality management (DM2), financing (DM3), and acquisition (DM4). The primary aim of this scenario is to assess the sustainability indicators of the sugar production supply chain based on its importance and level of data collection. Initially, a set of seven criteria were defined by the critical representatives for sustainability assessment of the sugar industry. It includes profit (R1), expense (R2), assurance (R3), development of products (R4), environmental issues (R5), consistency of products (R6), health and safety (R7).

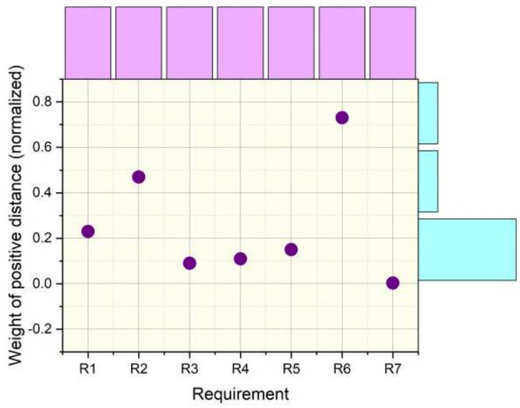

Fig. 6(a). Weight of the positive distance analysis

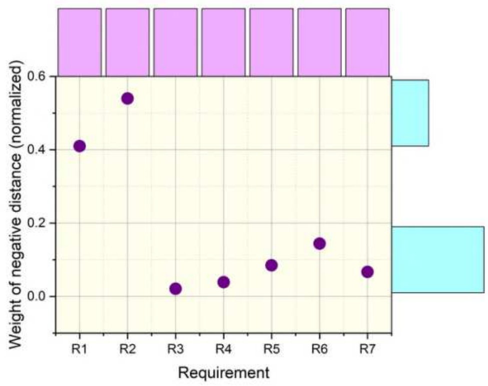

Fig.6(b). Weight of the negative distance analysis

Fig.6(a) and 6(b) show the weight of the positive distance and negative distance analysis of the proposed Sustainable Policies for Supply Chain

Management (SP-SCM), respectively. There are seven metrics such as profit (R1), expense (R2), assurance (R3), development of products (R4), environmental issues (R5), consistency of products (R6), health and safety (R7) are considered for the simulation analysis. Their predicted positive and negative distance are measured and plotted in the above figures. The results show that the proposed system has the highest performance in all indicators.

Table 1. Data analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Metrics	Importance (normalized)	Difficulty of data collection (normalized)
1	0.82	0.26
2	0.18	0.43
3	0.92	0.17
4	0.34	0.34
5	0.38	0.20
6	0.57	.47
7	0.38	0.71
8	0.47	0.74
9	0.34	0.54
10	0.31	0.22
11	0.73	0.82
12	0.33	0.69
13	0.45	0.45
14	0.66	0.76
15	0.75	0.56

Table 1 shows the data analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM). There are 15 metrics considered for the data collection and identification. The importance of collecting data and difficulty of data collection are calculated, and the result is tabulated in the above table. The results show that the higher the priority, the lower the difficulty of data collection. These two indicators are inversely related to each other.

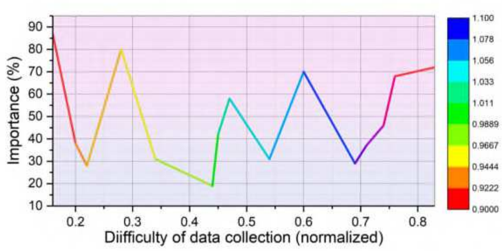

Fig.7(a). Data collection and importance analysis

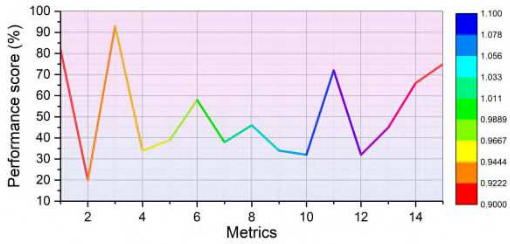

Fig.7(b). Performance score of the metrics

Fig.7(a) and 7(b) show the data collection importance and performance score of the proposed Sustainable Policies for Supply Chain Management (SP-SCM), respectively. The difficulty and importance of the data are calculated and plotted in the above figure. The performance score of the 15 data indicators is measured, and the result is plotted. The results show that the proposed Sustainable Policies for Supply Chain Management (SP-SCM) has the highest performance score in all the data indicators irrespective of the importance and difficulty level of data collection.

Table 2. Supply analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Sector	Supply (%)
Manufacture	24
Automobile	18
Food	11
Chemical	11
IT	11
Electronics	11
Transport	8
Textile	6
Marine	6
Energy	6

Table 2 shows the supply analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM). The product from different sectors such as Manufacture, Automobile, Food, Chemical, IT, Electronics, Transport, Textile, Marine, and Energy are considered for the simulation analysis. The respective supply of those products is monitored using the proposed Sustainable Policies for Supply Chain Management (SP-SCM). The results show that the proposed Sustainable Policies for Supply Chain Management (SP-SCM) efficiently manages the supply of all products.

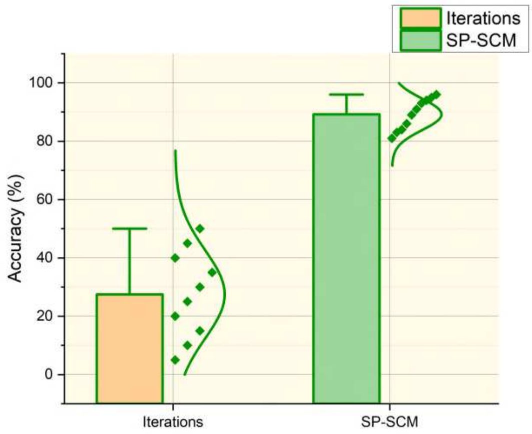

Fig.8(a). Accuracy analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

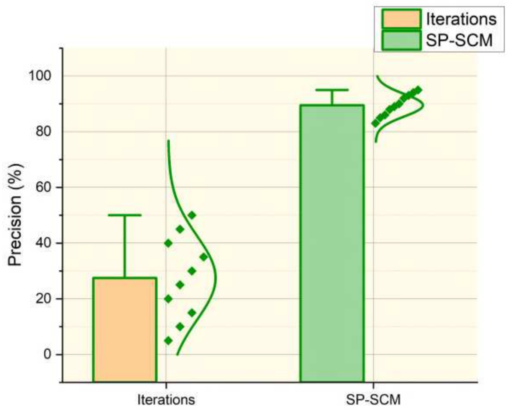

Fig.8(b). Precision analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM)

Fig.8(a) and 8(b) show the accuracy and precision analysis of the proposed Sustainable Policies for Supply Chain Management (SP-SCM), respectively. The accuracy is calculated as the ratio of the supply to the demand of the products. The precision is calculated as the ratio of delivered products to the total demanded products. As the number of iterations increases, the respective accuracy and precision of the proposed Sustainable Policies for Supply Chain Management (SP-SCM) further increases.

The proposed Sustainable Policies for Supply Chain Management (SP-SCM) was designed and implemented. The software outcomes, such as precision, accuracy, supply (%), performance score, data importance, the difficulty level of data collection, etc.,were analyzed. The results showed that the proposed Sustainable Policies for Supply Chain Management (SP-SCM) had the highest performance in all the scenarios.

5. Conclusion and future scope

The importance of sustainable development in the supply chain wasenhanced because of the community's government demands and significant burdens. One of the critical consequences for resource-saving and effective operation of the supply chain processes was sustainable production. It illustrated why sustainable supply chain management became one of organizations' leading competitive tactics. The proposed Sustainable Policies for Supply Chain Management (SP-SCM)usedplithogenic accumulation activities efficiently with the quality function approach. The findings were more accurate and the policymakers had evaluated.

Real contribution from this suggested framework:

- The critical input from this proposed paradigm is the accuracy of policy makers' analysis depending on the level of contradiction when implementing grouping.
- DMs may examine multiple expert viewpoints to optimize the effectiveness of decision-making by plithogenic accumulation.
- It also tests the resilience of the supply chain based on two main factors, the importance of the indicators and the degree of complexity of the collection of results.
- The use of a triangle neutrosophic language scale to assess requirements, measurement, and access to information increased the extent of consideration of complexity. The three objective levels of decision-making in positive, negative, and borderline areas were confirmed to be the best representative.
- The suggested approach is practical and has a high level of sensitivity in decision-making issues, so it is a perfect instrument that can help companies estimate consumer demands and evaluate the sustainable development demands of the distribution chain.
- This framework will test other supply chain techniques to determine their viability in future study directions. It may be integrated with other methods to assess the sustainability of the supply chain. Finally, the significance and complexity of collecting knowledge to assess sustainable supply chains should be extended to further assessment measurements.

6 Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

- **Conflict of Interest**

  All authors declare that they have no conflict of interests.

- **Informed consent**

  Informed consent was obtained from all individual participants included in the study.

References

1. Sarkis, J. (2020). Supply chain sustainability: learning from the COVID-19 pandemic. *International Journal of Operations & Production Management*.
2. Dhote, S., Vichoray, C., Pais, R., Baskar, S., & Shakeel, P. M. (2019). Hybrid geometric sampling and AdaBoost based deep learning approach for data imbalance in E-commerce. Electronic Commerce Research, 1-16. https://doi.org/10.1007/s10660-019-09383-2
3. Hybrid geometric sampling and AdaBoost based deep learning approach fordata imbalance in E-commerce S Dhote, C Vichoray, R Pais, S Baskar, PM Shakeel Electronic Commerce Research 20 (2), 259-274
4. Concurrent service access and management framework for user-centric futureinternet of things in smart cities P Gomathi, S Baskar, PM Shakeel Complex & Intelligent Systems
5. Prasad, S. K., Rachna, J., Khalaf, O. I., & Le, D. N. (2020). MAP MATCHING ALGORITHM: REAL TIME LOCATION TRACKING FOR SMART SECURITY APPLICATION. Telecommunications and Radio Engineering, 79(13).
6. Shuwandy, M. L., Zaidan, B. B., Zaidan, A. A., Albahri, A. S., Alamoodi, A. H., Albahri, O. S., &Alazab, M. (2020). mHealth Authentication Approach Based 3D Touchscreen and Microphone Sensors for Real-Time Remote Healthcare Monitoring System: Comprehensive Review, Open Issues and Methodological Aspects. Computer Science Review, 38, 100300.
7. Hu, S., Fu, Z., Jackson Samuel, R. D., &Anandhan, P. (2020). Application of active remote sensing in confirmation rights and identification of mortgage supply-demand subjects of rural land in Guangdong Province. European Journal of Remote Sensing, 1-9.
8. Gao, Q., Guo, S., Liu, X., Manogaran, G., Chilamkurti, N., &Kadry, S. (2020). Simulation analysis of supply chain risk management system based on IoT information platform. Enterprise Information Systems, 14(9-10), 1354-1378.
9. Tayal, A., Solanki, A., Kondal, R., Nayyar, A., Tanwar, S., & Kumar, N. (2020). Blockchain-based efficient communication for food supply chain industry: Transparency and traceability analysis for sustainable business. International Journal of Communication Systems, e4696.
10. Orjuela, K. G., Gaona-García, P. A., & Marin, C. E. M. (2021). Towards an agriculture solution for product supply chain using blockchain: case study Agro-chain with BigchainDB. Acta Agriculturae Scandinavica, Section B—Soil & Plant Science, 71(1), 1-16.
11. Xu, X., Chen, Y., Zhang, J., Chen, Y., Anandhan, P., & Manickam, A. (2020). A novel approach for scene classification from remote sensing images using deep learning methods. European Journal of Remote Sensing, 1-13.
12. Nayak, R., Akbari, M., & Far, S. M. (2019). Recent sustainable trends in Vietnam's fashion supply chain. *Journal of Cleaner Production*, *225*, 291-303.
13. Bandaragoda, T., Adikari, A., Nawaratne, R., Nallaperuma, D., Luhach, A. K., Kempitiya, T., ... &Chilamkurti, N. (2020). Artificial intelligence based commuter behaviour profiling framework using Internet of things for real-time decision-making. Neural Computing and Applications, 1-15.
14. Al-Turjman, F., &Deebak, B. D. (2020). Privacy-Aware Energy-Efficient Framework Using the Internet of Medical Things for COVID-19. IEEE Internet of Things Magazine, 3(3), 64-68.
15. "Shankar, A., & Natarajan, J. (2017). Base station positioning in wireless sensor network to aid cluster head selection process. International Journal of Intelligent Engineering and Systems, 10(2), 173-182."
16. Bilandi, N., Verma, H. K., &Dhir, R. (2020). AHP–neutrosophic decision model for selection of relay node in wireless body area network. CAAI Transactions on Intelligence Technology, 5(3), 222-229. doi:10.1049/trit.2020.0059
17. Sathishkumar, V. E., Venkatesan, S., Park, J., Shin, C., Kim, Y., & Cho, Y. (2020, April). Nutrient Water Supply Prediction for Fruit Production in Greenhouse Environment Using Artificial Neural Networks. In BASIC &

CLINICAL PHARMACOLOGY & TOXICOLOGY (Vol. 126, pp. 257-258). 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY.

18. Daú, G., Scavarda, A., Scavarda, L. F., & Portugal, V. J. T. (2019). The healthcare sustainable supply chain 4.0: The circular economy transition conceptual framework with the corporate social responsibility mirror: s*ustainability*, *11*(12), 3259.
19. Yadav, G., Luthra, S., Jakhar, S. K., Mangla, S. K., & Rai, D. P. (2020). A framework to overcome sustainable supply chain challenges through solution measures of industry 4.0 and circular economy: An automotive case. *Journal of Cleaner Production*, *254*, 120112.
20. Li, Y., &Mathiyazhagan, K. (2018). Application of DEMATEL approach to identify the clear indicators towards sustainable supply chain adoption in the auto components manufacturing sector. *Journal of cleaner production*, *172*, 2931-2941.
21. Pavlov, A., Ivanov, D., Pavlov, D., &Slinko, A. (2019). Optimization of network redundancy and contingency planning in sustainable and resilient supply chain resource management under conditions of structural dynamics. *Annals of Operations Research*, 1-30.
22. Gautam, P., Kishore, A., Khanna, A., &Jaggi, C. K. (2019). Strategic defect management for a sustainable green supply chain. *Journal of Cleaner Production*, *233*, 226-241.
23. Gómez-Luciano, C. A., Domínguez, F. R. R., González-Andrés, F., & De Meneses, B. U. L. (2018). Sustainable supply chain management: Contributions of supplies markets. *Journal of cleaner production*, *184*, 311-320.
24. Zimon, D., Tyan, J., &Sroufe, R. (2019). Implementing sustainable supply chain management: reactive, cooperative, and dynamic models. *Sustainability*, *11*(24), 7227.
25. Meherishi, L., Narayana, S. A., & Ranjani, K. S. (2019). Sustainable packaging for supply chain management in the circular economy: A review. *Journal of cleaner production*, *237*, 117582.