Adoption of Sustainable Supply Chain Enablers : A Construction Industry Perspective

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Abstract

Organizations pledge to adhere to sustainability standards globally. The adherence to sustainability ensures businesses contribute to the country's development, environment, and long-term societal values. Sustainable supply chain (SSC) has been receiving more focus from regulators, practitioners, and academicians nowadays. Among other industries, the building and construction industry has been accountable for using excessive resources and destroying the environment by producing pollution. The non-compliance to adopt sustainability creates barriers for the construction industry to implement SSC, which academia has given little attention to. The proposed research work is a critical study toward identifying SSC enablers in the construction industry and attempting to derive a causal relationship to evolve key enablers for SSC adoption based on hybrid MCDM methods. The novelty of the current work is the identification of key enablers in adopting SSC, and the interrelationship between enablers is of its first kind to be used for SSC. A case example was undertaken to find key enablers of sustainable procurement management in the construction supply chain to validate the proposed work. This study reveals that the obligation of an organization to adopt sustainable procurement management practices; government regulation to adopt sustainable procurement management practices; high incentive schemes for construction organizations in implementing sustainable procurement management practices; lower, middle, and top management involvement in adopting sustainable procurement practices; and sufficient checks and controls in adopting sustainable procurement management practices are the key enablers to be adopted by the businesses to achieve their sustainable goals.

Keywords : **sustainable supply chain, construction industry, sustainable enablers, Fuzzy Delphi, Fuzzy DEMATEL**

JEL Classification Codes : C4, D7, D8

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A supply chain comprises parties who want to satisfy consumers' needs by supplying products or services to maximize profit (Hassini et al., 2012). The pace of the global population has extensively stressed natural resources and poses many social, economic, and environmental problems. Thus, organizations are bound to regulators, stakeholders, and conscious consumers to adopt sustainability in their respective supply chains (Memari et al., 2019). Yu and Hou (2016) proposed a model based on modified multiplicative AHP in which green suppliers have been selected. Their proposed model also provided a solution to the alternative rank reversal problem. A Pythagorean fuzzy analytical hierarchy process framework was proposed to evaluate enablers of sustainable supply chain innovation for the Indian manufacturing industry by Shete et al. (2020). Sustainability

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is considered an element essential to be adhered to by businesses nowadays. Therefore, academicians and businesses shifted their focus on sustainability to define it from various angles depending on the research gaps. Sharma and Mathur (2022) proposed eight themes to define sustainability for startups.

Scholars attempted to address to adopt sustainable supply chains in many ways. Menon and Ravi (2021) proposed MICMAC to address barriers to sustainable supply chain management in the electronics industry. Among many less sustainable sectors, the Indian construction sector is one of the areas where sustainable procurement supply chain management is practiced marginally. To fill this gap, we propose research to investigate by identifying key enablers of sustainable procurement supply chains in the Indian construction industry. The proposed research work is a hybrid framework of Fuzzy Delphi and Fuzzy DEMATEL, where the Fuzzy Delphi method has been used for finalizing relevant enablers to be adopted in the sustainable procurement of the supply chain of the Indian construction industry. The Fuzzy DEMATEL technique has determined interrelationships between dependent and independent sustainable supply chain enablers. The Fuzzy DEMATEL technique synthesizes the key and independent elements for the analyst to be adopted in a system. The Fuzzy DEMATEL offers independent enablers which influence dependent enablers to adopt sustainable procurement supply chains in the construction industry.

Literature Review

With the rapid growth of population and technology, industries show growing trends toward producing more products and utilities to satisfy the needs of consumers. The organizations turned to exhaust natural resources limitlessly to satisfy the diverse needs of consumers with the principal aim of maximizing their profits. The harmful effects on social and environmental spheres are the main cause for organizations adopting a sustainable supply chain (Asadi et al., 2020). The countries' governments emphasize that businesses adopt social, economic, and environmental sustainability in their supply chains. Researchers adopt various MCDM models to solve the research problems. When barriers are overcome, they turn up as enablers. Ershadi et al. (2021) proposed a study on barriers to a sustainable procurement management supply chain under five heads. Rezaei (2015) proposed the best-worst method (BWM) to solve an MCDM technique involving the selection of a mobile phone based on the decision maker's judgment. Chen et al. (2020) developed a hybrid technique for smart supply chains using DEMATEL TOPSIS in a fuzzy state. Munny et al. (2019) investigated social sustainability enablers in the footwear supply chain in Bangladesh using BWM. Sustainability encompasses those activities where the organization's supply chain utilizes renewable resources without causing damage to the environment. Industrialization has pushed companies to adapt to low-carbon economies while Indian companies overcome environmental threats and grab opportunities that lie ahead in low-carbon developments (Dutta & Roy, 2014). Research conducted by Vazifehdan and Darestani (2019) revealed that convenient and appropriate logistics services were highly preferred when green logistics needed to be outsourced.

Sustainability is becoming a focused research area. Many authors have expressed the need to consider sustainability in future research studies to share environmental responsibility between stakeholders in the supply chain. Many authors have identified ways to adopt a sustainable supply chain. Hendiani et al. (2022) selected a socially sustainable enabler to emphasize employment rights. Kannan et al. (2015) considered stakeholder rights as a socially sustainable sub-enabler in their study of green supplier selection. The following social sub-dimensions (enablers) — disclosure of information, health and safety, forced-child labor, staff training, adherence to law and policy, and influence on the local community— were proposed by Zhou and Xu (2018), Sarkis and Dhavale (2015), Zimmer et al. (2016), and Kannan (2018). Sarkis and Dhavale (2015) and Zhou and Xu (2018) were also credited for including delivery reliability and supply capacity as economic sub-dimensions in their respective study of sustainable enablers. In a resilient supply chain, the utmost emphasis was laid on a relationship in the supply chain between the supplier and procuring company. Hence, keeping this economically sustainable enabler in view, Rajesh and Ravi (2015) proposed relationship conditions and flexibility as a sustainable sub-dimension (enabler) in the grey relational analysis approach in adopting supply chain enablers. Mahdiloo et al. (2015) considered environmental competence as an enabler in their supply chain study. Xu et al. (2019) assessed the sustainability of the construction sector in various regions of China. They concluded that most of its Eastern regions had benefited from social, economic, and environmental perspectives. Kannan (2018) studied critical success factors in supply chain management for selecting sustainable suppliers in the Indian textile industry. The author argued that the most influential success factor was the social dimension, and the fifth influential factor was the environmental dimension.

There are instances when decision-makers differ in their opinions regarding certain criteria. Expert approval is sought through consensus using the Delphi method. Murray et al. (1985) introduced the Fuzzy Delphi method. The advantage of using the Fuzzy Delphi method is identifying the key criteria through only one round of questionnaires. In addition, the introduction of fuzziness overcomes the vagueness associated with human responses (Ishikawa et al., 1993). Giri et al. (2022) applied the Pythagoras fuzzy set on the DEMATEL method to solve sustainable supplier selection in supply chain management. Chauhan et al. (2020) used ISM and MICMAC analysis while studying 21 sustainable enablers in supply chains and concluded that delivery, service, eco-design, and rights of stakeholders had high enabling characteristics but low dependence powers. Limited literature is available in identifying SSC enablers in the construction industry. The proposed methodology has been used to screen and finalize SSC enablers with the help of the Fuzzy Delphi technique. The Fuzzy DEMATEL method is employed to identify interrelationships among the finalized SSC dependent and independent enablers in order to identify the independent enablers (key enablers) that have the power to influence dependent enablers in the decision-making process.

Framework for the Proposed Methodology

The methodology has been studied in three phases. The first phase is devoted to an extensive literature survey toward identifying sustainable enablers in supply chain management. During the second phase, all the identified sustainable supply chain enablers were thoroughly discussed with decision makers (industrial practitioners) and finally selected with the help of the Fuzzy Delphi technique. In the third phase, the Fuzzy DEMATEL method is used to identify cause-and-effect relationships among chosen sustainable supply chain enablers. Thus, key enablers have to be identified in sustainable supply chain management. The whole process can be summarized in the framework diagram shown in Figure 1.

For clarity, the methodology of the proposed work has been represented in the flow diagram, as shown in Figure 2.

Figure 1. ***Framework for the Proposed Research Work***

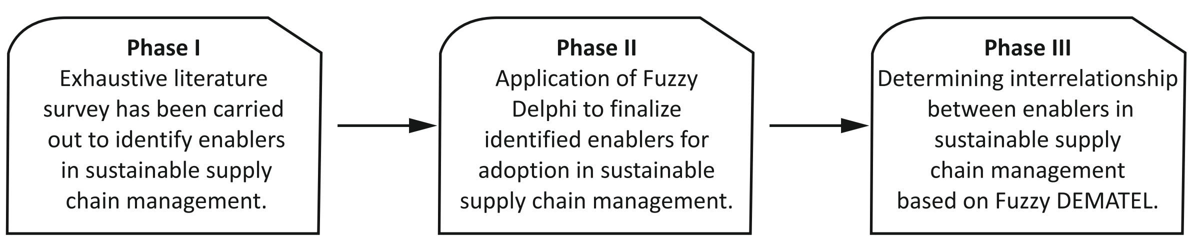
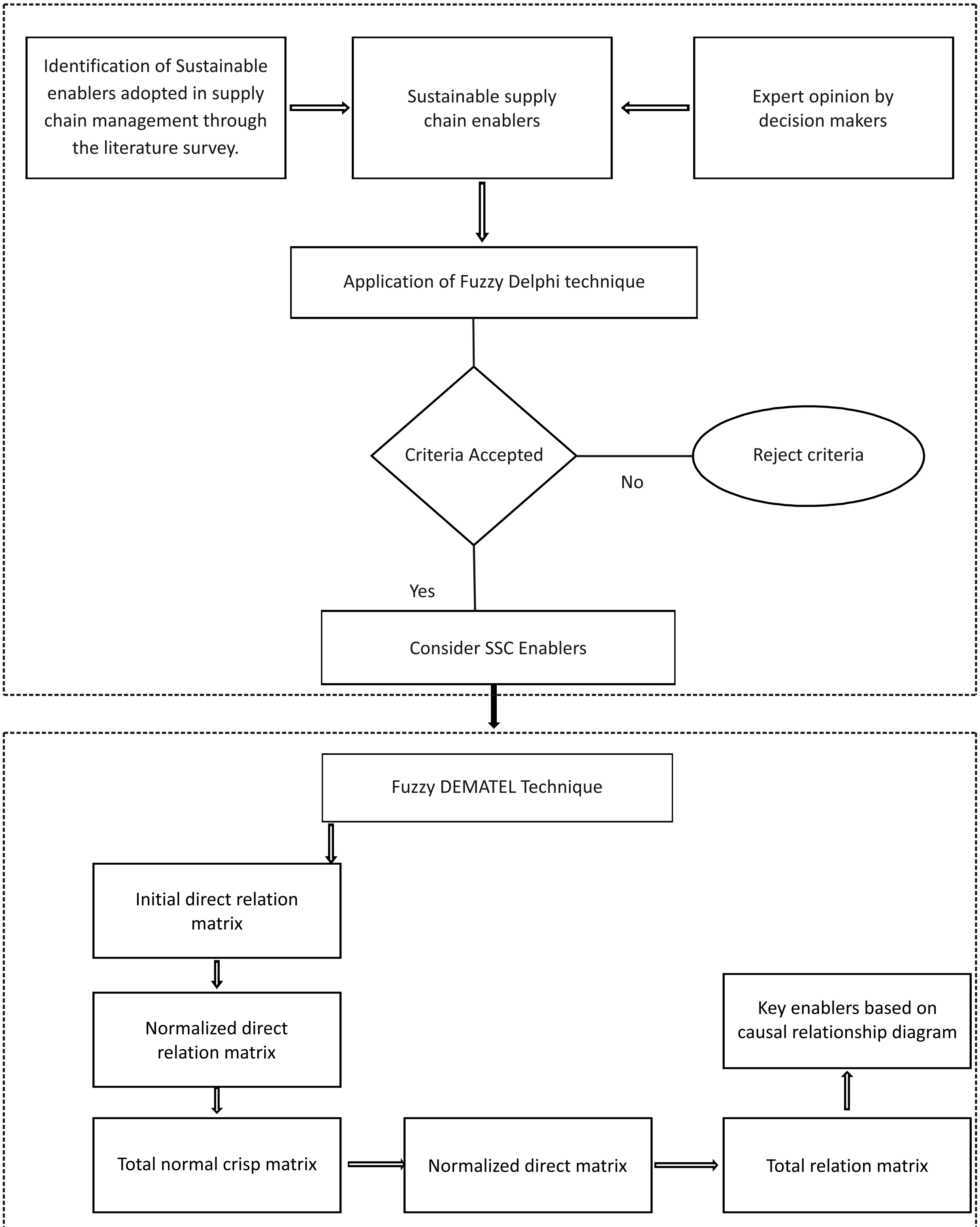


Figure 2. *Flow Chart Showing Identification of Key Enablers for Adoption of Sustainable Supply Chain*



Some Definitions

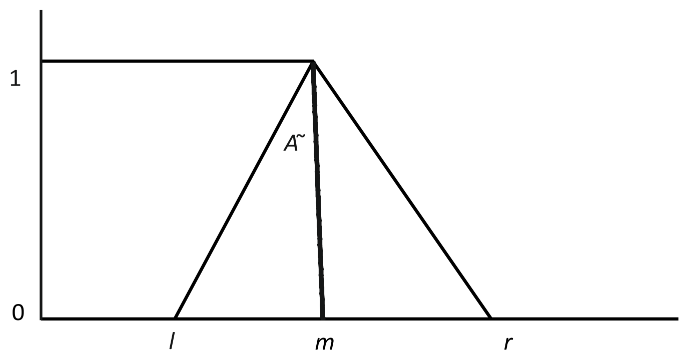
Fuzzy Set Theory

Zadeh, in 1965, introduced the Fuzzy set theory to address uncertainty on account of the decision maker's perceptions and knowledge of the subject at the data stages. In this concept, different linguistic variables are considered using the membership function.

Triangular Fuzzy Number (TFN)

The Fuzzy set theory uses a membership function concept. A TFN $\tilde{A}$ is a combination of three numbers in the form of (l, m, r) and a membership function $\mu_{\tilde{A}}$ is defined as :

Figure 3. ***Triangular Fuzzy Number*** $\tilde{A}$



A triangular fuzzy number is demonstrated in Figure 3, and the relationship of a triangular fuzzy concept is given as :

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x \leq l \\ x - l/m - l, & l < x \leq m \\ r - x/r - m, & m < x \leq r \\ 0, & x \geq r \end{cases}$$

A Fuzzy number is a general concept representing a possible set of value weighting between 0 and 1. Fuzzy numbers are used to address the vagueness of data on account of decision makers in their decision processes. Defuzzification is required for converting the fuzzy set into a suitable crisp value. Initially, replacing fuzzy set is replaced by a crisp set, and finally, the crisp set is replaced by a single value (Roventa & Spircu, 2003). Opricovic and Tzeng (2003) proposed converting Fuzzy numbers into Crisp Scores (CFCS) to obtain better crisp values.

Let $A_{ij} = (l^n_{ij}, m^n_{ij}, r^n_{ij})$ is the degree of criterion i that affects criterion j and fuzzy questionnaires n, (n = 1, 2, 3, ……h)., The following algorithm is followed to convert fuzzy data into crisp scores:

Stage 1. Normalization

$$xr^n_{ij} = r^n_{ij} - min\, l^n_{ij})/\Delta^{max}_{min}, xm^n_{ij} = (m^n_{ij} - min\, l^n_{ij})/\Delta^{max}_{min}$$

$$xl^n_{ij} = l^n_{ij} - min\, l^n_{ij})/\Delta^{max}_{min}, \text{Where } \Delta^{max}_{min} = max\, r^n_{ij} - min\, l^n_{ij} \qquad (1)$$

Stage 2. Compute right (rs) and left (ls) normalized values :

$$xrs^n_{ij} = xr^n_{ij} / (1 + xr^n_{ij} - xm^n_{ij}) \, , xls^n_{ij} = xm^n_{ij} / (1 + xm^n_{ij} - xl^n_{ij}) \quad (2)$$

Stage 3. Compute total normalized crisp values:

$$x^n_{ij} = [xls^n_{ij} (1 - xls^n_{ij}) + xrs^n_{ij} * xrs^n_{ij}] \, / \, [1 - xls^n_{ij} + xrs^n_{ij}] \quad (3)$$

Stage 4. Compute crisp values:

$$Z^n_{ij} = minl^n_{ij} + x^n_{ij} * \Delta^{max}_{min} \quad (4)$$

Stage 5. Integrate crisp values:

$$Z_{ij} = 1/h(Z^1_{ij} + Z^2_{ij} + Z^3_{ij} + Z^4_{ij} + ...Z^h_{ij}) \quad (5)$$

Fuzzy Delphi Method

Many sustainable supply chain management enablers exist, but identifying the key enablers is pivotal for the industry to adopt sustainable practices (Santos et al., 2013). RAND Corporation developed the Delphi technique in the 1940s to analyze future military events. It obtains experts' opinions on a research question (De Villiers et al., 2005). The advantages of using the Delphi method have been observed in reaching a consensus among decision-makers. Chang et al. (2000) proposed a new concept by modifying the Delphi method by combining fuzziness developed on account of various decision makers, where it expands the Fuzzy Delphi method to incorporate the approach of fuzzy statistics and fit continuous mathematically explicit membership functions. The Delphi method works on a consensus basis. However, expert opinions and responses cannot be interpreted quantitively on account of the vagueness of their responses. The fuzzy concept is clubbed with the Delphi technique to avoid such problems. The Fuzzy Delphi method comprises the following steps:

Step 1 : After an extensive literature survey, the enablers of sustainable supply chain management for different organizations have been identified. A questionnaire assesses significant enablers to adopt in sustainable supply chain management.

Step 2 : The decision maker's opinions are collected through a questionnaire and expressed on a 5-point Likert scale, as shown in Table 1.

Step 3 : ***Formulating TFN (Triangular Fuzzy Number)***

The linguistic responses of experts are expressed in terms of TFN, as mentioned in Table 1. The minimum and

Table 1. ***Linguistic Scale with TFNs***

Scale	Level of Significance	Triangular Fuzzy Number
1	Lowest	(0.1,0.1,0.3)
2	Low	(0.1,0.3,0.5)
3	Medium	(0.3,0.5,0.7)
4	High	(0.5,0.7,0.9)
5	Highest	(0.7,0.9,0.9)

maximum values of experts' opinions are considered as two endpoints of TFN. The geometric mean (GM) is considered as the membership degree of TFNs. The geometric means indicate the consensus of the expert group.

Let the i^{th} expert express the evaluation of the j^{th} element with n available experts as :

$$\widetilde{w}_{ij} = (l_{ij}, m_{ij}, u_{ij}), i = 1, 2, 3, \ldots m$$

Then, fuzzy weight $\widetilde{w}_j$ of the j^{th} element is :

$$\widetilde{w}_j = (l_j, m_j, u_j), \quad (6)$$

$$l_j = min_i (l_{ij}), m_j = {}^n\sqrt{\Pi^n{}_i m_{ij}}, u_i = max_i (u_{ij}) \quad (7)$$

where, l_j signifies the lowest expressed value of element j, m_j signifies the GM of the expert assessed evaluation for element j , and u_j expresses the highest value of the expert's assessment for element j.

Step 4 : TFN Defuzzification

TFN is changed into crisp value (S_j) of every element by considering the center of gravity formula as:

$$S_j = \frac{l_j + m_j + u_j}{3} \quad (8)$$

Step 5 : Fixing the Threshold Limit for Choosing the Element

This is the last step in the Fuzzy Delphi technique, where a significant element is to be chosen based on the comparison of the element with the threshold value (d) such that :

If $S_i \geq d$, the element is selected.

If $S_i < d$, the element is rejected.

Finalization of Criteria Using the Fuzzy Delphi

After identifying the enablers of a sustainable procurement supply chain in the construction industry, the significant enablers are finalized using the Fuzzy Delphi method. Three decision-makers with experience in sustainable procurement supply chains in the construction industry were invited to participate in this study.

After the invitation of decision-makers, we formed a questionnaire to gather their opinions. First, the Fuzzy Delphi method was applied to get the inputs of the decision-makers. Then, the decision makers' opinions were transformed into TFNs to confirm the decision maker's consensus.

Only those enablers have been accepted as significant for sustainable procurement supply chains in the construction industry, where all the experts agreed to 75% or greater (Chu & Hwang, 2008). Therefore, depending on the threshold value, the enablers of a sustainable procurement supply chain were selected as significant in the construction industry.

Fuzzy DEMATEL

Decision making trial and evaluation laboratory (DEMATEL) technique was initially introduced by the Geneva Research Centre of the Battelle Memorial Institute (Fontela & Gabus, 1972). The DEMATEL method uses a causal relationship to visualize the cause and effect groups, representing the strength of influence of one group on the effect group. The DEMATEL method comprises the following stages:

Initially, a four-level pairwise comparison scale was used to denote the degree of influence. Here, a scale of 1 represents the lowest significance, a scale of 2 represents low significance, a scale of 3 represents medium significance, a scale of 4 represents high significance, and a scale of 5 represents the highest significance, respectively. Initial direct-relation matrix ***T*** is a $n \times n$ matrix obtained by pairwise comparisons in terms of influences and directions between criteria, where T_{ij} is denoted as the degree to which criterion i affects criterion j, i.e., $T = [T_{ij}]_{nxn}$. Then, a normalized direct-relation matrix S, i.e., $\boldsymbol{S} = [S_{ij}]_{nxn}$ and $0 \leq S_{ij} \leq 1$ can be obtained through the formulas (6), (7), and (8).

where,

$$K = \frac{1}{max_{1 \leq i \leq n} \Sigma^{n}_{j=1} a_{ij}} \quad (9)$$

$$S = K x T \quad (10)$$

$$M = X(1-X)^{-1} \quad (11)$$

where, M is the total relation matrix, and i is an identity matrix.

$$M = m_{ij}, i, j = 1, 2, 3, ...n$$

The row sum is denoted by D, and the column sum is denoted by R in the total-relation matrix M as :

$$D = [\sum^{n}_{j=1} m_{ij}]_{nx1} \quad (12)$$

$$R = [\sum^{n}_{j=1} m_{ij}]_{1xn} \quad (13)$$

Lastly, we can draw a graph between $(D+R, D-R)$, which gives us the cause-effect mapping.

Case Example

A case example is used for determining the most influential enablers of sustainable procurement supply chain management in the construction sector. Based on the literature survey and with the help of the decision-makers, 15 enablers in sustainable procurement supply chain management of the Indian construction industry were identified. In addition, three decision makers having vast experience in the construction industry and working as Senior Project Managers and Deputy Managers were selected to obtain their responses using the Likert scale for finalizing the sustainable supply chain enablers suitable for sustainable procurement in the construction industry.

The following algorithm has been followed:

Step 1. Enablers in sustainable procurement management in construction organizations were identified.

Step 2. Three industrial experts having relevant experience in sustainable construction material sourcing were chosen to give their feedback for the enablers to be significant and ensure that only relevant enablers get considered. Decision-makers have to attach weight to each enabler of sustainable procurement management.

Step 3. A four-level pairwise scale is used to obtain the degree of influence between each criterion. Linguistic values have been converted into TFNs, and after this data gets normalized, TFN left and right normalized values are obtained. Afterward, crisp values and total normal crisp values are obtained.

The introduction of a Fuzzy set based on membership function has been applied using equations 1–5. These equations are used to transform fuzzy data into crisp values. The Fuzzy Delphi technique is applied for accepting or rejecting enablers of sustainable procurement management in the construction industry. Table 2 is the outcome of the Fuzzy Delphi technique when used to obtain the enablers having significance to be adopted in sustainable procurement management supply chain.

Subsequently, the accepted enablers are considered further for the Fuzzy DEMATEL study to understand the interrelationship between the enablers mentioned above. The emphasis has been on identifying independent key enablers that can influence dependent enablers of sustainable procurement management in the construction industry.

Table 2. ***Fuzzy Delphi Method with Corresponding Values and Decisions***

S. No.	Enablers	Defuzzification Value	Frequency of Threshold Value d <= 0.2	% of value d <= 0.2	Decision
1	Obligation of an organization to adopt sustainable procurement management practices	0.79	3	100	**Accept**
2	Government regulation to adopt sustainable procurement management practices	0.74	3	100	**Accept**
3	Greater communications of departments to adopt sustainable procurement management practices	0.50	1	33	Rejected
4	Incentive schemes for adopting sustainable procurement management practices	0.63	2	67	Rejected
5	Adequate tracking and feedback from construction organizations on adopting sustainable procurement management practices	0.74	3	100	**Accept**
6	Employee training to adopt sustainable procurement management practices	0.70	3	100	**Accept**
7	Participation of stakeholders in implementing sustainable procurement management practices	0.74	3	100	**Accept**
8	Collaboration between organizations	0.57	0	0	Rejected
9	High participation of construction businesses to undertake sustainable procurement management for adoption	0.63	2	67	Rejected
10	Cultural teamwork	0.63	2	67	Rejected
11	High incentive schemes for construction organizations in implementing sustainable procurement management practices	0.79	3	100	**Accept**
12	Awareness towards the adoption of sustainable procurement management practices	0.57	0	0	Rejected
13	Lower, middle, and top management involvement in adopting sustainable procurement practices	0.74	3	100	**Accept**
14	Sufficient cross-organizational collaboration	0.70	3	100	**Accept**
15	Sufficient checks and controls in adopting sustainable procurement management practices	0.70	3	100	**Accept**

Equations 9 to 11 are used to obtain the direct relation matrix by aggregating the normalized crisp values from all experts, normalized direct matrix, and total relation matrix, respectively.

Step 4. Equations 12 and 13 determine row and column sums of the total relation matrix S mentioned in Table 3.

Step 5. The cause-and-effect graph of sustainable sub-dimensions is produced by mapping the dataset of $(D+R, D-R)$ shown in Figure 4.

Table 3. ***Row and Column Sums of Total Relation Matrix Performed in Fuzzy DEMATEL Technique***

S. No.	Enablers of Sustainable Procurement Management for the Construction Industry	*D*	*R*
1	Obligation of the organization to adopt sustainable procurement management practices.	6.4	6.3
2	Government regulation to adopt sustainable procurement management practices.	6.4	6.0
3	Adequate tracking and feedback from construction organizations on adopting sustainable procurement management practices.	4.8	6.4
4	Employee training to adopt sustainable procurement management practices.	3.5	5.9
5	Participation of stakeholders in implementing sustainable procurement management practices.	4.1	5.6
6	High incentive schemes for construction organizations in implementing sustainable procurement management practices.	6.8	6.6
7	Lower, middle, and top management involvement in adopting sustainable procurement practices.	6.4	6.3
8	Sufficient cross-organizational collaboration.	3.3	5.7
9	Sufficient checks and controls in adopting sustainable procurement management practices.	6.8	6.3

Figure 4. ***Cause and Effect Relationship Graph for Sustainable Procurement Supply Chain Enablers in the Construction Industry***

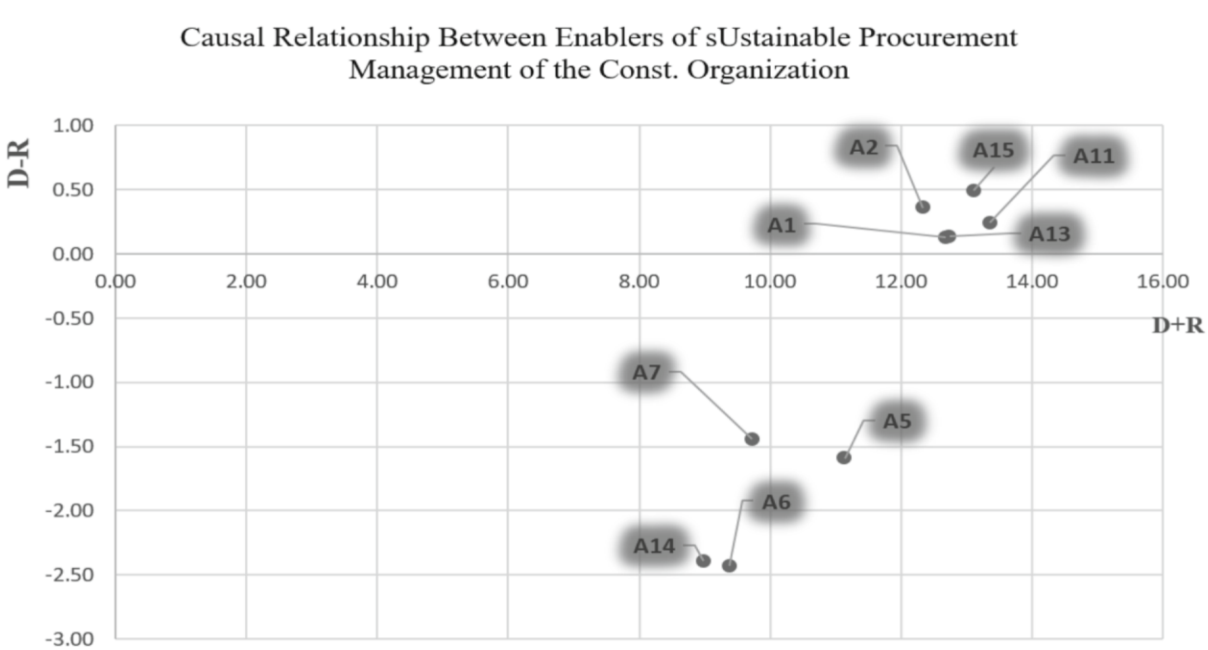


Table 4. ***List of Potential Enablers of Sustainable Procurement Management in the Construction Organization***

Notation	Significant Enablers of Sustainable Procurement Management in the Construction Supply Chain (Independent Enablers)
A1	Obligation of an organization to adopt sustainable procurement management practices.
A2	Government regulation to adopt sustainable procurement management practices.
A11	High incentive schemes for construction organizations in implementing sustainable procurement management practices.
A13	Lower, middle, and top management involvement in adopting sustainable procurement practices.
A15	Sufficient checks and controls in adopting sustainable procurement management practices.

The cause group of enablers of sustainable procurement management has been mentioned in Table 4.

Discussion

A literature survey has been done to identify various enablers of sustainable procurement supply chain management finalized by the Fuzzy Delphi technique. Three decision-makers from construction organizations have been selected to provide their opinion to select the significant enabler among the identified enablers of sustainable procurement management in the construction supply chain. Out of the 15 identified enablers, nine were selected with the help of decision-makers and the Fuzzy Delphi technique. Furthermore, the selected enablers have been studied further using the Fuzzy DEMATEL method to investigate their interrelationship so that key enablers are identified. The outcome of the study finds the following enablers as the most influencing and independent: The obligation of an organization to adopt sustainable procurement management practices; government regulation to adopt sustainable procurement management practices; high incentive schemes for construction organizations in implementing sustainable procurement management practices; lower, middle, and top management involvement in adopting sustainable procurement practices; and sufficient check and controls in adopting sustainable procurement management practices. In addition, the study finds the following dependent enablers: Participation of stakeholders in implementing sustainable procurement management practices, adequate tracking, feedback from construction organizations on adopting sustainable procurement management practices, employee training to adopt sustainable procurement management practices, and sufficient cross-organizational collaboration.

The impact of the cause group is significant on the overall choice of enablers of sustainable procurement management in the construction supply chain, and hence, requires more attention. Therefore, the focus should be on the cause group enablers for their influences on the effect group enablers (Fontela & Gabus, 1972). Thus, a small number of powerful criteria is preferred over a large group of weak criteria. Hence, the selected criteria have been considered for further operation by the decision-makers.

Conclusion and Scope for Future Research

Sustainability is being considered nowadays by every business, and steps have been taken to meet sustainability goals by each organization. This proposed paper uses hybrid multi-criteria decision-making to identify key enablers of sustainability to be adopted in the supply chain. The causal interrelationships between SSC criteria have been performed. The outcome of the study is the identified enablers of sustainable procurement management in the construction supply chain in the following order: Sufficient checks and controls in adopting sustainable procurement management practices; government regulation to adopt sustainable procurement management practices; high incentive schemes for construction organizations in implementing sustainable procurement management practices; lower, middle, and top management involvement in adopting sustainable procurement practices; and obligation of an organization to adopt sustainable procurement management practices. The research outcome has implications for supply chain managers to adopt enablers of sustainability in their organizations. This study can be extended to other sectors, and other hybrid MCDM techniques, such as ANP, TOPSIS, and VIKOR, can be analyzed for future studies.

Theoretical and Managerial Implications

Under this section, the implication of this study will be discussed in the following areas:

- Theoretical Implications
- Managerial Implications

Theoretical Implications

The current study adds a new dimension to sustainable procurement supply chain management by identifying key enablers of sustainable procurement supply chains in the construction industry with the help of MCDM techniques. This extended approach will help researchers explore sustainable supply chain management further. The attempted approach will be helpful to the academicians to understand the independent enablers for fulfilling the sustainable requirements to be utilized in the existing green supplier chain management. The study's outcome suggests that high incentive schemes for construction organizations in implementing sustainable procurement management practices are a highly influential enabler among other independent enablers needed to be adopted in a sustainable procurement supply chain in the construction industry. The least influential enabler in the sustainable procurement supply chain in the construction industry is sufficient cross-organizational collaboration. Toward the solution, this study explores a set of MCDM approaches; hence, it will benefit the researchers to adopt the approach in supply chains of various sectors.

Managerial Implications

The identified set of sustainable enablers helps procurement supply chain managers adhere to government regulatory compliance. The proposed output may be helpful to the managers working in other supply chains where this model can be implemented as an integrated framework to be adopted as a sustainable procurement supply chain. The current study will be helpful to the decision and policy-makers working in an organization related to enablers of sustainable procurement in construction supply chain management.

Limitations of the Study

Possibly no research area provides all the information in every aspect, and this study also has some limitations. One limitation is the sample size of experts and decision-makers who participated in the research study as many of them refused to participate in the research study and did not respond to the questionnaire and telephonic communication. This issue can be addressed if more experts and decision-makers participate in the research study. Another limitation of the study is the biases of the experts in weighing enablers of sustainable procurement of supply chains in the construction industry, as this study involves three decision-makers and two industry experts. Although decision-makers and experts are professionals in their fields, biases may crop up in their work level, religious beliefs, and the nature of their work environment. Fuzzy sets are used in the study to counter these biases. Improved versions of fuzzy sets can be used for improved results.

Authors' Contribution

We have done a systematic literature review to extract the research articles for the literature survey for the proposed manuscript. Firdous Ahmad Khan formulated the research questions, and thus, the database of documents was selected. Dr. Mohd Imran Khan screened keywords to remove invalid documents by checking the titles and abstracts. Both authors did a bibliometric analysis, after which a research gap was identified. Dr. Mohd Imran Khan designed the questionnaire for the respondents. Responses from industrial experts were received and analyzed by Firdous Ahmad Khan. The paper was written by Firdous Ahmad Khan and checked by Dr. Mohd Imran Khan before submission to the journal.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter, or materials discussed in this manuscript.

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