Corporate Sustainability Practices in Indian Automobile Industry: Enhancing Government Initiatives, Economic Improvements, and Environmental Practices

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Even though automobile manufacturers are striving to address sustainability issues by introducing corporate sustainability practices, there is limited studies related to this issue. This study aims to identify valid and accurate CSP, analyze causal interrelationships between aspects under uncertainty, and propose the criteria for practical implementations. This study proposed six aspects and seventy-three criteria. By employing a Fuzzy decision-making trial and evaluation laboratory (DEMATEL), our result confirms 39 criteria out of 79 original criteria. The most important aspects were organizational structure, societal features, technological utilization, actions taken by the government, and innovative ideas. The most significant criteria are assurances of security and auditing, sponsorship of sporting or recreational projects and gifts, support for arts and culture, awards related to social sustainability, internal control mechanisms, environmental management systems, and product environmental impacts. This research contributes to the existing corpus of knowledge by identifying the fundamental CSP characteristics required to facilitate the achievement of sustainable organizational goals, and then identifying the causal interrelationship between those characteristics. In addition, this study offers suggestions for policy makers to focus on governmental initiatives business social consciousness, technological innovation, and sustainable organizational culture in order to enhance CSP.

Keywords: *Automobile; Corporate sustainability; Corporate Sustainable Practices; Government Initiatives; Fuzzy Delphi; Fuzzy DEMATEL; India.*

Introduction

The size of the Indian automobile industry market is projected to reach $300 billion within the next decade, representing up to 22 % of the country's gross domestic product and showing India the seventh-largest automobile producer in the world (Luthra *et al.,* 2016; Mathiyazhagan *et al.,* 2018). An increase in automobile production has adverse effects on environmental, social, and economic well-being, including air pollution, loss of natural resources, ozone depletion, and medical issues (Kumar *et al.,* 2021). Understanding corporate sustainability practices (CSP) is necessary to meet the pressures of corporate shareholders and stakeholders while considering financial, ecologic, and social concerns to overcome and reduce these issues (Zahid *et al.,* 2019; Pranugrahaning *et al.,* 2021). However, Pranugrahaning et al. (2021) argued that there is still a dearth of studies investigating the CSP practices that need to adopt sustainability in their operations. Consequently, this study examines the interrelationships between the fundamental CSP characteristics to mitigate the harmful adverse of the production process and integrate effective measures.

Prior research has examined CSP aspects. Tjahjadi et al. (2021) indicated that the traditional operationalization of corporate sustainability is based on the notion of the triple bottom line (TBL), which consists of economic, social, and environmental factors. However, Zahid et al. (2019) emphasized that the available studies overlook important factors that could facilitate the integration of CSP into firms' daily operations. Hence, this study combines TBL with variables such as corporate culture, government initiatives, and technological characteristics. Ahlstrom et al. (2020) revealed that organizational culture inspires employees' and clients' loyalty to the company and enables the implementation of CSP. Previous studies have also found that government schemes play a crucial role in attaining successful outcomes; Miao et al. (2020) asserted that government involvement in corporate sustainability establishes strategies and regulations that organizations can use as guidance. Attributes associated with innovations and technology were also impactful for CSP application; Liu et al. (2021) posited that adopting cutting-edge technologies and green process innovation is a necessary management action that drives the adoption of new strategies, mechanisms, and products that can significantly enhance

firms' CSP. This approach incorporates TBL, organizational culture, government practices, technology, and innovation to encapsulate fundamental CSP characteristics.

This study applies fuzzy set theory to deal with the uncertainties related to expert judgments (Tseng *et al.,* 2020; Negash & Hassan, 2021). First, the fuzzy Delphi method (FDM) is applied to generate a set of valid and reliable attributes of CSP in the automobile industry (Bui *et al.,* 2020; Tsai *et al.,* 2020; Negash *et al.,* 2021). Moreover, Zahid et al. (2019) emphasized that CSP attributes are highly interrelated and can influence one another in numerous ways. Therefore, fuzzy decision-making trial-and-evaluation laboratory (FDEMATEL) is adopted to address the complex nature of CSP attributes by examining the causal interrelationship among the validated attributes (Tseng *et al.,* 2019; Negash & Hassan, 2020). Hence, this study adopted a hybrid FDM and FDEMATEL to examine the core CSP and develop insightful implications for future improvements. The study objectives are as follows:

• To identify valid and reliable CSP attributes in qualitative information.

• To evaluate causal interrelationships among CSP attributes under uncertainties.

• To determine the CSP criteria for the Indian automobile industry

Contributions of this study include: (1) offering a set of important CSP aspects; (2) conveying the causation effect model to simulate the landscape of interrelationship among the CSP aspects; (3) offering potential implications to enhance HWS intention; and (3) addressing a framework for CSP progression in the Indian automobile industry. The remaining sections of this study are divided into five components. The subsequent section discusses corporate sustainability, corporate sustainability practices, proposed methods, and proposed criteria. Section 3 describes the case's context and the research methods utilized. The findings and implications of the study are presented in the fourth section. In the final section, conclusions, limitations, and recommendations for future research are discussed.

Literature Review

This section includes a literature overview of CSP, as well as a proposed method and proposed attribute to be utilized in this research.

Corporate Sustainability Practices

The term "corporate sustainability," or "CS," refers to a leadership and management strategy that a firm takes in order to accomplish revenue growth while also taking into consideration the well-being of society and the environment (Miska *et al.,* 2018; Kantabutra & Ketprapakorn, 2021). According to Pranugrahaning et al. (2021), the purpose of CS is to assist owners and managers so that they may integrate sustainable growth into their operations and procedures. Considering sustainable production and service methods helps preserve the environment, satisfies the requirements of both the current generation and the following generations, and provides companies with a competitive edge (Tjahjadi et al., 2021;). According to Chatzitheodorou et al. (2021), well-planned, sustainable goals and strategies enable long-term performance by allowing businesses to develop their

reputations and improve their trustworthiness. In addition, Tseng et al. (2020) found that the corporation's sustainability performance and previous environmental reputation considerably raise its market and income, increasing the firm's profit and providing an offset for the expenditures associated with sustainability. In order to achieve CS, one must have a solid comprehension of CSP management, which is required for the accurate implementation of environmentally friendly business practices and the communication of the goals, directives, or purpose to every personnel (Zahid *et al.,* 2019).

However, Kantabutra and Ketprapakorn (2021) claimed that CSP governance in commercial enterprises is a huge challenge, and managers frequently lack awareness of how to incorporate sustainability into their operations effectively. In addition, Zahid et al. (2019) asserted that CSP management is a complicated process made up of a large number of characteristics that need to be addressed appropriately to achieve effective execution. On the other hand, some businesses have a pessimistic view of the possible financial benefits of implementing sustainable business practices into their operations (Zahid *et al.,* 2019; Annunziata *et al.,* 2018). According to Pranugrahaning et al. (2021), ambiguities, poor performance, and obstacles in CS implementation can be resolved by determining and assessing the essential CSP management attributes. Therefore, in order to address problems in CSP management and to make the process of CS adoption move more efficiently, this study combines the TBL features with the organizational culture, government initiatives, and technology attributes.

Proposed Attributes

This research suggests employing a literature review to investigate the basic CSP management features from six different perspectives and 73 different criteria.

Economic attributes (A1) require the effective use of a company's resources and its productive capacity to generate sustained economic growth in a manner that does not negatively impact the well-being of society or the natural environment (Miska *et al.* 2018; Koseoglu *et al.,* 2021). According to Kumar et al. (2021), certain aspects of a company's finances can either directly or indirectly affect the organization over the long run. As a result, economic factors play a significant part in formulating a strategy and deciding whether or not to implement CSP in the production process. It is essential to provide monetary gain for corporations in order to implement CSP; nevertheless, ignoring the financial gains and placing an excessive amount of emphasis on the well-being of society and the environment is undesirable and can become a significant barrier to sustainable production (Mathiyazhagan *et al.,* 2018; Koseoglu *et al.,* 2021). Concerning this factor, the research uncovered thirteen criteria containing the financial and economic elements that affect a company's implementation of a CSP.

Environmental practices and activities are what are referred to as environmental attributes (A2), and they aim to prevent environmental deterioration driven by production and consumption that is not sustainable (Mathiyazhagan *et al.,* 2018; Zahid *et al.,* 2019; Xia *et al.,* 2020). According to Kumar et al. (2021), the rising levels of emissions of greenhouse gases and the detrimental climate changes heightened the interest of corporate and government entities

in adopting sustainable strategies. However, despite the widespread awareness of the significance of environmental sustainability and the efforts that have been made to alleviate environmental concerns, there are still a significant number of obstacles to overcome in order to implement environmentally friendly manufacturing practices (Mathiyazhagan *et al.*, 2018; Tjahjadi *et al.*, 2021). As a result, the findings of this study presented 14 criteria to identify the fundamental CSP that will improve sustainable production and reduce the impact of environmental burdens.

Regarding social attributes (A3), the sustainability dimension means collaboration and involvement of various relevant parties in the production process. These stakeholders include enterprises, customers, the government, and a variety of other entities (Nadeem *et al.*, 2017; Xia *et al.*, 2020; Tjahjadi *et al.*, 2021). According to Koseoglu et al. (2021), corporations are responsible for considering the social dimension when formulating their value propositions. It is because corporations that demonstrate a higher social responsibility generate a greater degree of competitive advantage and better financial results. As a consequence, the social aspect is rapidly evolving into a strategic concern for companies and is dependent on the decisions made by management. As can be seen in Table 1, thirteen criteria were suggested throughout the course of this research regarding this particular facet.

The term "organizational culture" (A4) refers to the collective experiences, desires, beliefs, and practices that shape the behavior of group members and define the appropriate norms of the organization (Miska *et al.*, 2018; Lozano & von Haartman, 2018; Oriade *et al.*, 2021). To transition from non-sustainable to sustainable practices, an incremental shift in organizational culture is required. This shift can be made by merging CSP into the company's activities (Mathiyazhagan *et al.*, 2018; Ahlstrom *et al.*, 2020). According to Kantabutra and Ketprapakorn (2021), a company's organizational culture is the most crucial factor that determines the success of that company and is an essential requirement for the implementation of CSP. A corporate culture that is more compliant with sustainability concerns stands out among its rivals and has effectively achieved its long-term strategic goals (Kumari, 2018; Aramburu & Pescador, 2019; Kucharska & Kowalczyk; 2019). To evaluate the organizational culture component, this study proposed sixteen criteria based on the existing body of research.

Technology application and innovation (A5) refers to the incorporation of cutting-edge production technology into the overall strategic planning of a company and the production process in order to achieve more environmentally friendly manufacturing (Annunziata *et al.*, 2018; Xia *et al.*, 2020; Liu *et al.* 2021). Xia et al. (2020) asserted that cleaner technology encourages CSP and facilitates clean production, resulting in fewer adverse repercussions and more efficient natural resource planning and utilization. In addition, implementing new manufacturing technology increases the production of environmentally friendly products of higher quality, generates economic value, and fosters innovation within an institution (Guo *et al.*, 2020; Liu *et al.*, 2021). This research looked at the technology side of CSP and proceeded with 11 criteria that should be used to evaluate it. It was executed because the execution of CSP can be improved by using more recent technologies.

The term "government initiatives" refers to those sustainability efforts that governmental institutions establish. Key features of such initiatives include incorporating legal frameworks, providing guidance, and monitoring procedures to guarantee CSP execution (Zahid *et al.*, 2019; Khaled *et al.*, 2021; Pranugrahaning *et al.*, 2021). In its role as the primary market regulator, the government is responsible for developing national CS strategies and monitoring futures markets to maintain a fair and competitive environment and to promote the implementation of CSP (Tang *et al.*, 2018; Miao *et al.*, 2020). Government initiatives are driving factors and efficacious in directing CSP execution because corporations comply with government demands and plans because of the government's ability to penalize and praise behavior. Government interventions effectively guide CSP implementation (Nadeem *et al.*, 2017; Karaman *et al.*, 2021). According to Mangla et al. (2019), government practices may assist with beating issues related to strategy implementation, security, affirmation, and checking in helping organizations in overcoming CSP challenges. In terms of the government and regulatory requirements, the four criteria listed below were the core characteristics that were utilized the most frequently.

The resume of aspects and criteria are shown in Table 1.

Table 1

Proposed Aspects and Criteria

Aspect		Criteria	References
Economic Attributes (A1)	C1	Reporting of Performance	Aras et al. (2018); Mangla et al. (2019); Zahid et al. (2019); Zaid et al. (2020)
	C2	Market presence (Min Wages)	
	C3	Locals in Management	
	C4	Indirect Economic Impact	
	C5	Direct Economic Impact	
	C6	R&D Activities	
	C7	Procurement Activities	
	C8	Internal Control Mechanism	
	C9	Anti-corruption and Whistleblowing	
	C10	Ethical Standards	
	C11	Product quality information	
	C12	Product safety information	
	C13	funding collection	

Aspect		Criteria	References
Environmental Attributes (A2)	C14	Environmental Management System	Zahid et al. (2019); Zaid et al. (2020)
	C15	Material Recycled	
	C16	Energy utilization	
	C17	Water Consumption	
	C18	Biodiversity	
	C19	Effluents and Waste Reductions	
	C20	Product Environmental Impacts	
	C21	Transportation Impacts	
	C22	Suppliers' Environmental Impacts	
	C23	Environmental Related Awards	
	C24	Environmental policies	
	C25	Natural resource usage	
	C26	Pollution control	
	C27	Environmental protection	
	C28	Radiation safety information	
Social Attributes (A3)	C29	Social welfare	Zahid et al. (2019); Zaid et al. (2020 Aras et al. (2018); Zahid et al. (2019); Zaid et al. (2020)
	C30	Customer Satisfaction	
	C31	Consumer safety	
	C32	Products and Services Labeling (Eco-Labelling)	
	C33	Education Facilities (Training and Internships)	
	C34	Shelter's facilities	
	C35	Donations	
	C36	Social Sustainability Related Awards	
	C37	Relations with the local population	
	C38	Support for public health	
	C39	Sponsoring sporting or recreational projects & gifts	
	C40	Support for the arts and culture	
	C41	Sponsoring conferences, seminars or exhibits	
Organizational Culture (A4)	C42	Decent Labor Practices	Tomsic et al. (2015); Engert and Baumgartner, (2016); Aras et al. (2018); Annunziata et al. (2019); Zahid et al. (2019); Zaid et al. (2020)
	C43	Employment Opportunities	
	C44	Occupational Health and Safety	
	C45	Employee's development	
	C46	Diversity and Equal Opportunities	
	C47	Supplier Assessment	
	C48	Assurance of Human Rights	
	C49	Employees Satisfaction Survey	
	C50	Workplace Sustainability remuneration	
	C51	Clear sustainability goals	
	C52	Job description	
	C53	Monitoring employees	
	C54	Enterprise flexibility	
	C55	Effective communication	
	C56	Collaboration	
	C57	Employee's participation	
	C58	Customer service	
Technology Usage and Innovation (A5)	C59	Product innovation capability	Tomsic et al. (2015); Mangla et al. (2019); Annunziata et al. (2019); Abbas and Sagsan, (2019)
	C60	Innovation strategy	
	C61	Innovation commitment	
	C62	Innovation training	
	C63	Creativity Rewards	
	C64	Open Innovation	
	C65	Innovation Trademarking	
	C66	Leadership support	
	C67	Knowledge management	
	C68	Green technology innovation	
	C69	IT application	
Government Practices (A6)	C70	Government policymaking	Mangla et al. (2019); Annunziata et al. (2019); Abbas and Sagsan, (2019)
	C71	Security assurance	
	C72	Auditing	
	C73	Transparency and trust	

Proposed Method

Numerous statistical approaches have been put forward and utilized in the CSP research that has already been conducted. For example, Miska et al. (2018) investigated the influence of culture on the economic, social, and environmental sustainability practices of a company by employing SEM in their research. In their study on the impact of gender diversity in boardrooms on CSP, Nadeem et al. (2017) used a mechanism generalized method of moments as their research methodology. Miska et al. (2018) researched the influence of culture on the economic, social, and environmental sustainability practices of corporations by applying SEM. Annunziata et al. (2018) employed SEM to investigate organization capabilities' role in achieving CSP and economic performance. Zahid et al. (2019) applied

structural equation modeling (SEM) to examine the influence of government interventions, integrated strategies, and corporate internal attributes on CSP. Finally, Kantabutra & Ketprapakorn (2021) used qualitative case studies and mixed-method approaches to develop an integrated theory for CSP and ensure the external validity and practicality of the proposed idea. However, the existing literature neglects the ambiguity in the expert opinions judgment of the expert.

Moreover, the previously used statistical methods consider independence and linearity, while the CSP attributes are interrelated (Sari *et al.,* 2021). Therefore, this study proposed integrating fuzzy set theory to reduce the ambiguity of decision making. FDM is applied to validate the proposed measures, while FDEMATEL addresses the interrelationship among the attributes. The research framework for this study is shown in Figure 1.
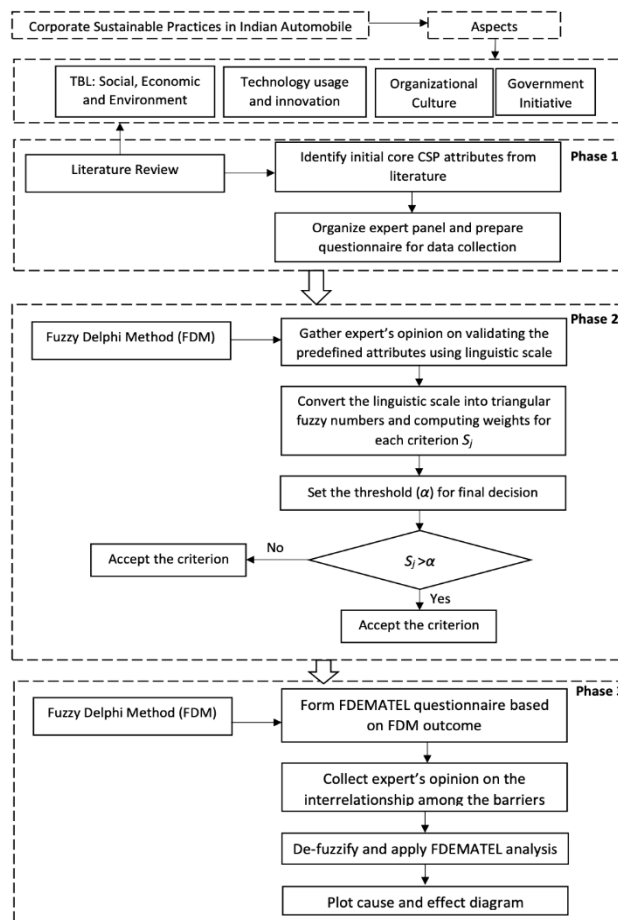

Figure 1. Research Framework

Method

Case Background

Economic expansion and rapid population growth over the past decade have contributed to an increase in the market for automobiles in India, leading to the rise in the country's capacity to produce automobiles for both domestic and international markets (Narsaria *et al.,* 2020). For example, in 2020, the nation was the fifth-largest auto market, and in 2019, it was the seventh-largest manufacturer of commercial

automobiles. Additionally, the domestic market for commercial and passenger vehicles combined was approximately 3.5 million (India Brand Equity Foundation, 2021). In addition, the automotive sector accounted for 7.5 % of the total GDP in 2019, equivalent to USD 397 million. The contribution made by the industrial sector to the nation's economy is the second largest (Indiastat India., 2019). As a result, it is anticipated that the automotive industry will continue to show consistent growth throughout the prediction period (2020–2026). On the other hand, the

automotive industry is widely considered to be the primary contributor to global carbon emissions, the largest consumer of natural resources, and the underlying cause of various environmental issues. As a result, the automotive industry must devise CSP to achieve more sustainable financial, ecologic, social, organizational culture, technology and innovation procedure, and government interference, all of which contribute to the acceptance of improved practices throughout the entire sector. However, to attain corporate sustainability, India's automobile industry has implemented several methods.

By defining the fundamental characteristics of CSPs, this research can be a starting point for professionals working toward improved corporate sustainability. A total of twelve experts from the automotive sector are participating in this research project. All of these experts have substantial experience working in various capacities within the automotive industry in India. First, the perspectives of the experts on the validity of the criteria were gathered using an FDM survey with 73 initial standards, as depicted in Table 1 and Appendix 1 with an explanation. After that, the FDEMATEL survey was used to gather the views of experts on the interrelationship between the attributes.

Fuzzy Delphi Method

Combined fuzzy set theory and traditional Delphi technique were employed to validate the proposed 73 criteria and develop a set of criteria that measure the core CSP for further investigation. Fuzzy set theory eliminates the uncertainty or fuzziness in the experts' opinions, and the Delphi method validates the initial CSP criteria and screens out the unnecessary criteria. The study collected experts' opinions in linguistic terms and then transferred the responses to corresponding triangular fuzzy numbers (TFNs), as shown in Table 2. Subsequently, the study employed FDM procedures adopted by previous studies (Tseng *et al.,* 2019; Negash *et al.,* 2020).

Table 2

FDM Transformation Table of Linguistic Terms

Linguistic (Importance)	Terms	Fuzzy Numbers
Very High	VH	0.75, 1.0, 1.0
High	HI	0.5, 0.75, 1.0
Low	LO	0.25, 0.50, 0.75
Very Low	VL	0.0, 0.25, 0.50
No	NO	0.0, 0.0, 0.25

Following is the aggregation and defuzzification process:

- Establish the fuzzy weight (w_j) of criteria by aggregating the experts' opinions. The geometric mean averaging method was used to get the aggregate

$$w_j = \left\{ a_j = min(a_{ij}), b_j = \left(\sum_{i=1}^{n}(b_{ij})\right)^{1/n}, c_j = max\,(c_{ij}) \right\}$$

where j is the score of the importance of criterion given by expert i. n represents the number of respondents or experts, and a, b, c denote TFN's.

- De-fuzzifying the aggregated fuzzy weights of each criterion

$$S_j = \frac{a_j + b_j + c_j}{3} \qquad j=1,2,3.....m \,(2)$$

Where S_j denoted the de-fuzzified weight of criterion and m stands for the number of criteria

- Set a threshold (α) to remove invalid criteria which are not important for this study. The criterion will be retained when $S_j \geq \alpha$, the other way around the criterion will be removed when $S_j \leq \alpha$. The threshold in this study is set to be the average of de-fuzzified weights of criteria.

Fuzzy DEMATEL

FDEMATEL was applied to examine the causal interrelationship among the CSP attributes (Tseng et al., 2019; Negash & Hassan, 2020). According to the valid set of criteria from FDM analysis, the FDEMATEL questionnaire is formed on the interrelationship among the criteria and experts were asked to submit their answers in linguistic terms. Table 3. is used to transform the linguistic terms in their corresponding TFNs.

Table 3

TFNs for FDEMATEL Assessment

Linguistic terms	Meanings (Importance)	Corresponding TFNs
VH	Very high	(0.70, 0.90, 1.00)
H	High	(0.50, 0.70, 0.90)
M	Medium	(0.30, 0.50, 0.70)
L	Low	(0.10. 0.30, 0.50)
VL	Very low	(0.00, 0.10, 0.30)

An expert n member, and $\tilde{z}_{ij}^f$ represent the fuzzy weight of the ith attribute affecting the jth attribute assessed by the fth evaluator.

- Normalize the fuzzy numbers

$$S = \left(s\tilde{z}_{lij}^f, s\tilde{z}_{mij}^f, s\tilde{z}_{uij}^f\right) = \left[\frac{\left(z_{lij}^f - minz_{lij}^f\right)}{\left(maxz_{uij}^f - minz_{lij}^f\right)}, \frac{\left(z_{mij}^f - minz_{mij}^f\right)}{\left(maxz_{uij}^f - minz_{lij}^f\right)}, \frac{\left(z_{uij}^f - minz_{mij}^f\right)}{\left(maxz_{uij}^f - minz_{lij}^f\right)}\right] \quad (3)$$

Where $\left(s\tilde{z}_{lij}^f, s\tilde{z}_{mij}^f, s\tilde{z}_{uij}^f\right)$ are the normalized TFNs.

- Determine left (S_{ltij}^{f}) and right (S_{rtij}^{f}) normalized values.

$$\left(S_{ltij}^{f}, S_{rtij}^{f}\right) = \left[\frac{s\tilde{z}_{mij}^{f}}{\left(1+s\tilde{z}_{mij}^{f}-s\tilde{z}_{lij}^{f}\right)}, \frac{s\tilde{z}_{uij}^{f}}{\left(1+s\tilde{z}_{uij}^{f}-s\tilde{z}_{mij}^{f}\right)}\right] \quad (4)$$

- Compute the total normalized crisp values

$$S_{ij}^{f} = \left[\frac{s_{ltij}^{f}\left(1-S_{ltij}^{f}\right)+\left(S_{rtij}^{f}\right)^{2}}{\left(1-S_{ltij}^{f}+S_{rtij}^{f}\right)}\right] \quad (5)$$

- Finally, get the crisp values

$$\tilde{w}_{ij}^{f} = minz\tilde{z}_{lij}^{f} + S_{ij}^{f}\left(maxz_{uij}^{f} - minz_{lij}^{f}\right) \quad (6)$$

- Aggregate the crisp values from Equation (6) to establish the initial direct relation matrix by aggregating the subjective judgment for *n* evaluators; find the synthetic value.

$$w_{ij}^{f} = \frac{1}{n}\left(\tilde{w}_{ij}^{1} + \tilde{w}_{ij}^{2} + \tilde{w}_{ij}^{3} + \cdots + \tilde{w}_{ij}^{f}\right) \quad (7)$$

Where *n* denotes the number of experts and w_{ij} represents the impact that criterion *i* has on criterion *j*.

- Obtain the normalized direct relationship matrix (U) by standardizing the initial direct relation matrix:

$$U = w \otimes Initial\ direct\ relation\ matrix \quad (8)$$

where $w = max\left(\sum_{j=1}^{n} w_{ij}^{f}\right)$

- Use *U* matrix and identity matrix I to obtain the total interrelationship matrix *Y*.

$$Y = U(I - U)^{-1} \quad (9)$$

- Compute the sum of rows and columns of the Y matrix to get the causal effect diagram of the attributes. The sum of rows is labeled as a vector D, and the sum of rows is labeled as a vector R. The value of the D and R summation will be the axis of the diagram, indicating the importance or prominence. While the subtraction value of D and R will be the diagram's vertical axis and indicate the relationship or causal effect powers. The attributes with a negative value of (D-R) are the effect group, and those with a positive (D-R) are the causal group.

$$D = \sum_{j=1}^{n} U_{ij} \text{ for all } j \text{ from 1 to } n \quad (10)$$

$$R = \sum_{i=1}^{n} U_{ij} \text{ for all } i \text{ from 1 to } n \quad (11)$$

Results

Fuzzy Delphi Results

This study projected seventy-three criteria from six CSP aspects for the FDM validation method. Each criterion was assessed based on its importance using the linguistic terms scale mentioned in Table 2, ranging from 1 (no importance) to 5 (very high importance). For the analysis part, the expert's linguistic opinions were converted into corresponding TFNs, as in Table 2. Afterward, Equations (1 – 2) are applied to get the consensus of opinions on the initial set of criteria. Appendix B shows the fuzzy weight and final decision for each criterion with a threshold of 0.543. Finally, 39 criteria are retained, and 34 are removed. The enclosed list of criteria represents the valid set of CSP for this study, as shown in Table 4 below.

Table 4

FDM Valid CSP Attributes

Criteria	CSP	Weight
C1	Reporting of Performance	0.637
C2	Market presence (Min Wages)	0.548
C3	Locals in Management	0.558
C4	Indirect Economic Impact	0.553
C5	Direct Economic Impact	0.644
C6	Internal Control Mechanism	0.636
C7	Anti-corruption and Whistleblowing	0.546
C8	funding collection	0.639
C9	Environmental Management System	0.633
C10	Material Recycled	0.551
C11	Energy utilization	0.546
C12	Biodiversity	0.551
C13	Effluents and Waste Reductions	0.659
C14	Product Environmental Impacts	0.676
C15	Transportation Impacts	0.641
C16	Suppliers' Environmental Impacts	0.648
C17	Environmental Related Awards	0.560
C18	Natural resource usage	0.553
C19	Pollution control	0.661
C20	Environmental protection	0.545
C21	Education Facilities (Training and Internships)	0.546

Criteria	CSP	Weight
C22	Shelter's facilities	0.546
C23	Social Sustainability Related Awards	0.551
C24	Support for public health	0.551
C25	Sponsoring sporting or recreational projects & gifts	0.635
C26	Support for the arts and culture	0.648
C27	Sponsoring conferences, seminars or exhibits	0.546
C28	Employment Opportunities	0.635
C29	Occupational Health and Safety	0.558
C30	Employee's development	0.546
C31	Supplier Assessment	0.546
C32	Collaboration	0.548
C33	Employee's participation	0.635
C34	Innovation commitment	0.636
C35	Knowledge management	0.617
C36	IT application	0.623
C37	Government policy making	0.617
C38	Security assurance	0.636
C39	Auditing	0.544
Threshold		**0.543**

Fuzzy DEMATEL Results

Based on the results from FDM and aspects identified from the literature, the experts evaluated the interrelationship among the attributes using linguistic terms. After applying Equations (3 – 11), the cause-effect diagram (Figure 2) is generated, with (D+R) as the horizontal axis depicting the "importance" and (D-R) as a vertical axis representing the "relation." The causal aspects were found to be government initiatives (A6), social attributes (A3), technology usage and innovation (A5), and organizational structure (A4). In contrast, economic attributes (A1) and environmental attributes (A2) were found to be the effect group aspects. Same as the aspects, the criteria causal effect diagram is depicted in Figure 3.
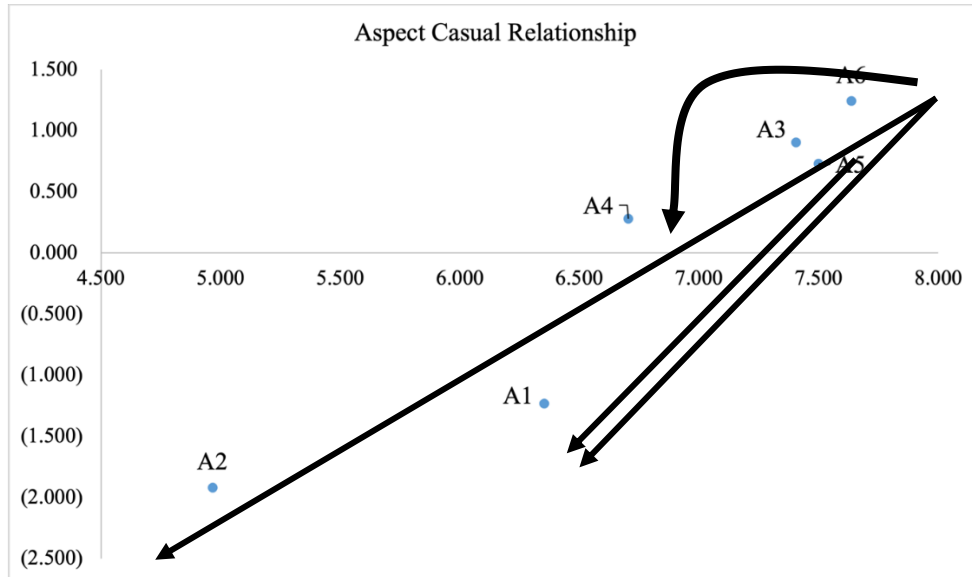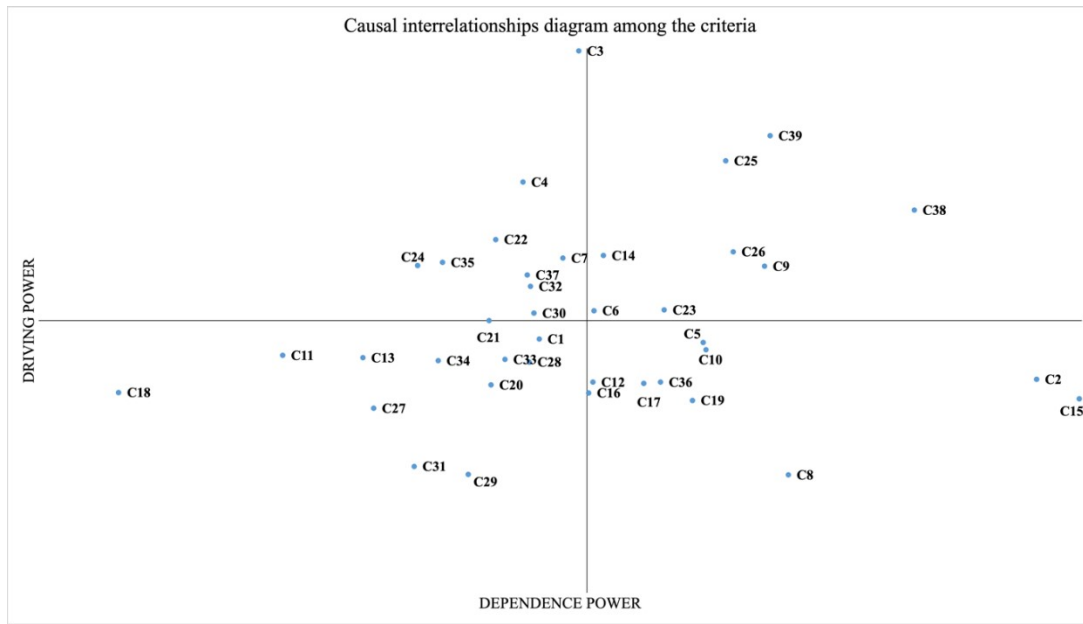

Figure 2. Aspect Causal Diagram

Figure 3. Criteria Causal Diagram

Discussions

Theoretical Implications

It was confirmed that government initiatives were the most significant factor in the process of achieving sustainable manufacturing.

The initiatives of the government in the manufacturing processes of corporations achieve a balance between the requirements of society, the health of the environment, and the expansion of profits, all while considering the conditions that will be placed on subsequent generations (Miao *et al.,* 2020; Khaled *et al.,* 2021). Through the implementation of command-and-control policies, sustainable efforts constructively mould the structures of organizations and compel corporate entities to use technology and rely on innovation. Businesses are urged to adopt financially, ethically responsible, and ecologically sustainable practices when the government provides instructions, incentive schemes, awareness programs, and mentoring. The development of national CSP policies and regulatory frameworks that encourage the productive utilization of available resources by producers and consumers is essential to achieving sustainability goals.

In order to achieve successful sustainable production, social features such as social responsibility on the part of corporations toward their personnel, stakeholders, and the general welfare of society were critical. Increasing a company's commitment to social responsibility might help it become more equipped to deal with the challenges presented by new sustainability efforts. Corporate entities can demonstrate social responsibility by instituting ethical labor procedures and providing equitable treatment to their human resources. These practices may include assuring long-term employment, facilitating professional advancement, and maintaining a healthy and risk-free working environment. In addition, in order to demonstrate a dedication to CSP, it is vital to make direct contact with the greater community through means such as donations, volunteering, and sustainable activities. Incorporating social sustainability into the missions, values, and beliefs of a corporation and its economic activities helps steer sustainable strategic objectives and the implementation of CSP.

CSP adoption in day-to-day company operations is significantly aided by a powerful driver, an organization's culture that emphasizes sustainable business practices. The concept of sustainability is gaining increasing relevance in today's world. As a result, in order for corporations to maintain their competitive edge, they need to modernize their organizational cultures by incorporating elements of sustainable culture. Building trust among workers, improving the company's image in the community, and giving the company a reputation for excellence will provide it with a competitive advantage (Ahlstrom *et al.,* 2020; Kantabutra & Ketprapakorn, 2021). Corporate entities can cultivate sustainable cultures by elucidating the key questions on why the company must implement CSP and responding clearly to these issues. Therefore, to motivate stakeholders to adopt sustainable efforts, it is necessary to understand the problems associated with sustainability in manufacturing and the solutions to those problems.

Additionally, improving the clarity of each employee's function and obligations within the corporate structure contributes to an increase in the organization's ability to maintain sustainable performance. A sustainable culture includes a well-structured monitoring system that promotes improved collaboration and compliance with sustainability standards and regulations. It is an essential component of a sustainable culture.

Utilization of technology and innovation has a significant part in both the facilitating of CSP and the delivery of long-term achievement for the company. This will be accomplished by providing unrivaled opportunities to resolve sustainability concerns and improve operations (Annunziata *et al.,* 2018; Xia *et al.,* 2020; Liu *et al.,* 2021). As a result, corporations are responsible for improving their research and knowledge management. To maximize the potential of technology and innovation teams, which are

tasked with discovering new technologies, developing innovative business practices, and facilitating more resource-efficient manufacturing. In addition, technological advancement and innovative thinking can benefit from working together with supply chain members and exchanging relevant information. These will incorporate ideas from a variety of perspectives and produce a CSP that is realistic throughout the operations of the organization.

Practical Implications

This study offers a comprehensive analysis of the management of the Indian automobile industry by focusing on the five most important factors identified in this study.

The administration and preservation of knowledge, information, and data of CSP by businesses, such as data of employees and customers, is an essential part of security assurance. Due to the fact that most people do not want their private details to be publicly disclosed, organizations should make every effort to guarantee that this data is secure within the organization's database. Since the members are willing to share their information with the organization, this information must be safeguarded at all costs because it is evidence of the participant's trust in the organization. If a company has a reputation for preserving the data of its stakeholders appropriately, it can boost the level of confidence that occurs between the company and the community in general, which in turn can improve the performance of the company over the long run. To ensure that organizations adhere to the CSP, government policies ought to consider this so as to protect not only the rights of the organization but also those of the stakeholders. Considering companies are expected to report on their progress toward sustainability on an annual basis, it is critical to maintain the confidentiality of all relevant data and information in the scenario that a system malfunction or investigation is conducted in the near or distant future.

Auditing is a valuable method for evaluating performance and determining the level of progress made toward sustainability by contrasting the practices of corporations with those of sustainable practices. The provision of openness and clarity brought about by the presence of an internal corporate auditing system contributes to an increase in stakeholder trust, which in turn contributes to an increase in corporate value. The management team will receive assistance with CSP changes, evaluations, and reports thanks to auditing, and the efficiency and effectiveness of business operations will improve as a result. Adopting internal audits will make it possible for policymakers to find corporations' weaknesses in sustainable production and will make it easier to get long-term solutions for the problems that now exist. Auditing is a practice that promotes sustainable business practices, and via auditing, one may predict the risks associated with sustainable business practices as well as their impact on the growth of a company. As a result, corporations need a reliable auditing system that takes into account and keeps track of all applicable procedures, protocols, laws, regulations, and industry standards in an all-encompassing manner.

These days, businesses are assessed on how much profit they can make. Still, their reputations are tied to their long-term contributions to society, such as through the sponsorship of athletic and recreational endeavors and the provision of charitable donations to local communities. Implementing CSPs focused on sports, and other leisure activities produce societal well-being and attract economic advantage for corporations. Sports and other recreational activities attract large crowds and bring people together. Still, the fact that they are entertaining, healthy, and positive activities contributes most to their ability to improve social integration. The expansion of a company's customer base, the enhancement of its brand reputation, and the way the general public views its products can result from the company's sponsorship or participation in such events. Partnerships with sporting organizations or events can, over the course of time, result in financial benefits due to the large number of people who participate in sporting and leisure activities. This charitable sponsorship not only brings in new consumers but also improves the mood of existing workers and helps the company keep talented workers concerned about the community's welfare.

Another form of philanthropy contributing to community development is support for the arts and culture, specifically the culture and arts of the local market. It could be done in one of two ways: by promoting cultural events or visiting cultural events arranged by the society. Culture and art define societies, and the people who live in each community are passionate about preserving and advancing the aspects of their organization that are responsible for describing them. Additionally, national governments in several nations actively support and invest in the maintenance of local cultures. As a result, culture and the arts play an essential part in societies, and businesses are obligated to devote resources and invest in activities connected to culture and the arts. These advantages and improvements boost the corporation's integration with its prospective clients. In conclusion, developing a framework that assists businesses in accomplishing their environmental objectives through the ongoing examination, evaluation, and improvement of their environmental performance is essential to the successful implementation of CSP. Implementing an environmental management system will bring numerous benefits to corporations, including the elucidation of employee responsibilities, the reduction of waste, compliance with laws governing sustainability, the provision of sustainable procedures for the reduction of environmental impacts, and the attraction of new stakeholders.

Conclusion

To direct a corporation's sustainable efforts, reduce the negative repercussions of unsustainable operational processes, and offer recommendations for practical development, one must understand the core CSP and identify the core CSP's linked nature's components. There is a lack of theoretical knowledge among corporations, despite the fact that they are conscious of the importance of sustainable practices. This lack of understanding can give a base that optimizes the complicated features and bring improvement in practical terms. As a result, this study thoroughly emphasizes the fundamental CSP characteristics and discusses the interplay among the characteristics in order to identify the CSP that is the most important for

businesses to concentrate on. This study offers a set of CSP aspects based on the existing literature, which is broadly divided into six aspects: economic, social, environmental, organizational culture, technology usage and innovation, and government initiatives. The FDM was utilized to validate seventy-three of the practical factors determined in the literature that influence CSP. The fuzzy set theory was employed to cut down on the ambiguity that was present in the experts' responses. In the end, FDEMATEL was used to develop a causal effect diagram and figure out how the attributes are related.

According to the results of the FDM, only 39 of the initially proposed 73 criteria were selected to comprise the reliable sample for measuring essential CSP. According to the findings of FDEMATEL, the factors of causality that need to be improved to successfully adopt CSP include government actions, social qualities, technology utilization and innovation, and organizational structure. It was discovered that government actions were the single most influential factor, influencing all other areas and significantly impacting the economic and environmental practices of corporations. Therefore, to improve the effectiveness of the CSP and the results, managers need to pay a substantial amount of attention to these criteria.

This research contributes to the existing body of knowledge by first determining the fundamental CSP characteristics necessary to facilitate the achievement of sustainable organizational goals and then determining the causal interrelationship among those characteristics. Clarification was provided regarding the significance of governmental initiatives, business social consciousness, technological innovation, and sustainable organizational culture about the implementation of CSP. The improvement of these characteristics will increase CSP, and in particular, this will generate economic gains for corporations while causing the least damage to the environment and to societal well-being. Additional suggestions are offered in the section on the implications, designed to provide empirical evidence and assist the company policymakers and professionals in accomplishing their sustainability development.

This research has significant drawbacks. Initially, the first qualities were derived from the existing literature. Therefore, the selected list does not necessarily include all CSP features, and the addition of other elements can be explored. Second, a limited number of experts participated in this study. Therefore, more experts can be expanded to obtain more diverse perspectives. Thirdly, the focus of the study is the Indian automobile sector; future research may examine other national contexts, which can enhance the generalizability of these findings.

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