

Drivers of Sustainable Supply Chain Management: an Empirical Study among Manufacturing Companies in Dakshina Kannada, Karnataka

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Abstract – Manufacturing companies and industrial sectors are increasingly required to integrate sustainable practices into their operations in order to protect the environment and promote social welfare. The concept of Sustainable Supply Chain Management (SSCM) has attracted widespread attention from academics and business practitioners in the last 20 years to address sustainability challenges in the supply chains. However, the adoption of SSCM practices is challenging for many businesses. This study aims to empirically evaluate the drivers that influence the adoption of SSCM practices among the manufacturing companies of Dakshina Kannada, Karnataka. The drivers were identified from the literature and included in the research questionnaire of the study. The empirical data were collected using a structured research questionnaire from 217 manufacturing firms across the district and analyzed descriptively to determine the degree of influence of each driver. The findings show that both internal and external SSCM drivers substantially influence SSCM practices in the manufacturing sector of Dakshina Kannada. Particularly, government regulations and top management commitment are among the most influential drivers.

Keywords – Drivers, Sustainable Supply Chain Management, Dakshina Kannada, Sustainability, Supply Chain, Manufacturing Companies.

I. INTRODUCTION

The term "sustainable development" has significantly progressed, driven by the intense lobbying efforts of the environmental movement over the past 30 years [1]. In the modern day, sustainability has become significantly popular in the business world and across various sections of society [2]. Global challenges like resource depletion, climate change, and social inequality can be addressed by incorporating sustainability into business operations [3]. Business sustainability requires managing and balancing environmental, social, and financial considerations during business activities [4]. Companies that adopt responsible environmental and social practices achieve financial stability, sales growth, and higher survival rates in the long term. However, they might not witness a significant difference in their profitability in the short run [5]. Despite these long-term benefits, implementing sustainable practices remains a complex and demanding process for many businesses. Several studies in the literature have found that implementing sustainable initiatives in the business environment comes with significant initial expenses [6]. This indicates that implementing sustainable practices is a challenging and complex process for business managers.

Sustainable supply chain management (SSCM) plays an important role in achieving business sustainability through integrating environmental, social, and economic considerations into the supply chain operations. According to Seuring & Muller [7], it is "the management of material, information, and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of

sustainable development, i.e., economic, environmental, and social, into account, which are derived from customer and stakeholder requirements." Nowadays, businesses of all sizes and sectors are becoming more mindful about managing supply chains in a sustainable manner [8]. The pursuit of SSCM is the result of the need of the present world in order to decrease waste production, innovate, generate profit, and build a competitive advantage [9]. Therefore, the image of the modern supply chain is associated with its consideration for environment protection and sustainable development. Considering the complexity of sustainable initiatives, the implementation of SSCM is affected by various drivers and barriers such as regulatory pressures, market demands, moral and ethical values of managers, etc.

The Dakshina Kannada district of Karnataka, India, has a dynamic manufacturing sector that plays an important role in the economic development of the state. The manufacturing sector of Dakshina Kannada includes various types of industries, such as food processing, chemicals, automotive, metal and machinery, plastics, electronics, etc. The growing awareness about the environment, rules and regulations, and emphasis on social responsibility have motivated the manufacturing companies to pursue new approaches in conducting their businesses [10]. At the moment, the concept of sustainability is viewed as an important component of production management in supply chain management [11]. This study focuses on the drivers of SSCM practices in the manufacturing sector of Dakshina Kannada, and it tries to provide an understanding of the experiences of manufacturing companies in this local context.

II. LITERATURE REVIEW AND THEORETICAL BACKGROUND

In modern times, industries, specifically the manufacturing sector, are required to move towards the adoption of sustainable practices. The adoption and implementation of sustainable practices are influenced by various external and internal drivers. In the literature, these impacting elements are synonymously called as triggers, pressures, enablers, and drivers [12]. According to Caniato et al. [13] and Schrettle et al. [14], the drivers are the forces that inspire the organization towards the adoption of sustainable initiatives. The reasons behind the engagement of the firms in SSCM practices differ. While some organizations respond reactively to external influences, some firms are influenced from within by internal drivers to initiate sustainable practices [1]. The Identification of the drivers and barriers is regarded as an important step in the implementation of SSCM [15].

The external drivers of SSCM can be explained based on the Institutional theory. Institutional theory is one of the widely used theories in the literature to explain the influential role of external drivers of SSCM practices. This theory emphasises the efforts of the companies to secure social legitimacy through adherence to norms and rules [12]. In their seminal work, DiMaggio et al. [16], as cited by Bhakoo & Sohal [30], argued that there are three isomorphic pressures that lead organizations to adopt homogenous structures and practices. These three isomorphic pressures are coercive, normative, and mimetic pressures. Coercive pressures are pressures from influential entities like governments or other organizations that have influence. The normative pressures stem from industry norms and professionalization. Lastly, the Mimetic pressures arise from uncertainty, which encourages the company to imitate others. Collectively, these three pressures drive organizations to align themselves with the established practices. According to the institutional theory, the external drivers of SSCM were identified as coercive, normative, or mimetic institutional pressures. On the other hand, the internal drivers of the SSCM practices can be explained based on the resource-based view theory. The resource-based view theory (RBV) in strategic management emphasizes the importance of internal resources and capabilities of the

firm in achieving a sustainable competitive advantage [17]. According to the RBV theory, these resources and capabilities include tangible and intangible assets of the company, such as managerial skill, operational processes, attributes, and the ability of the company to manage and use information and knowledge effectively [18].

A systematic review conducted by Saeed & Kersten [12] on SSCM Drivers found that external drivers impose greater pressure on organizations and their supply chains in comparison to internal SSCM drivers for adopting sustainable practices. Similarly, the findings of Walker et al. [19] show that the external drivers are more influential on the organization than internal drivers toward the implementation of sustainable practices. On the other hand, Emamisaleh & Rahmani [11] compared the impact of external drivers and internal drivers on the sustainability strategies of the companies, and it found that internal drivers are more effective than external drivers. Therefore, it can be noticed that there is no overall agreement about which set of SSCM drivers is more motivating. This might be because of the contextual characteristics of studies.

External Drivers of SSCM

As much as the external coercive, normative, and mimetic pressure increases, organizations are more influenced to implement sustainable practices to enhance the strengths of companies and avoid penalties [12]. There are numerous external drivers in the literature that may influence the adoption of sustainable practices. Government regulations and legislation are among the most frequently cited external drivers in the literature [14], [12], as companies must comply to avoid legal repercussions and a bad reputational image [14]. The strict enforcement of regulations serves as a crucial motivator and driver for companies to address environmental concerns throughout their entire supply chains [20]. Similarly, Hsu et al. [21] noted that the literature review shows the idea that mandates from government and regulatory authorities serve as key drivers for firms to implement green supply chain practices. Supplier sustainable policies and customer pressures for sustainable practices are other distinguishing drivers in influencing organizations to implement SSCM. A supplier can exercise its influence by stopping the delivery of an input if the customer firm fails to be environment friendly [22]. Large customers can influence smaller suppliers to adopt sustainable supply chain management (SSCM) practices by applying pressure within the supply chain [1]. Moreover, Customers may react favourably to environmental actions of a company by buying its products, but they may also boycott the company if it is known for poor environmental management [23]. According to Banerjee [24], corporate environmentalism can provide a competitive advantage; therefore, sustainable practices of the competitors also influence a firm towards the implementation of sustainable practices [9]. When competitors observe the success of others in the market driven by their sustainable initiatives, they are often motivated to adopt similar strategies and embrace sustainable thinking [11]. Furthermore, operational factors like rising raw material costs and resource scarcity drive organizations to optimize their processes and align them with environmental sustainability goals [25]. As a result, the scarcity of resources can also be a driver for SSCM practice, as noted by Wu & Pagell [26] that the growing need for environmental protection and the rising demand for natural resources are compelling companies to reevaluate their business models and reorganize their supply chain operations. In addition to the above, certifications and pressures from NGOs are other external drivers mentioned in the literature [1], [14], [24], [26], [27].

Internal Drivers of SSCM

Internal drivers of SSCM influence companies to implement environmentally and socially responsible practices. As a result, they can be considered as strategic resources to gain a competitive advantage. Tay et al. [1] divided the internal drivers of SSCM into three broad categories: people issues, strategic issues, and functional issues, which include top management commitment, organizational culture, employee involvement, company sustainable strategy, risk management, organization size, and others. Zimon et al. [9] noted that the top management's commitment to sustainability is one of the most important drivers of SSCM. Researchers have highlighted that the commencement and successful implementation of organizational change largely depend on the perspectives and attitudes of managers [11]. Moreover, the findings of Zimon et al. [9] emphasized that achieving SSCM critically depends on the vision and active support of top management. An empirical qualitative study in the context of developed and developing countries was conducted by Farrukh et al. [25] found that cost reduction is an important driver in adopting environmental practices in manufacturing companies. Risk management is another internal driver for implementing SSCM. Those companies that act proactively in SSCM can improve their competitiveness and assist in mitigating reputational and environmental risks [1]. Furthermore, the moral obligation of a company to take responsibility for implementing sustainable practices is another driver identified in the literature that influences a large number of business managers.

III. OBJECTIVE OF THE STUDY

The objective of this study is to empirically evaluate the influence of internal and external drivers of Sustainable Supply Chain Management among the manufacturing companies of Dakshina Kannada.

IV. SIGNIFICANCE OF THE STUDY

The importance of this lies in the fact that the study of SSCM drivers in the manufacturing sector of Dakshina Kannada is important for promoting sustainable practices. An overall understanding of these drivers provides actionable insights for business managers and policymakers and helps them to navigate the complexities of implementing sustainable practices. Narimissa et al. [15] mentioned that the identification of the drivers and barriers is regarded as an important step in the implementation of SSCM. This research study contributes to the academic literature by providing a localized perspective from the manufacturing sector of Dakshina Kannada. In addition, this study is valuable not only for this local context but also for providing an understanding about sustainable business practices in a larger context.

V. RESEARCH METHODOLOGY

This study follows a descriptive empirical survey design conducted to evaluate the drivers of SSCM among manufacturing companies in Dakshina Kannada. The primary data for this study were collected using a structured research questionnaire developed through an extensive review of the SSCM literature. The questionnaire included various SSCM drivers. The responses were collected using a five-point Likert scale to assess perceptions of respondents about the influence of SSCM drivers on their companies. According to information provided by the Dakshina Kannada District Industries Centre (DIC), there are 14 large-scale, 20 medium-scale, and 344 small-scale manufacturing companies. To ensure comprehensive coverage, all large- and medium-scale companies were surveyed, while a random sampling technique was used to select 186 small-scale manufacturing companies. Data were gathered through personal and physical distribution of the questionnaires to top managers over a period of three and a half months. In the final stage, responses were obtained from 12

large-scale, 17 medium-scale, and 187 small-scale companies that met the sampling requirements. Finally, the collected data were analyzed using descriptive statistics to identify key SSCM drivers.

VI. ANALYSIS RESULTS AND INTERPRETATION

In the first step, all the drivers of SSCM practices, including internal and external drivers, were analyzed together by calculating the overall mean of the responses. The overall mean of the responses will demonstrate the agreement or disagreement level of the participating companies about the influence of the drivers on the manufacturing companies toward the adoption of SSCM practices. Then, the three categories of companies, including small-scale, medium-scale, and large-scale manufacturing companies, were separately evaluated based on their respective overall mean scores to see the extent to which the drivers collectively influence each group of companies towards the adoption and implementation of SSCM practices. Therefore, this analysis will highlight to what extent the managers of manufacturing companies agree or disagree on the influence of drivers of SSCM practice on the manufacturing companies as a whole and on small-scale, medium-scale, and large-scale manufacturing companies separately.

Table 1. External drivers of sscm based on company size.

Size of the Company	Number	Mean
Small	187	3.774
Medium	17	4.063
Large	12	3.980
Total	216	3.939

Source: Survey Data.

The descriptive analysis of the drivers of SSCM practices shows an overall mean of 3.939, and this suggests that there is a positive agreement among the manufacturing companies participating in the study that the listed SSCM drivers have influenced their companies toward the adoption and implementation of SSCM practices. Moreover, as presented in Table 1. The descriptive statistics of the responses based on the size of the companies show that there is a notable difference between different categories of manufacturing companies concerning the extent to which the SSCM drivers have influenced each category of the companies. Based on the descriptive analysis of the data, the results indicate that medium and large-scale manufacturing companies have experienced a higher level of influence from the drivers of SSCM practices with an overall mean score of 4.063 and 3.980, respectively. On the other hand, the overall mean score for small-scale manufacturing companies is 3.774. The results show that companies with larger sizes are more influenced towards the implementation of SSCM practices (See Table 1). Larger companies have more capabilities, larger access to resources and more regulated and pressurized [28] and this might be the reason behind. Nevertheless, the analysis shows, surprisingly, that the mean score for the medium-scale is slightly higher than large-scale companies. This suggests that medium-scale companies are slightly more affected than large-scale companies by the drivers of SSCM practices. However, the analysis shows that larger companies, in general, are more influenced to go for sustainable practices in their business operations. This is compatible with the findings of Battisti & Perry [29].

While small-scale companies show positive agreement about the influence of the drivers of SSCM practices, the mean score is lower for them in comparison to medium and large-scale companies. This is because of limite-

-d access to resources, financial problems, and lack of technological advancement that possibly restrict small-scale manufacturing companies from adopting and implementing sustainable practices [28]. Therefore, providing support such as incentives, technological assistance, awareness, and capacity-building initiatives may help small-scale manufacturing companies improve their ability to adopt sustainable practices.

External Drivers

External drivers are important factors that originate from the outside environment on the companies and influence them toward the adoption and implementation of SSCM practices. These external drivers of SSCM practices include government regulations and legislation, customer pressure for sustainable practices, partner companies' sustainable policies, competitors' sustainable practices, scarcity of resources, standards such as ISO certification, and pressure from stakeholders (such as NGOs, local communities, etc) [1], [12], [6]. Further, the top-level managers of the companies were asked to rate the mentioned drivers based on the extent to which each driver has influenced their companies toward the implementation of sustainable practices. Each statement was rated by the respondents based on a points Likert scale.

Table 2. Descriptive statistics of external drivers of sscm.

No	Items	Mean	Std. Deviation
1	Government regulation and legislation	4.523	0.586
2	Partner companies' sustainable policies	3.982	0.685
3	Customers' pressure for sustainable practices	3.564	0.782
4	Competitors' sustainable practices drive us toward sustainable practices	3.945	0.658
5	Scarcity of resources	2.847	1.015
6	Standards such as ISO certifications	3.722	1.357
7	Pressure from other stakeholders (such as NGOs, local community, etc.)	3.181	0.935

Source: Survey Data.

The descriptive analysis of the responses is presented in Table 2. The analysis shows that Government regulations and legislation driver is the most influential external driver with a mean score of 4.52 (SD = 0.586). This implies the impactful role of regulatory measures. As per the results, the second most influential driver was Partner companies' sustainable policies with a mean of 3.982 (SD = 0.685). This suggests that many organizations are influenced or propelled toward taking sustainable initiatives and practices by the policies and commitment of their Partner companies. The third most impactful driver was found to be competitors' sustainable practices, with a mean of 3.94 (SD = 0.658), indicating that competitive pressures highly drive the companies to adopt some sustainable practices to maintain their reputation in the market. Further, customers' pressure for sustainable practices, with a mean of 3.56 (SD = 0.782), shows a moderate influence on manufacturing companies. Public awareness about the importance of sustainability could improve the strength of this driver and put more pressure on the companies through the customers' demand for sustainable products. The next influencing driver of SSCM practice among Dakshina Kannada manufacturing companies is standards such as ISO certifications with a mean score of 3.722 (SD = 1.357) showing the importance and influence of standardization and certification. However, the high standard deviation of the responses shows that there is no

general agreement among the respondents about the importance and role of this driver in moving manufacturing companies toward sustainable practices.

On the other side, the least influential drivers were found to be “pressure from other stakeholders (such as NGOs and local communities)” and “Scarcity of resources”. Pressure from other stakeholders (such as NGOs and local communities) with a mean of 3.181 (SD = 0.935) indicates that it is not a powerful SSCM driver for Dakshina Kannada manufacturing companies. The responses are almost neutral about the role of this driver, meaning that the respondents neither agreed nor disagreed about its influence on the adoption of SSCM practices. Lastly, the Scarcity of resources driver with a mean of 2.847 (SD = 1.015) was the least influential driver for SSCM. The mean value shows that the managers do not identify the driver “scarcity of resources” as an influencing factor towards SSCM practices implementation. Further, it highlights that scarcity of resources is not considered a critical issue for managers, or they may not be highly informed about the overall importance of resource preservation.

Internal Drivers

The adoption of SSCM practices can also be influenced from within the company because of several factors. Some of the most impactful internal drives of SSCM practices were identified from the literature. These internal drivers of SSCM practices include top management commitment, existing technologies and equipment, cost reduction through sustainable practices, risk management, moral obligation, and existing skills and capabilities. Besides the previous external drivers, the managers of manufacturing companies were asked to rate the internal drivers according to the extent to which each internal driver influences the companies towards the implementation of sustainable practices. Each internal driver was presented in the form of statements in the questionnaire to the participants and was rated by the respondents based on a five-point Likert scale. The descriptive statistics of the responses concerning internal drivers are shown in Table 3.

Table 3. Descriptive statistics of sscm internal drivers.

No	Items	Mean	Std. Deviation
1	Top management commitment	4.512	0.661
2	Existing technologies and equipment	3.664	0.597
3	Cost reduction through sustainable practices	3.384	0.757
4	Risk management such as reputational and environmental risks	3.945	0.592
5	The moral obligation of the Company	4.048	0.586
6	Existing skills and capabilities	3.713	0.944

Source: Survey Data.

The results of the descriptive analysis show both strongly influential internal drives as well as less impactful and influential internal drivers. Top management commitment with a mean of 4.512 (SD = 0.661) appeared to be the most important driver. This shows that leadership plays a critical role in promoting sustainable initiatives in an organization. The second highly influential internal driver of SSCM practices was found to be the moral obligation of the company with a mean value of 4.048 (SD = 0.586). This highlights that ethical issues play an important role in driving manufacturing companies toward sustainable initiatives in the manufacturing industry

of the district. This moral motivation in the sector has the potential to drive manufacturing companies toward sustainable practices in a meaningful way.

As per the analysis results, the third most effective internal driver is risk management such as reputational and environmental risks with an overall mean score of 3.945 and standard deviation of 0.592. This shows that business managers are aware that unsustainable manufacturing practices may face their business with bad reputational and environmental risks. Therefore, sustainable practices help companies to safeguard themselves against penalties and bad reputations. Moreover, this positions the company as a responsible organization and enhances the trust of the stakeholders. Next, the existing skills and capabilities driver is also identified by the respondents as an influential driving factor toward the adoption and implementation of SSCM practices with a mean score of 3.713 (SD = 0.944). This signals that the business managers are confident to some extent in the capabilities and skills of the workforce to implement SSCM practices. However, considering the high standard deviation of the responses in comparison to other factors in the list, there is not a general agreement on the existing capabilities and skills as a driving force.

Existing technologies and equipment with a mean score of 3.664 with a standard deviation of 0.597 is found to be less influential drivers in comparison to the above-mentioned SSCM drivers. However, the respondents consider it as a driving force toward the implementation of sustainable practices. This shows that even though existing technologies and equipment are considered a driving force for manufacturing companies; however, the strength of this driver is not that powerful may be because of the absence of modern technologies and equipment or maybe because of the reason that it is not a very motivating factor in general. Lastly, the least impactful driving factor is cost reduction through sustainable practices. The mean score value for cost reduction through sustainable practices is 3.38 with a standard deviation of 0.557. This implies that most manufacturing companies do not consider sustainable practices as a means of reducing their production costs.

VI. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

Discussion

This study investigated the primary internal and external drivers influencing the adoption of SSCM practices among manufacturing companies in the Dakshina Kannada district. The findings from the descriptive analysis confirmed that both internal and external drivers play a significant role in pushing companies toward the adoption of sustainable practices, while the level of influence varies. The results of the analysis showed that external drivers like government regulations and legislation, partner companies' sustainable policies, and competitor practices were the most impactful. Specifically, government regulation and legislation found to be the most influential external driver. This supports the findings of previous studies, which emphasized the critical role of coercive institutional pressures in shaping sustainable practices [12], [14]. Consistent with institutional theory, companies try to conform to external rules, norms, and expectations, and regulations to gain legitimacy [30]. On the other hand, external drivers like pressure from NGOs and local communities, and scarcity of resources, were found to be the least influential factors.

In the context of internal drivers, the results show that the most influential SSCM driver was top management commitment. The next most impactful internal driver was moral obligation and risk management. The RBV theory emphasizes the importance of internal capabilities and leadership commitment in achieving competitive

advantage through sustainable strategies [17], [9], which aligns with our findings. The role of top management is widely acknowledged in previous empirical studies. The success of SSCM initiatives significantly depends on the vision, priorities, and ethical attitude of top managers [11]. The high mean value for moral obligation as a key internal driver indicates the growing ethical awareness among business managers. Furthermore, risk management also emerged as a significant internal driver of SSCM practices. Companies recognize that adopting SSCM practices can help mitigate reputational and environmental risks. This finding supports the previous studies that suggest proactive engagement in sustainable practices strengthens the brand of the company, builds stakeholder trust, and maintains long-term profitability [14]. On the other hand, internal drivers such as cost reduction, existing technologies, and employee capabilities were found to be relatively less influential drivers among the manufacturing companies of Dakshina Kannada. Specifically, cost savings through sustainable practices is perceived by the participants of the study as the least influential among all internal drivers. This could be as a result of the high initial costs of implementing sustainable technologies and the lack of immediate financial benefits, as mentioned by Ortiz-de-Mandojana & Bansal [5].

The collective analysis of SSCM drivers based on company size showed that SSCM drivers influenced medium and large-scale companies more than small-scale companies. These findings are in line with the statement of Battisti & Perry [29] that larger companies often have more resources and can implement sustainable initiatives. In contrast, small companies showed the lowest mean score among the three categories, and this indicates that small-scale companies are less influenced by both internal and external SSCM drivers. This could be due to resource limitations, lack of technical knowledge, and limited awareness of the long-term benefits of sustainability among the small-scale manufacturing companies [28].

VII. CONCLUSION

This study evaluated the influence of SSCM drivers on the manufacturing companies of the Dakshina Kannada district. The findings of the study demonstrated that both internal and external SSCM drivers significantly influence the sustainability efforts of the companies. In general, government regulations and legislation, and top management commitment are found to be the most influential drivers. The results support institutional and resource-based theories by highlighting the role of external pressures and internal leadership capabilities in promoting sustainability. In addition, the study found a visible difference in the influence of SSCM drivers based on company size.

VIII. RECOMMENDATIONS

Several implications can be drawn for business managers and policymakers from the results of this study. Regarding small-scale companies, it is suggested that more support, such as financial incentives and awareness programs about sustainability be provided to enhance their capabilities and improve the adoption of sustainable practices. Policymakers are advised to strengthen enforcement mechanisms and encourage sustainability certification schemes. Finally, businesses are recommended to recognize that beyond compliance with norms and standards, SSCM practices provide a competitive advantage, like improved reputation, stakeholder trust, and long-term resilience.

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