

Exploring the Drivers and Barriers to Sustainable Logistics Practices in SMEs: An Emerging Economic Perspective in Bangladesh

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Abstract

The concept of circular economy (CE) has emerged as a highly encouraging approach to achieve sustainable economic development for small and medium sized enterprises (SMEs). In recent years, the growing emphasis on circular economy, effective supply networks and strategic supply chain drivers has played a vital role in the development of sustainable SME systems. Modern manufacturing scenario (rapid, technology-driven transformation, Industry 5.0) and natural resources have shown huge challenges, particularly in the high cost of technology transformation, limitations of resources, skill manpower. The purpose of this study is to identify the barriers to sustainable manufacturing (SM) from SMEs in Bangladesh and rank them as per their priority. In this study, Bayesian Best-Worst Method (BWM) was applied to identify 12 major previously unexplored barriers, which were subsequently classified into four categories based on their shared characteristics. The results demonstrated several critical barriers within SME sector in Bangladesh, with the most significant being appropriate strategy plan (0.5374), inadequate transportations and infrastructure (0.3886), lack of skilled workforce (0.3146), lack of environmental concerns (0.2620), and the lack of government regulations (0.2539), respectively. Importantly, this study identified significant barriers that can be applied to improve the quality and sustainability of SMEs by reducing risks in the recommended areas.

Keywords: Logistics, barriers, bayesian best-worst method, enterprises, supply chain

1. Introduction

The trend of globalization in recent decades augmented the importance of logistics management in a number of different contexts for attaining sustainability in small and medium sized enterprises (SMEs) [1]. The logistics management process coordinated the acquisition, maintenance, and transfer of resources to the right amounts at

the right time. However, many studies focused on logistics in a variety of applications such as planning, execution, and management of goods and services [2]. To address impediments, an effective logistics infrastructure was needed to enhance potential aspects of supply chain management. Sustainable logistics services facilitated the movement of goods, ensure their quality and promptness, and reduce the price of

international trade. The availability of top- notch logistics services and infrastructure had a big impact on transportation [3]. Industries were needed to investigate a broad spectrum of choices in order to successfully integrate logistics into their supply chain [4]. A prudent decision-making approach assisted the logistics systems in integrating other components into the entire system. If any component of the logistics malfunctions, the entire system could fall apart very rapidly [5].

Logistics networks were more vulnerable to a wide range of risks due to increase the international business. A strategy management was more significant according to the eyes of the world's logistics management specialists [5] while risk management approaches played a crucial role in the reduction of unintended business losses.

Many enterprises were developing cyber-physical systems that had the potential to alter the competitive market by exploiting new technologies such as additive manufacturing, advanced robotics, artificial intelligence, autonomous vehicles, block chain, drones, and so on [6]. In addition, sustainability and eco-sustainability protected the endangered species, renewable energy, and decreased carbon footprint from the environment [6]. Reputed SMEs maintained sustainability by conducting their logistics system in a right way that helped to grow customer's satisfaction. Importantly, according to view of experts, logistics shouldn't be considered as a cost center [6]. More importantly, this study aimed to find out key barriers with their rank to implement sustainable logistics in SMEs for our economic growth in Bangladesh.

On the other hand, Bayesian Best-Worst Method (BWM) is a highly efficient and powerful Multi-Criteria Decision-Making (MCDM) tool to find

out criteria weight coefficients in many areas of applications, particularly in SME for further improvement [6]. Herein, we use BWM tool to identify and rank significant barriers according, while the present study recommends to apply them in SME for further improvement.

2. Methodology

The methodological framework of the study demonstrated in Figure 1. Here, 12 most important logistics barriers identified based on literature reviews and the opinion of the experts. Further, we cross-checked these values as well (Figure 1). Importantly, we ranked all of the values by using Bayesian BWM algorithm according to their priority.

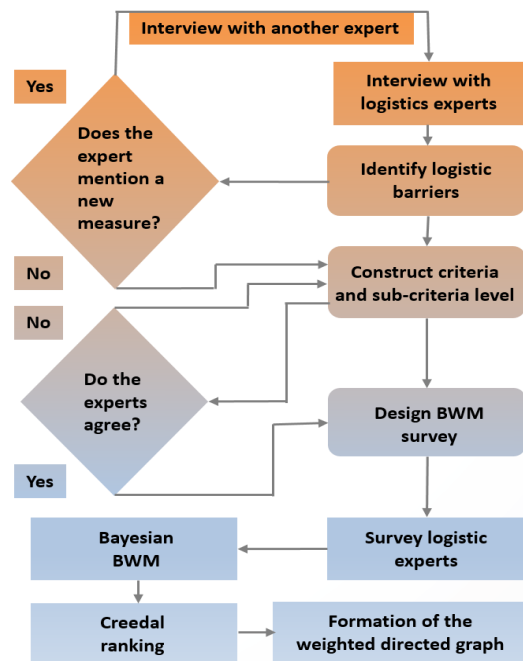


Figure 1: Conceptual strategic framework applied in this study

We identified the Barriers as demonstrated in Table 1 and their ranking were subsequently

determined using Bayesian Best-Worst Method (BWM) to find out the most significant barriers. This method aggregated preferences of multiple decision makers (DMs) in a probabilistic framework, enabling the derivation of robust reliable final conclusions.

Table 1: Identification of barriers in sustainable logistics

S N	Barrier	Ref.
1	Incapable of adopting new technology	[8]
2	Lack of skilled workforce	[9]
3	Inadequate transportation and infrastructure constraints	[10], [11]
4	Lack of Government regulation	[12]
5	Uncertainties in overall system	[13]
6	Unable to execute an appropriate strategy plan	[13]
7	Lack of attention to environmental concerns	[14]
8	Insufficient funds and resources for establishing sustainable logistics	[15]
	Inconsistency and lack of cooperation among the top management	[16]
10	Inadequate measures for transporting perishable commodities	[17]
11	Lack of understanding of operational systems	[18]
12	Unavailability of comprehensive performance metrics	[19]

3. Results and Discussion

This section presented the ranking of important barriers as estimated using the Bayesian BWM. The nodes of the graph demonstrated the criteria as well as their average weight values that were calculated using the mean of W^* distribution and each edge 1-2 indicated, while 1 was more important than 2 with level of confidence (Figure

2-6). In other words, each edge in the graph represented a credal ordering, while the whole graph visualized the credal ranking of a set of criteria.

Table 2: Confidence scores for different clusters

SN	Criteria	Weight
1	Technical impact	0.2531
2	Administrative policy	0.3016
3	Resources	0.2286
4	Organizational operation	0.2165

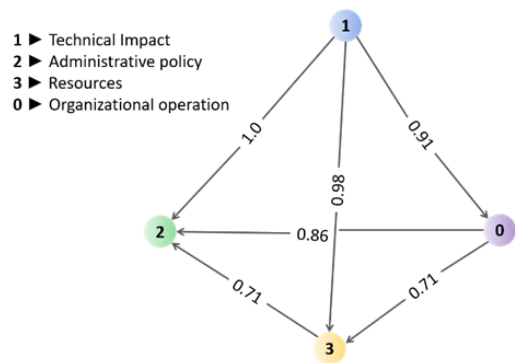


Figure 2: Ranking a set of various criteria

Table 2 showed the weight values corresponding to their different criteria. Among the four weight values, administrative policy (0.3016) was most important than others, while organizational level value (0.2165) was lowest one. Further, administrative policy related values were more implemented with 1.0 confidence level than resources (0.71) and technical impact (0.93) levels. Importantly, these values depend on the decision maker's perception, but we used 0.70 threshold limit for simplicity of the interpretation. Figure 3 demonstrated the sub-criteria ranking of administrative policy that were the most applicable for sustainable logistics. Further, Table 3 indicated the most influential uncertainties

(0.4840) sub-criteria barriers in overall systems, which the lack of environmental concerns (0.2620) were the second most important sub-criteria barriers and the lack of government regulations (0.2539) were the least important sub-criteria barriers. Therefore, the uncertainties sub-criteria barriers should be controlled for maintaining sustainable logistics in SMEs.

Table 3: Confidence scores of administrative policies related sub-criteria

SN	Sub-criteria	Weight	Creedal weight
1	Lack of government regulation	0.2539	0.07657624
2	Lack of attention to environmental concerns	0.2620	0.0790192
3	Uncertainties in overall system	0.4840	0.1459744

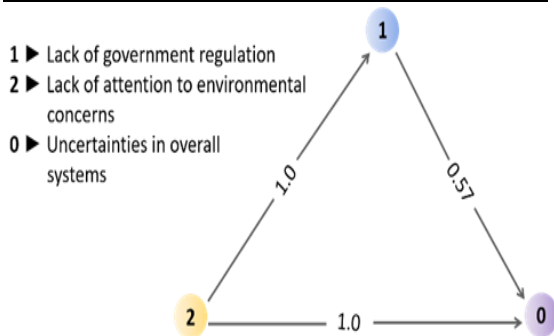


Figure 3: Ranking a set of administrative policy

Table 4 demonstrated the technical impact related sub-criteria confidence scores, while Figure 4 illustrated inter relationship among the three sub-criteria level of the technical impact. Importantly, the result indicated that inadequate transportations

as well as infrastructure constraints (0.3886) were the most influential obstacles for any SMEs.

Table 4: Confidence scores of technical impacts related sub-criteria

SN	Sub-criteria	Weight	Creedal weight
1	Incapable of adopting new technology	0.3557	0.09002767
2	Inadequate transportation and infrastructure constraints	0.3886	0.09835466
3	Inadequate measures for transporting perishable commodities	0.2557	0.06471767

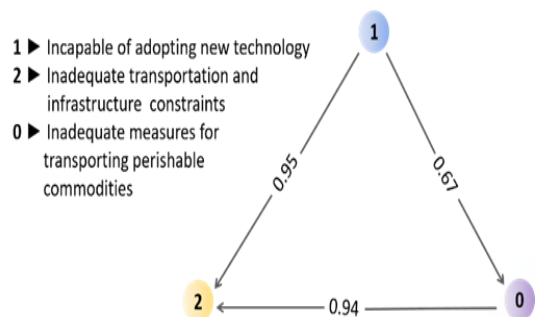


Figure 4: Ranking a set of technical impact

Table 5 indicated the sub-criteria level of the resources. On the other hand, figure 5 indicated inter relationship among the three sub-criteria level of the resources. Here, unavailability's of comprehensive performance metrics (0.3864) were the critical sub-criteria barriers among others. In addition, lack of skilled workforce (0.3146) at the industry indicated the moderate

obstacles for SMEs to maintain sustainable logistics.

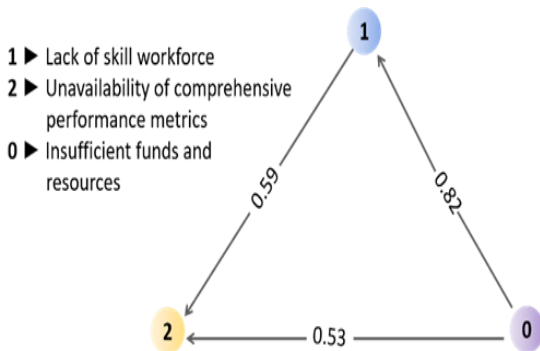


Figure 5. Ranking a set of resources

Table 5: Confidence scores of resources related sub-criteria

SN	Sub-criteria	Weight	Creedal weight
1	Unavailability of comprehensive performance metrics	0.3864	0.08833104
2	Lack of skilled workforce at the industry	0.3146	0.07191756
3	Insufficient funds and resources for establishing sustainable logistics	0.2988	0.06830568

Finally, Table 6 demonstrated the sub-criteria level of the organizational operations, while figure 6 illustrated inter relationship among the three sub-criteria levels of the organizational operation. Among the three mentioned sub-criteria, the most powerful one was unable to execute an appropriate strategy plan (0.5374) that

had to control for smooth functioning the activities of SMEs.

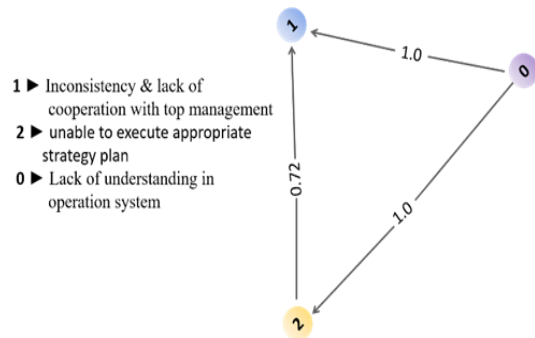


Figure 6: Ranking a set of organizational operation

Table 6: Confidence scores of organizational operations related sub-criteria

SN	Sub-criteria	Weight	Creedal weight
1	Unable to execute an appropriate strategy plan	0.5374	0.1163471
2	Inconsistency and lack of cooperation among the top management	0.2191	0.04743515
3	Lack of understanding of Operational systems	0.2428	0.0525662

Therefore, the present study strongly recommends that SMEs in Bangladesh can be strengthened by prioritizing the following key parameters: (1) lack of environmental concerns, (2) lack of government regulations, (3) inadequate transportations, (4) lack of infrastructure, (5) lack of skilled manpower, and (6) appropriate strategy plan.

4. Conclusion

Sustainable manufacturing is essential to overcome current challenges, while sustainable logistics network plays a vital role in ensuring the smooth growth of SMEs, particularly in Bangladesh. In this context, we designed a research plan to find out the key barriers in SME as demonstrated in figure 1, where the BWM was employed as a powerful multi-criteria decision-making tool to determine criteria weight coefficients.

We observed that the values are influenced by decision maker's perception, and uncertainties sub-criteria barriers were identified as the most influential factors that must be carefully applied to ensure sustainable logistics in SMEs. Particularly, several crucial barriers were found to maintain sustainable development in SME sectors including appropriate strategy plan (0.5374), inadequate transportations and infrastructure (0.3886), lack of skilled workforce (0.3146), lack of environmental concerns (0.2620), and the lack of government regulations (0.2539), respectively. While numerous published studies have proposed different models to solve these challenges, whereas this study proposed a simple, easy and straightforward approach to identify the barriers in the SME sectors. Finally, we believe that these findings can be important for the SME sector and at the same time, it could be helpful insights for researchers in this area.

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