Critical success factors for a circular economy: implications for business strategy and the environment

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Abstract

Eco-efficiency and resource optimization for business strategy and the environment can be achieved by the circular economy (CE) practices in supply chains (SCs). The leather industry is a significant industrial contributor to the economic growth of some countries, but at the same time, it leads to tremendous environmental pollution. This research focuses on the identification and evaluation of critical success factors (CSFs) needed in the business strategy development of CE practices as well as to minimize environmental pollution in leather industry SCs. The CSFs are identified via a comprehensive literature review and are validated by experts' opinions. The validated CSFs are further analyzed using the best-worst method (BWM) and the decision-making trial and evaluation laboratory (DEMATEL). The BWM is used to identify the weights of the CSFs, and DEMATEL is used to determine the cause-effect relationship between the CSFs. The findings show that 'leadership and top management commitment' is the most important CSF. Six CSFs are classified as causal towards CE practices: 'leadership and top management commitment', 'strong legislation towards CE practices', 'ecological scarcity of resources', 'knowledge of CE practices', 'funding support for R&D from the government', and 'competitor pressure on CE practices'. The findings of this study can help managers in the leather industry implement CE practices in their existing SCs to minimize waste.

Keywords: Circular economy; Business strategy; Critical success factors; Leather industry; Resource optimization; Environmental protection; BWM; DEMATEL

1. Introduction

Manufacturing industries play a noteworthy role in the industrial development of a country. To ensure sustainable industrial development, it is important to understand the interdependencies between industry and the environment, economy, and society (Rajesh and Rajendran, 2020a; Rajesh, 2020b; van Loon and van Wassenhove, 2018a; Zhu, 2016). Of these three major areas of impact (environmental, social and economic), environmental issues have recently received more attention by practitioners and researchers (Caniato et al., 2012; Ding et al., 2016; Acquaye et al., 2018; Kalverkamp and Young, 2019; Koberg and Longoni, 2019). New concepts in business strategy development such as circular economy (CE) practices (Geissdoerfer et al., 2017; Lozowski, 2018) and industry 4.0 (Ding, 2018; Moktadir et al., 2018a) have become increasingly popular in developed countries due to their positive impact on the environment. However, there is little evidence on the implementation of these topics in developing countries. Therefore, this study aims to study the CSFs of CE in the context of the leather industry of a developing country, Bangladesh.

The rapid industrial development of manufacturing sectors (Singhal and Singhal, 2019) may impose significant negative impacts on society and the environment via the generation of vast amounts of solid waste and harmful air, water, and soil pollution (Govindan and Hasanagic, 2018; Kluczek, 2019). Additionally, population growth increases the consumption of resources. Hence, the challenge is meeting the growing daily demands of the world's population with limited natural resources. To satisfy this demand in the context of scarce natural resources, it is essential to use natural resources more sustainably (Tuni and Rentizelas, 2018; Kelle et al., 2019). CE practices are one approach to achieving this global agenda (Prieto-Sandoval et al., 2018b). CE practices may drive industries to develop strategies for sustainable manufacturing practices (van Loon et al., 2018b; Kwon and Lee, 2019; Centobelli et al., 2020). They can help minimize waste and build a resilient supply chain (SC) framework. To overcome the issue of scarce natural resources, CE practices such as the 4R policy (reduce, reuse, recycle, remanufacture) may prompt industries to reuse items, recycle waste, and reduce consumption of resources (Govindan and Hasanagic, 2018; van Loon and Van Wassenhove, 2018a; Hazen et al., 2017). The closed-loop supply chain (CLSC) concept may also contribute to the prevention of environmental pollution (Perey et al., 2018). In a CLSC, materials progress through multiple phases, and CE practices in a CLSC have significant benefits. Besides, the economic aspect of CE practices aims to minimize environmental degradation and energy consumption without hampering economic growth or social and technical progress (Marconi et al., 2019). In developed countries, CE practices have been identified as beneficial for business. It is expected that CE practices in Europe may promote business opportunities, increase job opportunities, and minimize waste and material consumption. In the EU, particularly, CE practices are predicted to generate €600 billion in net savings. In the UK, CE practices could help create 50,000 new jobs and €12 billion in investment (EMF, 2013). In the Netherlands, CE practices are expected to provide opportunities via the generation of €7.5 billion in market value and the creation of 54,000 new jobs, as well as facilitating environmental benefits (EMF, 2013).

Numerous studies have investigated the implementation and measurement of CEs. Principato et al. (2019) studied CE practices to minimize food loss and wastage in the context of the Italian pasta industry, while Baldassarre et al. (2019) investigated CE practices for an eco-industrial design process in the south of the Netherlands. In another study, Millar et al. (2019) conducted a literature review to identify and discuss the challenges and opportunities of CEs, and Pieroni et al. (2019) proposed a new business model by conducting a review for the adoption of CE practices. Suárez-Eiroa et al. (2019) conducted a review to link theory with practice to advance the understanding of CE operational principles, while García-Barragán et al. (2019) proposed a mathematical model for measuring CE performance. In a similar study, Ünal and Shao (2019) detailed CE practices for manufacturing firms, while Tunn et al. (2019) studied business models for sustainable consumption in the context of CEs. Flynn and Hacking (2019) researched the issue of setting standards for CE practices. Huysveld et al. (2019) developed a performance indicator to measure CE outcomes in the context of the plastic industry in Belgium, and Govindan and Hasanagic (2018) conducted a literature review to identify the drivers, barriers, and practices relevant to a CE.

The literature review reveals that CE could bring several benefits to economies. Previous studies have been mainly conducted in developed countries and in different industries. Little evidence exists to support the benefits of CE in developing countries, and there is no study in the leather industry, a gap which we try to fill in this study. Despite numerous benefits of CE, leather industry of Bangladesh faces challenges like a lack of proper functioning central effluent treatment plant, difficulty in accessing the latest technologies, insufficient legislation towards CE practices, high cost of environmentally friendly chemicals, lack of reverse logistics facilities, absent of eco-design facilities for waste management, which all are prerequisites for the implementation of CE practices in order to prevent environmental degradation (Hong, 2018; Moktadir et al., 2019a; Moktadir et al., 2020). The leather industry of Bangladesh provides clear examples of these challenges as it moves towards adopting CE practices and strategies due to global pressure and environmental pollution. The leather industry is currently a linear economy, and the production process generates substantial water pollution (Moktadir et al., 2018a). The industry needs to rethink its strategy and adopt global trends. A CE approach can help reduce waste while increasing market value and reputation. However, the execution of CE practices to minimize leather industry waste comes with a series of challenges. To overcome these challenges, it is of utmost importance to identify and examine the critical success factors (CSFs) that can lead the leather industry to implement CE practices. Considering gaps in the existing literature, the research objectives are listed below:

a. To identify the key CSFs required to promote CE practices in leather supply chains.
b. To examine the key CSFs by estimating their importance (weights) and determining the contextual relationships between them.
c. To propose strategic policy frameworks for CE practices in leather supply chains, based on the research findings.

In order to fulfill these research objectives, this study reviews the literature to identify the CSFs required to derive CEs. Then, the best-worst method (BWM) is employed to determine the importance (weight) of each CSF. Finally, the decision-making trial and evaluation laboratory (DEMATEL) method will be used to determine the cause-effect relationships between CSFs. The contribution of this research is twofold. First, it is the first attempt to identify a comprehensive list of CSFs required to derive CE practices in the industrial domain of the leather industry, one of the most environmentally detrimental industrial segments. Second, a combined approach of BWM and DEMATEL is used in this study to provide a clear understanding to industry managers and policymakers about the relative importance (weight) and cause-effect relationships of CSFs.

The rest of the study is divided into the following sequence. Section 2 provides a review of existing literature to identify the CSFs and validates them using experts' opinions. Section 3 provides details of the research framework and used methods. Section 4 presents the analysis and results of the study, which is followed by a discussion of the findings in Section 5. Section 6 gives an overview of the theoretical and policy implications of the research, while Section 7 concludes the paper with a discussion of the limitations of this research and future research goals.

2. Literature Review

This section highlights existing literature regarding CE and waste management, waste management in leather supply chains, and critical success factors for CE implementation.

2.1 *Circular Economy and Waste Management*

The circular economy is the process of transforming supply chain operations from the linear model to a circular production/business model where used/waste materials and components are reintroduced into the supply chain in a closed-loop system through reusing, recycling, remanufacturing, repair and refurbishing as a means of recapturing value and minimizing negative impacts (Frei et al., 2020; Chen et al., 2020; Kusi-Sarpong et al., 2019). With the implementation of CE practices, waste generation from manufacturing can be reduced by a significant amount (Katz-Gerro and López Sintas, 2018). In a CE, waste materials are assessed for further use (Murray et al., 2017; Abbey et al., 2019). If reuse is not possible, the materials are passed on for recycling, which helps manage waste significantly. CE practices for waste management have attracted the attention of many researchers and practitioners in developed countries (Korhonen et al., 2018; Sariatli, 2017), and research into CE practices in waste management has recently gained popularity. Mahpour (2018) identified the barriers to CEs for construction and demolition waste, while Qu et al. (2019) investigated the effects of China's waste ban on the global CE. Blomsma

(2018) proposed 'collective' action recipes in CE implementation to manage waste and resources and Malinauskaite et al. (2017) highlighted solid waste management in the context of a CE. Table 1 summarizes previous studies on CE.

Table 1: Contribution of the previous literature on CE

Reference	Contribution	Country context	Industry context	Methodology
Primc et al., (2020)	In this study, the authors contributed to the organizational life cycle theory by proposing configuration indicators of CE. They proposed 13 indicators of the organizational life cycle	Slovenian	Manufacturing, retail and industrial sectors	Crisp-set qualitative comparative analysis
de Sadeleer et al., (2020)	They investigated the environmental benefits for household organic food waste towards CE practices.	Norway	Household organic food waste	Material flow analysis and life cycle analysis (LCA)
Suzanne et al., (2020)	In their study, the authors conducted a systematic literature review to offer research towards CE in production planning.	-	-	Literature review
Luttenberger, (2020)	The study demonstrated the waste and circularity indicators to ensure circularity in waste management.	Croatia	Waste food and plastics	Holistic approach
Sassanelli et al., (2019)	In their literature review, the authors focused on the performance assessment of circularity in the companies.	-	-	Systematic literature review
Genovese et al., (2017)	In that study, the authors investigated the environmental performance of two process industries in the context of traditional and circular production systems.	EU	Chemical and food	Hybrid LCA
Sousa-Zomer et al., (2018)	They demonstrated the challenges to circular business models for manufacturing firms.	Brazil	Manufacturing firms	Qualitative case study design
Heyes et al., (2018)	In their study, the authors demonstrated the service-oriented business sector to develop and offer CE business model.	The UK	Micro-ICT business	Iterative Backcasting and Eco-design fo r Circular Economy (BECE) decision-support framework

Bressanelli et al., (2018)	They offered the conceptual framework to show how digital technologies can enable CE practices within a usage-focused servitized business model.	Northern Europe	Household appliance industry	Conceptual framework
Kirchherr et al., (2018)	They investigated barriers to CE in the context of the European Union (EU).	EU	-	Survey-based research

This literature demonstrates that managing waste via waste reduction is currently a popular research topic. However, we found no studies on the implementation of CE practices in waste management in the leather industry, which has its own characteristics and calls for further investigation. This paper is an attempt to fill this research gap.

2.2 *Circular Economy in the Leather Industry*

Leather is a valuable commodity with a long history of positive contributions to the economic development of countries (Kweka et al., 2014). The world market for leather, leather goods, and leather footwear is approximately US$215 billion, of which Bangladesh captures only US$1.08 billion (EPB Report, 2018). To efficiently secure a higher percentage of the world market, this industrial sector needs proper strategic planning for the implementation of CE practices. The size of the world market for leather shows that the leather industry is important for Bangladesh's economic growth; however, it negatively impacts the environment by generating various liquid and solid waste products during the manufacturing process. The negative impact of those waste products needs careful consideration and application of waste minimization and environmental pollution reduction strategies (Nadeem et al., 2018). The waste generated throughout the life cycle of leather and leather goods is alarming. Various types of waste, including leather, plastic, solid waste, tannery effluent, and chemicals, are generated during the manufacturing process (Pringle, 2017). Current disposal procedures for leather materials and tannery effluent do not optimize the recovery of waste leather and effluents (Moktadir et al., 2018b). Furthermore, the manufacturing process for various types of leather goods is a major area of solid waste generation. Currently, leather,leather goods and leather footwar industries operate a linear manufacturing system. To satisfy future demand and achieve efficient manufacturing that minimizes waste, it is essential to implement a closed-loop manufacturing framework. A closed-loop manufacturing framework may allow the leather industry to minimize waste as well as optimize the use of raw materials in the manufacturing process. The framework for closed-loop leather processing is shown in Figure 1.

Figure 1. Closed-loop manufacturing system

2.3 *Critical Success Factors for a Circular Economy*

In this section, the CSFs needed to derive CE practices are discussed briefly. The theory of CSFs is well established in the literature, examining different industries like textiles, mining, oil and gases, and chemicals. The theory of CSFs can be explained as “the areas in which the results if they are satisfactory, will ensure successful competitive performance for the firms” (Dinter, 2013). Critical success factors may be able to ensure and improve organizational performance (Dewi et al., 2018). The identification of CSFs can assist firms in the formulation of strategic policy directed towards achieving organizational goals.

The following steps were employed to identify CSFs:

(1) Keywords such as ‘critical success factors’, drivers/challenges/key factors/enablers of the circular economy were utilized to search for scientific articles on various scholarly databases.

(2) ScienceDirect, Scopus, Wiley, Google Scholar, Emerald, Springer, Taylor & Francis were used to gather relevant papers. All collected articles were refined as per the set attributes: articles must be written in English, peer-reviewed, and suitable for the current research theme.

(3) From the identified articles, the CSFs were finalized via brainstorming sessions with experts from the leather industry. These sessions not only helped to remove overlapping CSFs, but also helped develop new criteria relevant to leather industry supply chains like ‘appropriate facilities for waste recycling and reuse’ and ‘capacity-building and information management for CEs’.

Using the above-mentioned steps, CSFs identified from the literature review are listed and briefly explained in Table 2.

Table 2: CSFs identified from the literature review

Critical Success Factor (CSF)	Brief description	References
Eco-design for waste management	Eco-design can help minimize environmental pollution. It also helps to achieve resource efficiency by minimizing waste in SCs.	Bilitewski (2007); Senthil Kumar and Femina Carolin (2018)
Funding support for R&D from the government	R&D for CE implementation needs funding. It requires the decision-makers to make SCs more efficient for CE implementation.	Rizos et al. (2016); Sousa-Zomer et al. (2018)
Leadership and top management commitment	Leadership and top management commitment may cause decision-makers to implement CE practices. CE implementation requires good leadership and commitment from top management.	Heyes et al. (2018); Zucchella and Previtali (2018)
Ecological scarcity of resources	Ecological scarcity of resources may act as a success factor by forcing decision-makers to implement CE practices to minimize resource usage in the production process. It may act as a motivational success factor for CE implementation.	Bressanelli et al. (2018); Murray et al. (2015); Senthil Kumar and Femina Carolin (2018)
Strong legislation mandating CE	Strong legislation can force industries to implement CE practices for the reduction of environmental pollution. It may stimulate the collection of used products and waste for recycling and reuse.	Ali et al. (2018); Moktadir et al. (2017)
Knowledge of CE	In developing countries like Bangladesh, CE practices are not well known. Training facilities for CE practices could be helpful for CE implementation.	Moktadir et al. (2017)
Reverse logistics practices	Used products create significant environmental pollution. Reverse logistics practices throughout the SC may help to achieve CE goals.	Lu and Ye (2007); Yunkai (2009); Zeqiang and Wenming (2006)
Competitor pressure towards CE	Increasing globalization compels the leather industry to represent themselves not only within the domestic market but also within the international market. Competitor pressure towards CE practices in the global market can compel the introduction of CE practices.	Kirchherr et al. (2018); Kirchherr et al. (2017a)

3. Research Framework and Methods

The research methodology framework of the study is outlined in Figure 2.

Figure 2. Research methodology framework of the study.

As this study problem is a multi-criteria problem (Haseli et al., 2020a;b Akhyani et al., 2020) therefore, as per Figure 2, the core methods we are using in this study are BWM and DEMATEL, two popular MCDM methods (Chowdhury and Paul, 2020) with various applications in solving complex real-world problems (see Table 3 for some applications). In the following two sub-sections, we explain these two methods.

Table 3: Major and recent application areas of BWM and DEMATEL

Author(s)	**Application areas**	**Methodology**
Wang et al., (2020)	In this study, the authors offered an integrated framework based on BWM to assess the risks of chemical plants for implementing strategies for environmental risk mitigation.	• BWM
Yadav et al., (2020)	In this study, the authors developed a framework based on the BWM and ELECTRE approach to investigate the challenges and solution measures for the implementation of industry 4.0 and circular economy.	• BWM • ELECTRE
Moktadir et al., (2020)	The authors investigated the challenges faced by the leather industry towards CE practices.	• BWM
Singh and Sarkar, (2020)	They investigated the eco-design practices for sustainable product development	• Delphi and DEMATEL
Munim et al., (2020)	They demonstrated the port governance models for the successful implementation of green port management practices in the port of Bangladesh, Sri Lanka, and Tanzania.	• ANP • BWM
Kusi-Sarpong et al., (2019)	They examined sustainable suppliers in the context of a circular economy.	• BWM • VIKOR
Rajput and Singh, (2019)	In this study, the authors demonstrated the connecting factors (i.e., enabling and challenging factors) of Industry 4.0 and circular economy.	• PCA • DEMATEL
Paul et al., (2019)	They evaluated the transportation service provider based on sustainability criteria.	• BWM • VIKOR
Kheybari et al., (2019)	In their study, the authors examined the factors related to bioethanol facility location selection.	• BWM
Raj and Sah, (2019)	In their study, the authors investigated CSFs towards drone implementation in the logistics sector.	• DEMATEL
Moktadir et al. (2018a)	Authors assessed the challenges surrounding Industry 4.0 implementation in the leather industry.	• BWM
Moktadir et al. (2018b)	In this study, authors developed a decision support framework to assess the interrelationship between barriers to sustainable supply chain implementation.	• DEMATEL
Ahmadi et al. (2017)	In this research, authors assessed the social sustainability criteria for the sustainable supply chain management.	• BWM

From the literature review and the application areas of BWM and DEMATEL presented in Table 3, it is clear that the research gaps exist in the literature on the combination of BWM and DEMATEL in the CE context. Additionally, we used a combined approach of BWM-DEMATEL because not only we want to find the importance of the CSFs (which is identified by BWM), we also want to see the relationship between the CSFs (which are identified by DEMATEL). The individual methods we employ (BWM and DEMATEL) have several advantages, which make them suitable for our study. We use BWM because (i) the structured pairwise comparison used in BWM (i.e. using two reference points and conducting the pairwise comparisons based on these reference points) leads to more reliable and consistent pairwise comparisons by the experts; (ii) the use of two opposite reference points in BWM could mitigate possible anchoring bias in pairwise comparisons provided by the experts; (iii) compared to matrix-based methods (e.g. AHP), BWM is a data-efficient method which not only uses less pairwise comparisons, but it also enables the analysts to check the consistency of the provided pairwise comparisons (something which is not possible for single-vector methods like Swing) (Rezaei, 2020). We use DEMATEL as it is the only known reliable method in the context of MCDM field to identify the cause-effect relationship among the criteria. The cause-effect relationship will help decision-makers formulate strategies towards waste minimization via the implementation of CE practices.

The following two sub-sections describe the methodological procedure of BWM-DEMATEL.

3.1 *Best Worst Method*

The BWM procedure is described below (Rezaei, 2015, 2016).

Step 1: Identification of decision criteria by the decision-makers/experts.

A set of *n* decision criteria (here, the CSFs) is fixed as .

Step 2: Decision-makers/experts determine the best and worst criteria found in Step 1.

In this stage, decision-makers/experts identify the best and worst criteria. The best here represents the most important CSF, while the worst represents the least important CSF.

Step 3: Decision-makers/experts compare the best criterion to the other criteria

A decision-maker/expert constructs the best-to-others vector using a 1-9 scale, where 1 indicates an equal preference between the criteria, and 9 indicates an extreme preference. The constructed best-to-others vector is written as follows:

(1)

where denotes the preference value of Best criterion *B* over criterion *j*.

Step 4: Decision-makers/experts compare the other criteria to the worst

A decision-maker constructs the others-to-worst vector using a 1-9 scale, where 1 indicates an equal preference between the criteria, and 9 indicates an extreme preference. The constructed others-to-worst vector is written as follows:

(2)

where denotes that the preference value of criterion *j* over the worst criterion *W*.

Step 5: Compute the optimal weight of the decision criteria

Compute the optimal weights of the decision criteria (here, the CSFs) so the maximum absolute differences for all *j* are minimized over the following set:

A min-max model can be constructed as:

min

Subject to,

(3)

Model (3) may be transformed into a linear programming problem as follows:

min

Subject to,

(4)

By solving Model (4), the optimal weights of all the criteria and optimal value of are achieved. A lower value denotes higher consistency and vice versa.

3.2 *DEMATEL*

DEMATEL (Gabus and Fontela, 1972) is a powerful decision-making tool that is used in MCDM practical problems. It has the unique characteristic of being able to capture the interrelationship between criteria and show this relationship in a digraph. It helps to compute the cause-effect relationship between factors where causal criteria have the power to derive improvement in the effect criteria. In addition, this means the improvement of a causal variable can reciprocally improve the effect variable. The procedure of the DEMATEL technique is described below.

Step 1: Experts' feedback is taken to construct the initial relation matrices between previously identified CSFs of CE practices, using a linguistic rating scale. To get clear opinion from the respondents, it is always better to give them more flexibility options therefore the linguistic rating scale in Table 4 was provided to experts for them to construct the initial relation matrices.

Table 4: Linguistic rating scale for DEMATEL analysis

Linguistic scale	**Linguistic attributes**
0	No influence
2	Very low influence
4	Low influence
6	Medium influence
8	High influence
10	Extremely highly influence

Note. Intermediate scores 1, 3, 5, 7, and 9 can be used if necessary.

If the number of identified CSFs for CE practices is n, and the number of respondents is H, $k = 1, \ldots, H$, it follows that each expert construct a $(n \times n)$ matrix indicated as , where indicates the significant value of factor i affects factor j according to expert k.

For the H number of experts, the initial relation matrices were constructed as follows:

(5)

Therefore, the average initial relation matrix is constructed by averaging initial relation matrices obtained from H experts. The average relation matrix is constructed using the following equation:

(6)

***Step 2*:** In this step, the normalized direct-relation matrix P is constructed. The normalized direct-relation matrix is formulated from the average relation matrix M with the help of the following equation:

$$P = M \times S \quad (7)$$

where S is computed in the following way:

Step 3: In this step, a total relation matrix T is constructed using Equation 8.

(8)

where the notation I indicates the identity matrix.

Step 4: This step involves developing cause and effect variables by summing rows and columns. From the total relation matrix, , the r_i and c_j values are determined. r_i denotes the sum of the i^{th} row in matrix T, and c_j denotes the sum of j^{th} column in matrix T. Therefore, r_i and c_j can be computed by the following equations.

(9)

(10)

The sum denotes the total effect received by CSF i. In addition, it indicates the 'prominence' group CSFs. It also represents the degree of importance for the i^{th} CSF in the whole system. Consequently, the value of indicates the 'net effect' that the i^{th} CSF contributes to the whole system. If the value of is positive, the i^{th} CSF is the net cause group. If the value of is negative, the i^{th} CSF indicates the net effect.

Step 5: The threshold value is computed from the total relation matrix to develop a causal digraph. It is computed by summing up the mean value and standard deviation of CSFs in the total relation matrix T, in order to help to avoid complexity in the digraph. Therefore, causal relations are plotted in the digraph with the help of dataset

4. **Analysis and Results**

4.1 ***Case Study Companies***

The leather industry is one of the oldest industrial segments in Bangladesh. The contribution of the leather industry to the country's economy is significant due to the availability of raw materials, the high quality of grain patterns of the finished leather, and the cheap labor costs. However, the leather industry is responsible for such a high degree of environmental degradation, with a massive amount of waste generated from tannery operations (Moktadir et al., 2018a). In addition, according to a 2018 Environmental Performance Index (EPI) report, Bangladesh ranks 179th among the 180 countries in the world (EPI Report, 2018), which should improve CE practices, as CE practices are still not well established in the leather industry. To sustain the leather business in the global market and to introduce CE initiatives for the minimization of waste, it is important to identify and examine CSFs for the leather industry. Therefore, in this research, CSFs required to derive CE implementation have been identified via a detailed literature review and feedback from experts at real leather-processing companies. The five real case study companies selected for the data evaluation (Table 5) assessed the CSFs of CE practices. They have a strong interest in developing sustainable business models/frameworks and supporting organizational goals to minimize waste. The convenience and snowball sampling methods were used for selection. After contacting one expert, that expert referred the research team to another expert working in the same area who had vast experience regarding our research topic. In this study, 15 experts from five case companies responded to participate in data collection. Data were collected from the experts in three stages. In the first stage, we collected feedback from experts by arranging face to face interview. In the face to face interview of the first stage of data collection, we have provided the identified CSFs to experts for its validation and also asked to suggest new relevant CSFs in the context of the leather industry supply chain. Based on the feedback of experts, apart from the CSFs identified by reviewing existing literature, we received two new CSFs. These CSFs are:

- *Appropriate facilities for waste recycling and reuse*: Tannery effluent needs appropriate facilities for recycling to minimize waste generation and to utilize waste for further use.
- *Capacity-building and information management for CE*: Capacity-building and updating information management systems are pre-requisites for implementing CE practices.

Details of all 15 experts and the five selected real case study companies involved in this study are provided in Table 5. All experts demonstrated agreement regarding the CSFs and their implications for waste minimization.

Table 5: Characteristics of the five selected companies and experts

Sr. No.	Position	Experience (in years)	Role	Annual production rate and sales turnover of selected companies
1.	Senior production manager	17+	Ensuring operations run smoothly by monitoring the overall process, managing research and development, evaluating the market, and maintaining relationships with buyers	Company 1 > 31 million square feet of leather and US$40 million
2.	Supply chain manager	16+	Ensuring supply meets demand, processing shipments, and managing the workers' facilities	
3.	Technical manager	18+	Processing the raw hides and skins, solving technical problems, and ensuring the quality of the finished leather	
4.	Production manager	15+	Managing overall production processes and quality of the finished leather	Company 2 > *18* million square feet of leather and US$24 million
5.	Logistics manager	11+	Managing the timely delivery of finished leather, managing the transportation facility and controlling relationships with buyers	
6.	Technical manager		Processing the raw hides and skins, solving technical problems, and ensuring the quality of the finished leather	
7.	Supply chain manager	16+	Managing sourcing/procurement, meeting timely demands, contracting & warehouse management	Company 3 > *8* million square feet of leather and US$15 million
8.	Technical manager	15+	Responsible for processing the raw hides and skins, solving technical problems, and ensuring the quality of the finished leather	
9.	Senior merchandiser	16+	Purchasing chemicals, processing shipments, preparing the production schedule, maintaining good relationships with foreign buyers	
10.	Senior production manager	19+	Monitoring the overall process to ensure smooth operations, managing research and development, evaluating the market, and maintaining relationships with buyers	Company 4 > *7* million square feet of leather and US$12 million
11.	Technical manager	16+	Responsible for processing the raw hides and skins, solving technical problems, and ensuring the quality of the finished leather	
12.	Senior planning executive	15+	Preparing the overall production plan, preparing budgetary planning, executing the total cost involved in operating the factory	
13.	Senior	15+	Monitoring the overall process to ensure	Company 5

	production manager		smooth operations, managing research and development, evaluating the market, and maintaining relationships with buyers	> *3* million square feet of leather and US$9 million
14.	Technical manager	21+	Processing the raw hides and skins, solving technical problems, and ensuring the quality of the finished leather	
15.	Senior chemist (SC)	15+	Preparing recipes for the leather processing operations, ordering required chemicals, checking the quality of the chemicals	

4.2 Application of BWM

To evaluate the importance of the CSFs, we asked the experts (Table 5) for their input in determining the best and worst CSFs and conducting pairwise comparisons among best and worst and other CSFs using a 1-9 scale. The best and worst CSFs were identified as the most important and least important CSFs, respectively, for implementing CE via the experts' input, as shown in Table 6.

Table 6: Selection of Best and Worst CSFs

Code	Critical Success Factors (CSFs)	Best CSFs marked by decision-maker	Worst CSFs marked by decision-maker
CSF_1	Eco-design for waste management		3M, 5M, 10M, 13M
CSF_2	Funding support for R&D from the government		8M, 11M, 14M
CSF_3	Leadership and top management commitment	2M, 4M, 6M, 9M	
CSF_4	Appropriate facilities for waste recycling and reuse	13M, 14M	
CSF_5	Ecological scarcity of resources		2M, 6M
CSF_6	Strong legislation towards CE	1M, 5M,10M	
CSF_7	Knowledge of CE		9M, 12M
CSF_8	Practices of reverse logistics	3M, 8M, 11M, 12M	
CSF_9	Capacity-building and information management for CE	7M, 15M	
CSF_{10}	Competitor pressure towards CE		1M, 4M, 7M, 15M

Note. *M* stands for an industry manager

The ratings for the best CSF over the other CSFs and the other CSFs over the worst CSF for the respondents were constructed using equations (1) and (2) and are displayed in Table 7 and Table 8, respectively. In addition, the weight assigned to each CSF by each expert was obtained via model (4) and is shown in Table 9. After calculating the weights from each respondent, the weights of the CSFs were averaged. The average weights are summarized in Table 9. We also checked the consistency ratio of the pairwise comparisons based on the input-based thresholds in Liang et al (2020), and found that all pairwise comparisons are reliable.

Table 7: Evaluation of Best to other CSFs to CE implementation

Expert	Best CSF	CSFs									
		CSF_1	CSF_2	CSF_3	CSF_4	CSF_5	CSF_6	CSF_7	CSF_8	CSF_9	CSF_{10}
Company-1: M1	CSF_6	5	6	3	4	8	1	7	2	4	9
Company-1: M2	CSF_3	6	5	1	4	9	4	6	3	2	7
Company-1: M3	CSF_8	9	5	3	6	5	4	6	1	2	7
Company-2: M4	CSF_3	3	6	1	8	5	4	7	2	4	9
Company-2: M5	CSF_6	9	6	3	5	2	1	7	4	3	7
Company-2: M6	CSF_3	5	4	1	3	9	8	7	2	4	6
Company-3: M7	CSF_9	4	6	2	8	5	4	7	3	1	9
Company-3: M8	CSF_8	5	9	3	4	8	7	6	1	2	6
Company-3: M9	CSF_3	4	7	1	6	3	8	9	5	2	7
Company-4: M10	CSF_6	9	8	3	7	5	1	6	3	2	8
Company-4: M11	CSF_8	5	9	3	7	6	4	2	1	2	7
Company-4: M12	CSF_8	6	7	3	5	4	8	9	1	2	8
Company-5: M13	CSF_4	9	7	2	1	5	3	7	4	5	8
Company-5: M14	CSF_4	5	9	2	1	5	8	6	4	3	7
Company-5: M15	CSF_9	2	4	2	6	7	4	5	3	1	9

Table 8: Experts' comparison - others-to-worst CSFs to CE implementation

	Experts														
	Company-1: M1	Company-1: M2	Company-1: M3	Company-2: M4	Company-2: M5	Company-2: M6	Company-3: M7	Company-3: M8	Company-3: M9	Company-4: M10	Company-4: M11	Company-4: M12	Company-5: M13	Company-5: M14	Company-5: M15
Others to the Worst	CSF_{10}	CSF_5	CSF_1	CSF_{10}	CSF_1	CSF_5	CSF_{10}	CSF_2	CSF_7	CSF_1	CSF_2	CSF_7	CSF_1	CSF_2	CSF_{10}
CSF_1	6	3	1	3	1	2	6	2	5	1	2	2	1	5	2
CSF_2	3	6	4	8	3	4	3	1	8	2	1	5	2	1	6
CSF_3	2	9	7	9	2	9	6	7	9	7	7	7	5	8	7
CSF_4	5	6	2	2	5	5	8	3	6	5	5	4	9	9	5
CSF_5	4	1	3	4	8	1	2	5	3	7	8	6	7	3	3
CSF_6	9	3	4	6	9	5	5	4	4	9	7	3	5	8	6
CSF_7	6	4	2	5	2	6	4	6	1	4	4	1	6	7	4
CSF_8	8	7	9	7	5	8	7	9	5	8	9	9	3	6	7
CSF_9	7	8	6	7	8	7	9	7	8	6	6	8	4	7	9
CSF_{10}	1	2	3	1	6	2	1	3	2	3	3	3	3	3	1

Table 9: Final weights of the CSFs

Expert		Weights									
		CSF_1	CSF_2	CSF_3	CSF_4	CSF_5	CSF_6	CSF_7	CSF_8	CSF_9	CSF_{10}
Company-1: M1	0.0800	0.0713	0.0594	0.1189	0.0891	0.0446	0.2765	0.0509	0.1783	0.0891	0.0218
Company-1: M2	0.0695	0.0579	0.0695	0.2781	0.0869	0.0232	0.0869	0.0579	0.1159	0.1738	0.0497
Company-1: M3	0.0608	0.0254	0.0700	0.1166	0.0583	0.0700	0.0875	0.0583	0.2890	0.1749	0.0500
Company-2: M4	0.0942	0.1207	0.0604	0.2680	0.0453	0.0724	0.0905	0.0517	0.1811	0.0905	0.0193
Company-2: M5	0.0773	0.0211	0.0574	0.1147	0.0688	0.1721	0.2669	0.0492	0.0860	0.1147	0.0492
Company-2: M6	0.0800	0.0713	0.0891	0.2765	0.1189	0.0218	0.0446	0.0509	0.1783	0.0891	0.0594
Company-3: M7	0.1003	0.0911	0.0608	0.1823	0.0456	0.0729	0.0911	0.0521	0.1215	0.2643	0.0182
Company-3: M8	0.0784	0.0732	0.0232	0.1219	0.0915	0.0457	0.0523	0.0610	0.2874	0.1829	0.0610
Company-3: M9	0.1016	0.0946	0.0540	0.2767	0.0630	0.1261	0.0473	0.0195	0.0757	0.1891	0.0540
Company-4: M10	0.0819	0.0220	0.0453	0.1207	0.0517	0.0724	0.2803	0.0604	0.1207	0.1811	0.0453
Company-4: M11	0.0866	0.0666	0.0178	0.1110	0.0476	0.0555	0.0833	0.1577	0.2465	0.1665	0.0476
Company-4: M12	0.0720	0.0614	0.0526	0.1228	0.0737	0.0921	0.0460	0.0249	0.2963	0.1842	0.0460
Company-5: M13	0.0829	0.0223	0.0524	0.1832	0.2836	0.0733	0.1222	0.0524	0.0916	0.0733	0.0458
Company-5: M14	0.1021	0.0743	0.0186	0.1857	0.2692	0.0743	0.0464	0.0619	0.0928	0.1238	0.0531
Company-5: M15	0.0603	0.1063	0.0819	0.1638	0.0546	0.0468	0.0819	0.0655	0.1092	0.2672	0.0230
Average Weights	0.0819	0.0653	0.0542	0.1761	0.0965	0.0709	0.1136	0.0583	0.1647	0.1576	0.0429

The final rankings of CSFs for CE practices are made based on the average weight of each CSFs obtained from the BWM and are presented in Table 10.

Table 10: Final ranking of CSFs for CE practices

Notation	Name of CSFs	*Rank*
CSF_3	Leadership and top management commitment	1
CSF_8	Practices of reverse logistics	2
CSF_9	Capacity-building and information management for CE	3
CSF_6	Strong legislation towards CE	4
CSF_4	Appropriate facilities for waste recycling and reuse	5
CSF_5	Ecological scarcity of resources	6
CSF_1	Eco-design for waste management	7
CSF_7	Knowledge of CE	8
CSF_2	Funding support for R&D from government	9
CSF_{10}	Competitor pressure towards CE	10

4.3 Application of DEMATEL

The DEMATEL method was used to assess the interactions between CSFs. DEMATEL is a very dynamic MCDM method that helps capture the causal relationship between CSFs (Kumar et al., 2018). To understand the influence among CSFs, the research team approached the experts (Table 5), to get their inputs on the interactions among the finalized CSFs. Nine experts out of 15 responded in this stage and provided the interactions among the CSFs. The comparison relationship matrices were constructed based on experts' feedback using the linguistic rating scale shown in Table 4. The initial relationship matrices for the CSFs are given in Tables A1-A9 in Appendix A. The average relationship matrix was constructed using Equation (6), which is shown in Table 11.

Table 11: Average matrix

CSFs	*CSF₃*	*CSF₈*	*CSF₉*	*CSF₆*	*CSF₄*	*CSF₅*	*CSF₁*	*CSF₇*	*CSF₂*	*CSF₁₀*
CSF_3	0.000	6.222	7.444	3.444	6.777	3.555	7.222	3.778	3.111	3.556
CSF_8	2.888	0.000	7.222	3.000	7.222	3.666	6.778	3.333	2.556	3.111
CSF_9	2.444	6.888	0.000	4.222	7.333	3.778	6.111	4.111	3.667	3.444
CSF_6	4.000	6.444	6.333	0.000	6.777	4.111	7.333	4.222	3.778	3.889
CSF_4	3.222	7.111	6.444	4.666	0.000	3.889	7.556	3.444	2.556	4.556
CSF_5	3.444	6.555	6.666	4.111	6.333	0.000	6.667	4.778	2.889	3.889
CSF_1	3.111	8.222	6.888	4.222	7.444	3.222	0.000	3.778	2.444	3.556
CSF_7	3.555	6.666	7.000	4.888	7.111	5.222	6.222	0.000	3.000	3.556
CSF_2	3.111	5.666	6.222	4.111	6.111	4.667	6.333	4.667	0.000	4.222
CSF_{10}	2.888	6.555	6.888	4.555	6.666	4.778	6.778	3.556	3.444	0.000

The normalized direct relation matrix (*P*) is constructed from the average matrix using Equation (7). The final normalized CSF relation matrix is presented in Table 12.

Table 12: Normalized direct relation matrix (*P*)

CSFs	*CSF_3*	*CSF_8*	*CSF_9*	*CSF_6*	*CSF_4*	*CSF_5*	*CSF_1*	*CSF_7*	*CSF_2*	*CSF_{10}*
CSF_3	0.000	0.101	0.121	0.056	0.109	0.058	0.117	0.061	0.051	0.058
CSF_8	0.047	0.000	0.117	0.049	0.117	0.059	0.109	0.054	0.042	0.051
CSF_9	0.039	0.112	0.000	0.068	0.119	0.061	0.099	0.067	0.059	0.056
CSF_6	0.065	0.104	0.103	0.000	0.109	0.067	0.119	0.068	0.061	0.063
CSF_4	0.052	0.115	0.104	0.076	0.000	0.063	0.122	0.056	0.042	0.074
CSF_5	0.056	0.106	0.108	0.067	0.103	0.000	0.108	0.077	0.047	0.063
CSF_1	0.051	0.133	0.112	0.068	0.121	0.052	0.000	0.061	0.039	0.058
CSF_7	0.058	0.108	0.113	0.079	0.115	0.085	0.101	0.000	0.049	0.058
CSF_2	0.051	0.092	0.101	0.067	0.098	0.076	0.103	0.076	0.000	0.068
CSF_{10}	0.047	0.106	0.112	0.074	0.108	0.077	0.109	0.058	0.056	0.000

Following this, the total relation matrix is constructed using Equation (8). The total relation matrix is provided in Table 13.

Table 13: Total relation matrix (*T*)

CSFs	*CSF_3*	*CSF_8*	*CSF_9*	*CSF_6*	*CSF_4*	*CSF_5*	*CSF_1*	*CSF_7*	*CSF_2*	*CSF_{10}*
CSF_3	0.121	*0.343*	*0.357*	0.209	*0.353*	0.206	*0.354*	0.206	0.164	0.197
CSF_8	0.152	0.224	0.326	0.187	*0.332*	0.191	0.320	0.184	0.143	0.177
CSF_9	0.152	*0.335*	0.233	0.211	*0.345*	0.201	0.323	0.201	0.164	0.187
CSF_6	0.187	*0.355*	*0.352*	0.163	*0.363*	0.220	*0.365*	0.218	0.178	0.208
CSF_4	0.166	*0.346*	*0.335*	0.222	0.246	0.206	*0.349*	0.196	0.152	0.206
CSF_5	0.175	*0.348*	*0.348*	0.221	*0.349*	0.153	*0.347*	0.221	0.167	0.203
CSF_1	0.163	*0.357*	*0.337*	0.213	*0.350*	0.195	0.237	0.199	0.148	0.191
CSF_7	0.181	*0.359*	*0.362*	0.238	*0.369*	0.237	*0.352*	0.156	0.167	0.204
CSF_2	0.169	*0.335*	*0.341*	0.221	*0.345*	0.224	*0.342*	0.220	0.117	0.208
CSF_{10}	0.169	*0.352*	*0.355*	0.229	0.357	0.228	*0.353*	0.207	0.172	0.146

Threshold value = *Mean + Standard deviation = 0.2477+0.0794 = 0.3271*

From the total relation matrix, the values of and are computed using Equations (9) and (10). The sum of and was also computed. The value of indicates the impact of each CSF. If the value of is positive, the CSFs are considered causal. If the value of is negative, the CSF is in the effect group. The causal impact of CSFs is displayed in Table 14.

Table 14: Causal impact of CSFs

Name of CSFs					Impact
CSF_3	2.5110	1.6361	4.1471	0.8749	**Cause**
CSF_8	2.2346	3.3564	5.5909	-1.1218	**Effect**
CSF_9	2.3535	3.3468	5.7003	-0.9933	**Effect**
CSF_6	2.6096	2.1141	4.7237	0.4955	**Cause**
CSF_4	2.4258	3.4095	5.8354	-0.9837	**Effect**
CSF_5	2.5281	2.0621	4.5901	0.4660	**Cause**
CSF_1	2.3913	3.3429	5.7342	-0.9516	**Effect**
CSF_7	2.6273	2.0090	4.6363	0.6183	**Cause**
CSF_2	2.5224	1.5681	4.0904	0.9543	**Cause**
CSF_{10}	2.5673	1.9261	4.4934	0.6413	**Cause**

To avoid minor effect, a threshold value is computed using the formula (Mean + Standard deviation = 0.2477+0.0794 = 0.327). Those values which are greater than the threshold values are marked italics in the total relation matrix and showed their interactions with other CSFs in Figure 3.

Figure 3. Cause-effect relationships between CSFs for CEs.

5. Results and Discussion

This research focuses on CSFs as a pivotal driving force to implement CE practices in the context of the leather industry of Bangladesh. The research findings of this study were discussed with industrial decision-makers to assist them in successfully implementing a CE strategy to promote waste minimization and develop a sustainable business environment.

Based on the findings of this study, 'leadership and top management commitment (CSF_3)' is ranked first (see Table 10), which indicates the importance of this success factor for the implementation of CE practices in the SC. Furthermore, in the DEMATEL analysis, it received a positive (r_i-c_j) value of 0.8749 (see Table 14), indicating it is a causal CSF. If decision-makers give special attention to this CSF, it will aid the facilitation of CSFs in the effect group during the implementation of CE strategies. This suggests that special emphasis should be placed on this factor during strategic planning. This finding is also contradicted by other studies from developed countries. For example, Gusmerotti et al. (2019) showed that economic drivers were the most crucial drivers for encouraging 'linear companies' to adopt circular economy practices for the manufacturing firms. Saeed and Kersten (2019) assessed drivers for sustainable supply chain practices and said that regulation and market pressure are the prevailing driving factors for manufacturing firms. Sharma et al. (2019) tried to evaluate the challenges for circular economy and sustainability and mentioned that poor governmental policy is the driving challenge for developing countries. The result of this study also aligns with previous studies, but none of those found the interaction between drivers of sustainable SCM and circular economy. For instance, the CSF 'leadership and top management commitment (CSF_3)' has already been proven to drive policy-makers to implement sustainable manufacturing practices in other SCs (Moktadir et al., 2018b). Gardas et al. (2019) also demonstrated the CSFs of the reusable plastic packaging system and confirmed that top management commitment is an important factor for circular economy implementation in reusable polymer processing.

The CSF 'practices of reverse logistics (CSF_8)' received the second position in the BWM analysis (see Table 10), indicating that practices of reverse logistics can enhance the overall performance of CE implementations. In the DEMATEL analysis, this factor received a negative value -1.1218 of r_i-c_j, indicating the significant influence that other factors have on this CSF (see Table 14). Therefore, attention to the causal factors may have a positive impact on this CSF. The literature shows that reverse logistics practices may help achieve a sustainable business environment by minimizing waste in SCs (Yunkai, 2009). Gardas et al. (2019) noticed that reverse supply chain for reusable plastic products is an important issue for circular economy practices. Moktadir et al. (2018b) identified a lack of reverse logistics practices as an influential barrier for sustainable supply chain practices in the leather supply chains. Bernon et al. (2018) showed the importance of reverse logistics practices for CE implementation and urged that reverse logistics practices can help manufacturing firms to achieve sustainability.

Next, 'capacity-building and information management for CE (CSF_9)' received the third position in the BWM analysis (see Table 10). This CSF is an important factor for the current situation in Bangladesh. Bangladesh is a developing country, and capacity-building for information management for CE practices remains a challenging issue. Capacity-building may drive the implementation process by facilitating the collection and integration of data throughout the SCs. Information management and capacity-building can be improved by improving the causal CSFs, as it received a negative r_i-c_j value of -0.9933, indicating it is in the effect group. Previous research has not considered this factor for CE implementations. Information management is an important task for the CE implementation process. Without the proper information management facility, it will not be possible to introduce CE practices into the existing SCs. Moktadir et al. (2018b) did not consider this factor for the implementation of sustainable manufacturing practices in leather industry SCs. Some studies, such as Wang et al. (2014), showed the interrelationship between CE accounting information and CE practices, while Wei (2014) demonstrated the importance of strategic enterprise management for CE practices. Singh et al. (2019) showed the importance of information technology for achieving sustainable growth for the Indian food industry. Therefore, information management and capacity-building can act as a driving factor for CE implementation, and this factor can be improved by attention to causal factors.

'Strong legislation towards CE (CSF_6)' has received the fourth position in the BWM analysis (see Table 10), and in the DEMATEL analysis, it falls into the causal group along with a positive value 0.4955 of r_i-

c_j. It is a crucial factor for the successful implementation of CE practices in the Bangladeshi leather industry. Strong legislative power may force the industry decision-makers to initiate CE practices in the supply chains. This factor is very important in the current leather supply chains, as mentioned in previous studies (Moktadir et al., 2018a; Moktadir et al., 2018b). The leather industry is greatly responsible for environmental degradation by producing a huge amount of waste. If strong legislation is imposed, then the industry decision-makers will facilitate more funds for CE implementation, which will, in turn, help minimize environmental degradation. Kirchherr et al. (2017) examined existing CE literature and confirmed that legislative policy is an imperative issue for the successful implementation of CE practices. Lewandowski (2016) conducted a review of CE and mentioned that CE practices are now spreading throughout the world with the aim of achieving social, environmental, and economic sustainability of business activities. Prieto-Sandoval et al. (2018a) gave an overview of the circular economy, focusing on the consensus view of CE and agreed that legislative power is an important driver of CE practices. Korhonen et al. (2018) demonstrated that CE contributes to the achievement of social sustainability.

'Appropriate facilities for waste recycling and reuse (CSF_4)' is also an important CSF for CE implementation in the context of the leather industry. This CSF received the fifth position in the BWM analysis (see Table 10). This finding provides deep insight into it for the reduction of raw material, water, and energy consumption in SCs. Consequently, in DEMATEL analysis, this CSF falls into the effect group along with a negative r_i-c_j value of -0.9837 so that causal CSFs may influence it during the implementation of CE practices. Therefore, policymakers may take it as a less critical CSF as it can be improved by addressing the causal group CSFs. A study by Nainggolan et al. (2019) showed consumer behavior in a circular economy for household waste. This research indicated that appropriate recycling facilities could be the best tool for CE practices. de Oliveira et al. (2019) demonstrated the impact of reverse logistics for circular economy practices in the polystyrene supply chain in a Brazilian context. Kokkinos et al. (2019) demonstrated techniques of chromium and energy recovery for CE implementation in the tannery industry and confirmed that appropriate recovery techniques can be enacted as crucial success factors for waste recovery. Cusenza et al. (2019) showed the importance of CE in the domain of used electric vehicle batteries and mentioned that suitable facilities for waste recycling and reuse can improve a firm's sustainability. These studies confirm that appropriate recycling techniques and reuse facilities can greatly assist decision-makers in the implementation of CE and can help achieve sustainability in the supply chain networks.

'Ecological scarcity of resources (CSF_5)' received the sixth position in the BWM analysis (see Table 10), and in DEMATEL, it fell under the cause category as this CSF recived a positive r_i-c_j value of 0.4660. This means that improving this CSF may significantly drive the CSF effect group. Ecological scarcity of resources is a causal CSF because the scarcity of natural resources may prompt decision-makers to reduce material usage by reducing waste in the supply chains. Global resources are limited, and material consumption needs to be reduced to create sustainable business frameworks. Literature has shown that the scarcity of resources is an important issue for sustainable resource management (de Jesus et al., 2019; Svensson and Funck, 2019), and in this case, CE practices can help minimize material consumption by reducing waste and reusing waste materials.

'Eco-design for waste management (CSF_1)' is an important CSF for the leather industry due to the massive amount of tannery effluent produced during the manufacturing process. Eco-design may help facilitate the implementation of CE practices in the supply chains. It was ranked seventh by the BWM analysis (see Table 10), and it is in the CSF effect group with negative value (r_i-c_j) of -0.9516, indicating it may be influenced by the causal CSFs. Strong legislation and funding may significantly support the realization of an eco-design framework in the leather manufacturing industry. A study by Hidalgo et al. (2019) proposed a multi-waste plan for waste recovery for the implementation of CE. The authors demonstrated the process of waste reduction for CE policy. de Jesus et al. (2019) showed the eco-innovation pathways for CE practices and suggested that proper design for eco-efficiency may be achieved via eco-innovative supply chain design.

The last three CSFs, 'knowledge of CE (CSF_7)', 'funding support for R&D from the government (CSF_2)', and 'competitor pressure towards CE (CSF_{10})' all fall into the causal group along with positive values (r_i-c_j) of 0.6183, 0.9543, and 0.6413 accordingly which indicates the importance of these CSFs during the implementation process (see Table 14). Knowledge of CE practices is an important CSF as it may motivate industry decision-makers to implement CE in their supply chains and educate the SC managers about the importance of CE practices. Hankammer et al. (2019) demonstrated the consumer need for CE business models, which indicated that knowledge of CE is another vital issue for CE implementation. Svensson and Funck (2019) investigated the management control system and its importance for CE practices. Funding support from the government is a causal CSF as it could facilitate the redesign of SC networks necessary for the implementation of CE practices. Sauerwein et al. (2019) explained the importance of additive manufacturing in the context of CE and agreed that funding is an essential issue for CE implementation. Lastly, competitor pressure towards CE also falls into the causal group and has a strong influence on effect group CSFs. Business is competitive and requires sustainable business models. In this context, CE may help achieve a sustainable business environment and sustainability (de Sousa Jabbour et al., 2019). Morrissey et al. (2020) mentioned that the fashion industry is facing difficulties achieving sustainability in supply chains. Hence, CE practices can give direction to the entire global market. Therefore, attention to these causal CSFs may significantly improve the whole system. From Figure 3, it is clear which CSFs can derive others and the interrelationships between them. The details of these interrelationships are very important for the implementation process.

The above explanations indicate that the success factors for CE implementation still exist within a gap in the research, and this study explores and enhances the literature by filling these gaps.

6. **Research Implications**

6.1 ***Practical Implications***

This research focuses on how CSFs act as pivotal driving forces in the implementation of CE practices in the context of the leather industry in Bangladesh. The priority and cause/effect-based analysis of CSFs can help managers in the leather industry better understand factors needed to successfully implement CE practices for waste minimization and support the development of a sustainable business environment. In addition to leather industry managers, there are also implications for policymakers and the wider public. This research offers numerous implications mentioned as follows.

- This study found that ‘leadership and top management commitment’ is both the highest-ranked success factor and a causal factor. This suggests that a strong commitment from management will be required for the successful implementation of CE practices in the leather industry (Kumar et al., 2018; Jabbour et al., 2019). This will need to be reflected by an on-going leadership style that supports initiatives in CE practice and motivates staff to do likewise, in order to achieve the ultimate objectives in a timely manner (Kumar et al., 2018; Jabbour et al., 2019).
- The second most important factor is ‘strong legislation towards CE’, which shows that strong legislation by the country’s government is of paramount importance. For instance, the Chinese government has officially implemented CE practices (Su et al., 2013; Ali et al., 2018; Jia et al., 2018; Batista et al., 2018). Hence, the Bangladeshi government should develop strong legislation and policies for CE practices for the leather industry, so that sustainable development can be achieved.
- We have limited resources for a rapidly growing world population. However, by managing waste, we can better manage the scarcity of resources. Industries should take strong steps to initiate and adhere to the reuse, recycle, and remanufacture strategy in order to minimize waste. This CE strategy helps minimize material consumption by reusing waste materials and reducing waste generation.
- Other causal factors such as knowledge of CE, funding support for R&D from the government, and competitor pressure towards CE all play critical roles in the proper implementation of CE initiatives in different industries. Therefore, the leather industry of Bangladesh should adopt some of these approaches. For example, the industry should provide employees with training in CE practices and make these initiatives known to encourage competitors to do likewise (Batista et al.,

2018; Kumar et al., 2018). The Bangladeshi government should provide funding support to the industry so it can enhance its research and development activities in this direction.

6.2 *Theoretical Implications*

This research also makes certain unique theoretical contributions.

- ✓ This research focuses on the CSFs in the context of leather industry supply chains, which is ignored in the existing literature and confirmed in the literature review (Chiappetta Jabbour et al., 2019; Gardas et al., 2019; Gusmerotti et al., 2019; Sharma et al., 2019; Simon, 2019). Existing studies either focus on the basic concept of CE or on other industries.
- ✓ Theoretically, this study contributes to the CE literature by offering two new CSFs, which are unique in the CE literature.
- ✓ This research aims to show how a combined methodology (i.e., BWM and DEMATEL) helps to find the importance of the CSFs along with interrelationship of them. In this study, qualitative feedback was collected and employed in the decision-making model to determine important CSFs and their cause/effect relationships. This methodology is unique because of the implementation of the industry-employee feedback in the BWM-DEMATEL process in the context of CE and CSFs evaluation; this is supported by a review of recent existing studies (Gardas et al., 2019; Sharma et al., 2019).

7. Concluding Remarks

In today's competitive business network, CE is an important research topic. All types of businesses are striving to make themselves eco-efficient and optimize their resources. Likewise, CE practices in SCs are attracting more attention from researchers. This study is an attempt to help the leather industry identify how to implement CE practices in their SCs. From a conceptual point of view, the research identifies the CSFs for CE practices in the leather industry SCs. This was achieved via literature review and procurement of expert opinions. An integrated approach using both BWM and DEMATEL methods was employed to reach the desired objectives. BWM was used to prioritize the CSFs, and DEMATEL was employed to extract interrelationships between CSFs for CE practices in the SC context. Ten CSFs were validated after an extensive literature review and input from experts from the Bangladeshi leather industry. The data shows that the CSFs of 'leadership and top management commitment', 'practices of reverse logistics', 'capacity-building and information management for CE', 'strong legislation towards CE', and 'appropriate facilities for waste recycling and reuse' are the highest priority factors. However, the factors of 'leadership and top management commitment', 'strong legislation towards CE', 'ecological scarcity of resources', 'knowledge on CE', 'funding support for R&D from the government', and 'competitor pressure towards CE' were causal factors. The outcomes of this research could potentially help leather industry managers and practitioners decide where to concentrate their efforts to implement CE practices in their SCs. The significant contributions of this research have been described in the previous section, indicating this study has a great impact on CE literature, especially for the leather industry supply chains. This study will help build circular economy practices for the betterment of society and the environment.

This study has some limitations: i) it only focused on the leather industry of Bangladesh, which is constrained to external generalization, ii) a limited number of case companies and experts were involved during the data collection process, and iii) a limited number of CSFs were investigated. Therefore, to overcome these limitations, a cross country study could be conducted in order to generalize critical insights on the CSFs for CE. In this study, we used BWM for ten factors (all in one category), which might have affected the reliability of the findings (it is suggested not to use more than nine criteria for pairwise comparisons under a single category). Further, future research can try to measure the impact of the proposed CSFs on the performance of the leather industry using a life cycle assessment approach. Additionally, researchers can advance this research considering the role of government initiatives on the successful implementation of CE in different industries.

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Appendix-A

Table A1: Company-1: manager-1 feedback for DEMATEL analysis

Company-1: M1	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	7	9	2	6	3	5	2	1	3
CSF_8	2	0	6	3	7	3	6	3	2	4
CSF_9	1	6	0	4	8	4	7	4	3	5
CSF_6	5	8	7	0	9	3	7	2	1	4
CSF_4	3	9	8	4	0	3	6	3	2	5
CSF_5	2	8	9	3	5	0	8	4	1	3
CSF_1	4	9	5	3	7	2	0	2	3	2
CSF_7	4	9	7	2	8	5	6	0	1	2
CSF_2	1	5	6	3	8	5	9	4	0	6
CSF_{10}	2	7	8	3	6	4	7	3	1	0

Table A2: Company-1: manager-2 feedback for DEMATEL analysis

Company-1: M2	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	5	9	4	7	5	8	3	2	5
CSF_8	5	0	6	2	8	6	9	4	1	3

CSF_9	1	8	0	6	9	4	7	5	3	2
CSF_6	2	6	7	0	8	3	8	1	4	5
CSF_4	1	8	3	9	0	2	7	4	2	3
CSF_5	3	6	6	5	8	0	9	6	4	2
CSF_1	4	7	7	3	9	4	0	2	1	3
CSF_7	2	8	8	5	8	6	7	0	3	2
CSF_2	3	6	9	5	5	7	9	4	0	3
CSF_{10}	2	7	6	4	7	5	7	3	4	0

Table A3: Company-1: Manager-3 feedback for DEMATEL analysis

Company-1: M3	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	6	8	3	7	4	9	5	4	7
CSF_8	7	0	9	5	8	1	7	2	3	4
CSF_9	4	7	0	6	9	3	6	4	1	3
CSF_6	6	5	6	0	6	5	9	5	3	2
CSF_4	4	8	4	4	0	6	7	2	1	4
CSF_5	2	7	6	6	7	0	6	6	3	2
CSF_1	3	9	9	2	9	5	0	5	4	6
CSF_7	4	5	7	7	4	4	5	0	3	2
CSF_2	6	6	8	5	6	6	4	6	0	1
CSF_{10}	4	4	5	6	9	5	8	2	1	0

Table A4: Company-2: Manager-4 feedback for DEMATEL analysis

Company-2: M4	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	6	9	4	7	3	8	5	3	2
CSF_8	1	0	8	3	8	5	7	4	2	4
CSF_9	3	5	0	6	5	1	5	2	4	5
CSF_6	2	8	8	0	6	3	8	4	3	6
CSF_4	1	6	7	2	0	2	9	3	4	3
CSF_5	4	7	8	3	4	0	7	2	1	2
CSF_1	2	9	5	4	7	3	0	5	1	3
CSF_7	3	5	6	5	5	7	6	0	3	4
CSF_2	5	7	6	6	6	6	5	4	0	5
CSF_{10}	4	6	7	3	8	5	7	3	5	0

Table A5: Company-2: Manager-5 feedback for DEMATEL analysis

Company-2: M5	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	7	8	4	8	3	8	2	4	5
CSF_8	1	0	7	3	7	9	7	2	2	3
CSF_9	2	6	0	4	6	8	9	1	6	1
CSF_6	5	6	6	0	8	7	5	4	7	2
CSF_4	2	5	4	6	0	4	7	3	4	4
CSF_5	4	6	5	5	7	0	6	2	3	2
CSF_1	2	7	8	7	5	3	0	5	5	3
CSF_7	1	9	7	4	9	8	4	0	4	4
CSF_2	3	4	6	5	7	8	6	3	0	6
CSF_{10}	2	6	9	9	6	9	8	5	5	0

Table A6: Company-2: Manager-6 feedback for DEMATEL analysis

Company-2: M6	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	4	8	4	7	3	8	5	3	2
CSF_8	3	0	7	4	6	3	7	3	4	3
CSF_9	1	5	0	3	7	4	6	4	5	5
CSF_6	2	7	5	0	9	7	8	6	4	3
CSF_4	5	6	8	2	0	6	9	4	3	4
CSF_5	3	9	7	4	7	0	7	5	2	6

CSF₁	4	8	6	5	8	3	0	6	1	3
CSF₇	2	7	8	6	7	5	9	0	5	4
CSF₂	1	5	7	3	5	2	4	3	0	4
CSF₁₀	1	8	9	2	6	4	8	2	4	0

Table A7: Company-3: Manager-7 feedback for DEMATEL analysis

Company-3: M7	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	4	5	5	6	3	4	2	3	2
CSF_8	2	0	9	2	7	1	6	3	4	4
CSF_9	5	8	0	3	8	2	7	5	3	3
CSF_6	4	5	3	0	6	3	9	4	2	4
CSF_4	3	7	8	5	0	6	7	6	3	6
CSF_5	2	7	7	4	6	0	4	7	2	3
CSF_1	3	9	5	7	8	5	0	3	1	2
CSF_7	4	5	7	8	9	4	7	0	2	4
CSF_2	3	5	4	7	6	3	8	7	0	5
CSF_{10}	2	9	8	5	7	8	5	2	5	0

Table A8: Company-4: Manager-10 feedback for DEMATEL analysis

Company-4: M10	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	9	7	4	9	5	9	2	1	2
CSF_8	2	0	6	2	7	3	5	3	3	1
CSF_9	3	8	0	4	8	4	3	7	5	3
CSF_6	5	7	8	0	6	1	5	4	4	4
CSF_4	4	9	7	6	0	3	7	2	2	7
CSF_5	6	5	6	4	5	0	7	8	6	8
CSF_1	3	8	9	5	5	2	0	1	1	4
CSF_7	7	6	6	4	7	3	7	0	3	3
CSF_2	3	8	7	2	8	2	5	3	0	2
CSF_{10}	2	7	5	7	5	1	4	5	4	0

Table A9: Company-5: Manager-13 feedback for DEMATEL analysis

Company-5: M13	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	0	8	4	1	4	3	6	8	7	4
CSF_8	3	0	7	3	7	2	7	6	2	2
CSF_9	2	9	0	2	6	4	5	5	3	4
CSF_6	5	6	7	0	3	5	7	8	6	5
CSF_4	6	6	9	4	0	3	9	4	2	5
CSF_5	5	4	6	3	8	0	6	3	4	7
CSF_1	3	8	8	2	9	2	0	5	5	6
CSF_7	5	6	7	3	7	5	5	0	3	7
CSF_2	3	5	3	1	4	3	7	8	0	6
CSF_{10}	7	5	5	2	6	2	7	7	2	0

Table A10: Identity matrix

Matrix I	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	1	0	0	0	0	0	0	0	0	0
CSF_8	0	1	0	0	0	0	0	0	0	0
CSF_9	0	0	1	0	0	0	0	0	0	0
CSF_6	0	0	0	1	0	0	0	0	0	0
CSF_4	0	0	0	0	1	0	0	0	0	0
CSF_5	0	0	0	0	0	1	0	0	0	0
CSF_1	0	0	0	0	0	0	1	0	0	0
CSF_7	0	0	0	0	0	0	0	1	0	0
CSF_2	0	0	0	0	0	0	0	0	1	0
CSF_{10}	0	0	0	0	0	0	0	0	0	1

Table A11: *(I-P)* matrix

(I-P)	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	1.0000	-0.1007	-0.1205	-0.0558	-0.1097	-0.0576	-0.1169	-0.0612	-0.0504	-0.0576

CSF₈	-0.0468	1.0000	-0.1169	-0.0486	-0.1169	-0.0594	-0.1097	-0.0540	-0.0414	-0.0504
CSF₉	-0.0396	-0.1115	1.0000	-0.0683	-0.1187	-0.0612	-0.0989	-0.0665	-0.0594	-0.0558
CSF₆	-0.0647	-0.1043	-0.1025	1.0000	-0.1097	-0.0665	-0.1187	-0.0683	-0.0612	-0.0629
CSF₄	-0.0522	-0.1151	-0.1043	-0.0755	1.0000	-0.0629	-0.1223	-0.0558	-0.0414	-0.0737
CSF₅	-0.0558	-0.1061	-0.1079	-0.0665	-0.1025	1.0000	-0.1079	-0.0773	-0.0468	-0.0629
CSF₁	-0.0504	-0.1331	-0.1115	-0.0683	-0.1205	-0.0522	1.0000	-0.0612	-0.0396	-0.0576
CSF₇	-0.0576	-0.1079	-0.1133	-0.0791	-0.1151	-0.0845	-0.1007	1.0000	-0.0486	-0.0576
CSF₂	-0.0504	-0.0917	-0.1007	-0.0665	-0.0989	-0.0755	-0.1025	-0.0755	1.0000	-0.0683
CSF₁₀	-0.0468	-0.1061	-0.1115	-0.0737	-0.1079	-0.0773	-0.1097	-0.0576	-0.0558	1.0000

Table A12: Inverse *(I-P)* matrix

$(I\text{-}P)^{-1}$	CSF_3	CSF_8	CSF_9	CSF_6	CSF_4	CSF_5	CSF_1	CSF_7	CSF_2	CSF_{10}
CSF_3	1.1208	0.3425	0.3571	0.2099	0.3534	0.2064	0.3536	0.2062	0.1639	0.1973
CSF_8	0.1523	1.2239	0.3263	0.1869	0.3315	0.1913	0.3202	0.1836	0.1431	0.1756
CSF_9	0.1522	0.3355	1.2331	0.2112	0.3446	0.2006	0.3231	0.2016	0.1643	0.1872
CSF_6	0.1867	0.3551	0.3515	1.1632	0.3631	0.2206	0.3649	0.2185	0.1781	0.2079
CSF_4	0.1665	0.3461	0.3350	0.2216	1.2460	0.2061	0.3495	0.1965	0.1522	0.2063
CSF_5	0.1748	0.3485	0.3481	0.2206	0.3490	1.1534	0.3476	0.2215	0.1616	0.2030
CSF_1	0.1631	0.3573	0.3375	0.2132	0.3503	0.1948	1.2370	0.1987	0.1489	0.1905
CSF_7	0.1813	0.3598	0.3623	0.2378	0.3694	0.2375	0.3515	1.1557	0.1679	0.2041
CSF_2	0.1698	0.3354	0.3412	0.2205	0.3449	0.2238	0.3423	0.2200	1.1167	0.2078
CSF_{10}	0.1686	0.3524	0.3547	0.2293	0.3573	0.2275	0.3531	0.2066	0.1715	1.1463