Achieving Circularity is a Distant Dream: Entrepreneurial barriers to Circular Business Models in SMEs of Emerging Economies

Akash Saharan, Ashutosh Samadhiya, Anil Kumar, Krishan Kumar Pandey, Sunil Luthra, Jose Arturo Garza-Reyes

Abstract

Purpose: Circularity has acted as an essential phenomenon for Small and Medium Enterprises (SMEs) in emerging economies, pressuring entrepreneurs to its adoption in their businesses. During the adoption and implementation of circularity, entrepreneurs or circular entrepreneurs (to be precise) are facing various challenges to its effective functioning. However, the scholarly literature has offered limited research into this phenomenon. Thus, the purpose of this research is to identify the various barriers and sub-barriers for circular entrepreneurs to adopt circularity in SMEs of emerging economies.

Design/methodology/approach: A combined qualitative and quantitative approach was employed to achieve the objectives of the study. In the first stage, through an extensive literature review, a list of barriers was identified and in the second stage, a deductive approach was employed to finalize the barriers. Finally, Best-Worst Method (BWM), a multi-criteria decision-making (MCDM) method, was used to analyze the significant importance of the barriers.

Findings: The findings of the study suggested the 'financial barrier' as the first-ranked barrier in the adoption of Circular Business Models (CBMs), followed by the 'regulatory and operational barriers' as the top second and third barriers. In terms of sub-barriers, 'lack of access to funding and capital' has been identified as the top sub-barrier in the adoption of CBM, followed by 'excessive regulations and red tape' and 'challenges due to ambiguity of the concept'.

Practical implications: To transition from a circular to a linear business approach considerably quicker and smoother, entrepreneurs may utilize the findings of this study as a blueprint for the steps to overcome the barriers in a linear to a circular transition.

Originality: This research differentiates from other studies due it solicited input directly from the people who are most familiar with the challenges of making the transition from linear to CBM, i.e. the entrepreneurs themselves.

Keywords: Circular entrepreneur; circular entrepreneurship; circularity; circular economy

1. Introduction

Many industries and countries have set ambitious goals towards a circular economy (CE) for the next 20-25 years. Recently, the G20 countries have declared CE as one of the three priority areas in the first environment and climate sustainability working group (ECSWG) meeting (PIB, 2023). Owing to its focus on minimizing resource use, waste, and emissions, the CE is attracting industry, academicians, and policymakers (Geissdoerfer *et al.*, 2020). European Union members and many other countries such as Kenya, the Republic of Rwanda, Singapore, China, and the USA have adopted the framework for CE (World Economic Forum, 2023). As per the European Commission, it is estimated that the transformation of linear business models to circular can add 600 billion euros in economic gains (European Commission, 2019). Similarly, estimates suggest that India can also create value worth US$ 624 billion in the year 2050 (Ellen MacArthur Foundation, 2016). However, serious and large-scale efforts for the implementation of circular practices are still lacking, and CE is suffering like Mother Earth. As per the Circularity Gap report 2022, the percentage of materials entering the global economy that will be recycled is expected to decrease from 9.1% in 2018 to 8.6% in 2022 (Circle Economy, 2022).

Some practitioners from the industry argue that adopting circular practices is now more than just a desirable option for organizations - it is a crucial factor in gaining a competitive advantage (Mensink *et al.*, 2019). Therefore, new business models called as "Circular Business Model (CBM)" are being developed that broaden the definition of value creation to encompass both environmental and social value (Cullen and de Angelis, 2021; Zucchella and Urban, 2019). As per Geissdoerfer et al. (2020), a circular business model is defined as "*business models that are cycling, extending, intensifying, and/or dematerializing material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organizational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerialising)*" (pg 7).

In a similar vein, transforming businesses from a linear model to a circular model through entrepreneurship has been conceptualized as "circular entrepreneurship". It is defined first by Zucchella and Urban (2019) "*to be an element of a complex socio-economic system that needs rethinking in terms of relationships, patterns (accumulated memories of events and structures) and context (technical, political, legal, cultural)*" (pg. 8). They further argue that circular entrepreneurship aims to establish organizations focused on sustainability, which includes not

just legally registered businesses but also non-governmental organizations (NGOs), territorial institutions, communities with a sustainability agenda, and political associations (Zucchella and Urban, 2019).

But according to the recent World Economic Forum (2023) report, 58% of the entrepreneurial actions towards CBMs are caught in the planning or pilot stages. Within this context, CE practices among small and medium enterprises (SMEs) in developing countries are also in their early stages, both in terms of academic research and practical implementation (Mishra *et al.*, 2022). It is rare to put CE practices into action among SMEs as they lack a proper strategy for such practices (Luthra *et al.*, 2022). Moreover, a significant proportion of SMEs lack familiarity with the concept of CE and its associated practices (Sharma *et al.*, 2021).

Therefore, it is crucial to search for the issues faced by entrepreneurs to employ CBMs, particularly in the SME context. Previously, studies mainly focused on barriers and drivers of CE practices in SMEs. For example, Agyemang et al. (2019) in their study delved into barriers and enablers of putting CE practices in the automobile industry in Pakistan. Using a multiple-case study approach, Tura et al. (2019) proposed a framework of drivers and barriers for the adoption of CE in businesses in SMEs from Finland. García-Quevedo et al. (2020) identified barriers to environmental innovations – a dimension of CE practices – among SMEs from a cross-sectional dataset of European countries. Sharma et al. (2021) identified opportunities, barriers, and prerequisites for the transition from a linear economy to CE among six SME cases in India. Other studies have explored the enablers and barriers of CBM, for example, Rizos et al. (2016) identified barriers and enablers for implementing CBM among European SMEs. Vermunt et al., (2019), using case study methodology, explored the barriers to CBM adoption among 43 SMEs in the Netherlands. Further, only a few studies have addressed the entrepreneurial critical factors of CBMs (Cullen and de Angelis, 2021; Zucchella and Urban, 2019).

The recent reviews related to CBMs (Geissdoerfer *et al.*, 2020; Suchek *et al.*, 2022) highlighted that research in this area is in its nascent stage. The existing literature suggests, in the SME context, the focus of scholars has shifted from CE practices to CBM and recently to entrepreneurial factors of CBM (Cullen and de Angelis, 2021). But, as mentioned above, the majority of previous studies investigating barriers to the adoption of CBM have been performed in developed economies creating a knowledge gap from emerging economies. Moreover, despite the identification of barriers to CBM, there is no clarity in the literature about which

barriers are more important and need immediate attention from practitioners. Hence, in the CBM context, an empirical examination of entrepreneurial barriers to CBM adoption among SMEs from emerging economies is needed. Thus, this study acts as a beacon in investigating the entrepreneurial barriers to adopting CBMs among SMEs in emerging economies. More precisely, the study aims to address the subsequent research question:

RQ1: What are the entrepreneurial barriers that hinder the adoption of CBM in SMEs of emerging economies?

RQ2: Which are the most and least significant entrepreneurial barriers among all the barriers?

RQ3: What are the key measures that SMEs can take to overcome these barriers and adopt CBMs?

Therefore, to address these questions, the study aims to explore the key barriers to CBM adoption. We conducted a thorough examination of existing literature and found that there is a lack of information on entrepreneurial barriers to the adoption of CBM among SMEs. To address this gap in the existing literature, subsequent objectives were established.:

- To empirically investigate the entrepreneurial barriers to the adoption of CBM in SMEs for achieving circularity
- To assign and prioritize the most and least significant entrepreneurial barriers to adopting CBM in SMEs.
- To provide strategic and managerial implications to overcome the most important entrepreneurial barriers to adopting CBM in SMEs.

To attain the aforementioned objectives, the current study, in its initial phase, conducted a thorough literature review to investigate the entrepreneurial barriers to adopting CBM in SMEs, validated with the experts using deduction technique and on experts' recommendations classified barriers according to integrated Human-Organization-Technology and Technology-Orgnaization-Environment (HOT-TOE) framework. Further, in the second phase, the same experts were approached again to rate the final 6 main barriers and their subsequent 23 sub-barriers. These ratings were analyzed using Best-Worst Method (BWM), a multi-criteria decision-making (MCDM) method. The findings reveal that among the main barriers (sub-barriers), financial barriers (lack of access to funding and capital for CE) are the top barrier, followed by regulatory barriers (excessive regulations and red tape), operation barriers (waste processing challenges), market barriers (challenges due to ambiguity of the concept CE),

stakeholder's barriers (lack of access to CE networks) and human resource barriers (lack of understanding about 4-R of CE) respectively. Finally, a framework is suggested to overcome the most significant barriers. The current study aims to provide entrepreneurs and academicians with insights into the entrepreneurial barriers of CBM that firms need to overcome to "go circular from the linear model".

The remaining article is organized as follows: Section 2 presents the literature review to provide a holistic view of entrepreneurial barriers of CBM among SMEs in emerging economies. Section 3 describes the research methods. Next, Section 4 presents the finalization process of the barriers and analysis of the results. Further, Section 5 discusses the contribution of the study on the basis of findings and provides practical implications. In the end, Section 6 presents the conclusion of the study, including limitations and provides future research directions.

2. Literature Review

This section provides an overview of the existing literature on CBM and its significance for SMEs and elaborates on exploring the entrepreneurial barriers to the adoption of CBM among SMEs in emerging economies. Research gaps from the literature review are outlined in the last sub-section and justify the need for the current study.

2.1 Significance of CBM adoption for SMEs

The underlying principle of the CE paradigm is focused on reducing waste generation through the implementation of the 4Rs approach, encompassing reduction, repair, reuse, and recycling while also ensuring controlled waste and minimizing environmental impact (Agyemang *et al.*, 2019; Ellen MacArthur Foundation, 2016). The prevailing approach to operationalizing CE for SMEs is to bring about a significant transformation in the business model and transition from a linear to a circular model (Takacs *et al.*, 2022). Thus, the implementation of CBMs in SMEs holds the potential to reduce waste and energy costs (Rizos *et al.*, 2016; Tura *et al.*, 2019) to confer financial benefits. CBMs facilitate firms to generate and add new value chains, thereby attaining a competitive advantage (Sharma *et al.*, 2021). Hence, to adopt CBM, businesses need to develop profound knowledge and capabilities, undo prevailing organizational routines, and procure additional resources encompassing skilled personnel, capital for fresh investments and advanced technology (Dzhengiz *et al.*, 2023).

By adoption of CBM, SMEs can contribute to society as they have the capacity to generate numerous job prospects for people in their local communities (Kumar *et al.*, 2019). Similarly, CBM assists firms in getting valuable insights from their customers and in delivering more customized and personalized recyclable products that cater to their needs at lower prices (Ellen MacArthur Foundation, 2016). The commitment of SMEs to sustainability and social responsibility also improves brand reputation (Luthra *et al.*, 2022). Nonetheless, the adoption of CBM helps in reducing social pressure and makes SMEs adhere to government laws (Kumar *et al.*, 2019; Sharma *et al.*, 2021). Despite these opportunities, less than 9% of the global economy is found to be circular (Circle Economy, 2022). Therefore, it becomes crucial to investigate the barriers to CBM adoption.

2.2 Barriers to CBM adoption among SMEs in emerging economies

Accordingly, for an exploration of the barriers to CBM adoption, literature was searched on databases including "Scopus" and "Web of Science" (WoS). Following keywords were searched in these databases: "*Circular Business Models*" OR "*Circular Economy*" AND "*SMEs*" AND "*Entrepreneur*" AND "*Barriers*" OR "*Constraints*" OR "*Challenges*" OR "*Impediments*". The keyword search was restricted to titles, keywords, and abstracts. The scope of the search was constrained to "articles" and the time period from "2015–2022". The objective of this article's inclusion was to concentrate on the provision of high-quality content in the study. An extensive literature examination initially uncovered 26 barriers (Explained in Table 1).

The researchers are increasingly focusing on CBM comprising cycling, extending, intensifying, and dematerializing resources to benefit the environment, people, and economic dimensions of a firm (Geissdoerfer *et al.*, 2020). In this vein, based on the strategies and innovations adopted, (Henry *et al.*, 2020) proposed five types of circular start-ups including: "design-based, waste-based, platform-based, service-based and nature-based". Similarly, (Reim *et al.*, 2021) investigated the CBM selection and their implementation among the manufacturing firms and based on their maturity level suggested 4 types of CBMs including "regeneration, customer operation optimization, responsibility sharing service agreements, and product looping business models". However, evidence from a survey of 10,618 SMEs in the UK indicates that as a CBM approach, 59% of firms consider only reducing waste as CBM by either waste material recycles or reuse or selling it to other firms (García-Quevedo *et al.*, 2020).

This indicates that SMEs even from the developed economy are not clear about how to implement CBM.

Various studies in literature, although small in number, have focused on opportunities, enablers, and barriers of CE and CBMs in SMEs (Suchek *et al.*, 2022). For example, firms entering foreign markets with a CBM strategy are struggling with support on legal, practical, and technical advice in addition to financial support (Rizos *et al.*, 2016). The heterogeneity of economic growth, national policies, finance mechanisms, institutional interventions and incentives among EU countries significantly impacts the engagement of SMEs in the CE (Zamfir *et al.*, 2017). A study of Romanian SMEs reports a high level of bureaucracy in monitoring, a lack of information on CBM benefits, and insufficient support from suppliers and consumers as major barriers (Ghenta and Matei, 2018). Similarly, Spanish SMEs reported the unavailability of innovative technology, consumer preferences, financial, and legal constraints to pose challenges in harnessing the potential benefits of CE (Pla-Julián and Guevara, 2018). The adoption of CBM introduces a novel form of risk referred to as "circular-risk" leaving conventional financing instruments inadequate for accommodating the unique requirements of CBM implementation among SMEs (Ghisetti and Montresor, 2020). Also, different types of CBMs exhibit heterogeneity in terms of associated risks, thus, resulting in different responses from various financial sources (Ghisetti and Montresor, 2020).

A survey of manufacturing firms by Kumar et al. (2019) from the UK and Ireland reported economic, environmental, and socio-political barriers to the adoption of CE practices. Vermunt et al. (2019) focused on firms with “product-as-a-service, product life extension, resource recovery, and circular supplies” and classified their CBM adoption barriers as internal, external, and institutional. Similarly, SMEs from Norway and the USA reported an insufficiency of technical skills and information pertaining to circular product design and production, higher start-up costs, lack of cooperation among SMEs, and time-consuming waste processing (Jaeger and Upadhyay, 2020). Likewise, García-Quevedo et al. (2020) studied the role of two sets of barriers including a lack of capabilities and resources; and the presence of regulations. Further, Takacs et al. (2022) have classified barriers to CE implementation among SMEs as company internal, technology, market, legislative, society and consumer barriers.

From the previous literature, it is established that manufacturing firms, particularly SMEs, face complex challenges in adopting CMBs which require distinct and robust entrepreneurial skills (García-Quevedo et al., 2020; Kumar et al., 2019; Mishra et al., 2022;

Takacs et al., 2022). At times, SMEs lack knowledge about the green and sustainable practices that they should adopt (Mishra *et al.*, 2022). Extant research suggests that various human, technological, organizational, and environmental barriers are vexing firms from adopting CBM (Agyemang *et al.*, 2019; de Angelis, 2021; Kumar *et al.*, 2019; Le *et al.*, 2022). The final representation of barriers to CBM adoption among SMEs is exhibited in Table 1.

2.3 Research Gaps

In light of the substantial social, environmental, and economic pressures, the focus on CBMs has become highly pertinent as it reflects the significant transformations observed in the role of firms (Ünal *et al.*, 2019). The literature review suggests CBM concept is gaining attention from scholars (Cullen and de Angelis, 2021; Geissdoerfer *et al.*, 2020; Suchek *et al.*, 2022). CBM adoption among SMEs requires the formulation of strategies that can be executed by considering existing internal and external challenges (Dzhengiz *et al.*, 2023; Suchek *et al.*, 2022). Therefore, understanding different CBM challenges is important for SMEs and scholars. Most previous studies have identified barriers to CBM from developed economies (Kumar *et al.*, 2019; Moktadir *et al.*, 2020; Takacs *et al.*, 2022) thus, it is important to explore barriers to CBM adoption among SMEs in developing economies. Next, for the understanding of both scholars and practitioners, these studies fail to explain the degree of importance of each barrier. Therefore, further investigation is required to identify which entrepreneurial barriers of CBM are more significant than others so that industry and policymakers can target to overcome those barriers first.

242 **Table 1:** Initial list of entrepreneurial barriers to circular business model adoption

Barriers	Description	Supporting References
Lack of access to funding and capital for CBM	The paucity of investments such as impact investing, crowdfunding, and public-private partnerships in CBM poses a formidable challenge to the growth and sustenance of CBM, impeding progress towards the CE.	(European Commission, 2019; Luthra *et al.*, 2022; Pla-Julián and Guevara, 2018; Rizos *et al.*, 2016; Suchek *et al.*, 2022; Toxopeus *et al.*, 2021)
Technology expenses for CBM	Technology expenses include the development and implementation of resource-efficient technologies, adoption of closed-loop production systems, and establishment of viable CE practices.	(Ghisetti and Montresor, 2020; Luthra *et al.*, 2022; Tura *et al.*, 2019)
Logistical costs and footprint challenge	The adoption of CBMs poses significant logistical challenges and environmental footprints, including the establishment of optimization of material flows and management of waste streams.	(Jaeger and Upadhyay, 2020; Mensink *et al.*, 2019; Takacs *et al.*, 2022)
Reverse logistics costs	Implementing reverse logistics in CBMs entails significant costs and challenges, including the collection, sorting, and processing costs of used products and materials.	(Geissdoerfer *et al.*, 2020; Mensink *et al.*, 2019; Vermunt *et al.*, 2019)
Lack of funds for research	The insufficiency of financial resources allocated towards exploring CBM represents a notable constraint to advancing knowledge in this field.	(Rizos *et al.*, 2016; Vermunt *et al.*, 2019)
Excessive regulations and red tape	CBMs are subject to complex regulations and administrative procedures which create excessive red tape and hinder the development and implementation of these models.	(Ghenta and Matei, 2018; Jensen *et al.*, 2022; Takacs *et al.*, 2022; Tura *et al.*, 2019)
Lack of awareness about the taxation system of CE	Taxation policies can influence the economic feasibility and competitiveness of CBMs, but complexity and multiplicity in the tax system create confusion among SMEs.	(Hull *et al.*, 2021; Luthra *et al.*, 2022; Mensink *et al.*, 2019)
Lack of awareness about government regulations regarding CE	SMEs' lack of awareness about government regulations related to waste management, product design, and end-of-life management designed to support CBM poses a significant challenge for SMEs aiming to adopt circular practices.	(European Commission, 2019; Hull *et al.*, 2021; Luthra *et al.*, 2022; Zucchella and Urban, 2019)
The challenge of balancing business with environmental impact	It is a huge challenge for SMEs to achieve balance in CBM which necessitates aligning economic, social, and environmental considerations within a systemic and circular framework.	(Henry *et al.*, 2022; Hull *et al.*, 2021; World Economic Forum, 2023)
Non-acceptance of CE by people	People have limited awareness and lack trust in circular products and have pre-notions that circular products are more expensive than traditional options.	(Jensen *et al.*, 2022; Tunn *et al.*, 2021; Tura *et al.*, 2019)
Challenges due to ambiguity of the concept of CE	Circular products present several challenges, including varying interpretations and definitions, difficulties in measuring the circularity of products, and the potential for greenwashing.	(European Commission, 2019; Geissdoerfer et al., 2020; World Economic Forum, 2023)

Volatile market condition	The volatile market conditions persist for circular products due to several reasons, including limited consumer demand, lack of market incentives, and challenges in scaling CBMs.	(Jensen *et al.*, 2022; Kumar *et al.*, 2019; Luthra *et al.*, 2022)
Lack of a market for CE products	SMEs lack the market for CE products, which hinders the spread of sustainable business practices and obstructs the adoption of CBM.	(Ellen MacArthur Foundation, 2016; Rizos *et al.*, 2016)
Lack of skilled employees	SMEs lack skilled employees as CBMs requires a range of specialised skill, including those related to product design, and sustainable resource management.	(Jensen *et al.*, 2022; Sharma *et al.*, 2021; Zucchella and Urban, 2019)
Lack of awareness about the waste management	Employees at SMEs are unaware of the waste management practices required for CBMs.	(Luthra *et al.*, 2022; Mishra *et al.*, 2022)
Lack of understanding about 4-R of CE	SMEs often face challenges in implementing the 4-R of CBMs - reduce, reuse, repair, and recycle - due to limited resources and expertise.	(Khan *et al.*, 2022; Tura *et al.*, 2019; World Economic Forum, 2023)
Employee hiring & training challenges.	Hiring and training employees in SMEs for CBMs presents several challenges, including a lack of available talent, limited training programs, and the need for specialized skills.	(Kumar *et al.*, 2019; Sharma *et al.*, 2021)
Employee retention & compensation challenges	SMEs face difficulties in hiring and keeping qualified employees with the necessary skills for CBMs in light of the limited pool of experienced candidates.	(García-Quevedo *et al.*, 2020; Sharma *et al.*, 2021)
Lack of access to CE networks	SMEs transitioning towards CBMs lack access to circular entrepreneurs' networks and their knowledge to learn from.	(Kumar *et al.*, 2019; Mensink *et al.*, 2019)
Lack of cooperation between stakeholders	SMEs lack a culture of collaboration, transparency, and trust between stakeholders for the implementation of CBMs.	(Jaeger and Upadhyay, 2020; Le *et al.*, 2022; Tura *et al.*, 2019)
Lack of Confidence in CE	SMEs lack confidence in CBMs due to several factors, including a limited understanding of circularity, a lack of market incentives, and excessive government regulations.	(Kumar *et al.*, 2019; World Economic Forum, 2023)
Fear of failure of CE	The fear of failure of CBMs among SMEs stems from perceived risks, uncertainties, and lack of expertise related to circularity.	(Agyemang *et al.*, 2019; Henry *et al.*, 2022)
Manufacturing and recycling challenge	The manufacturing and recycling challenges in CBMs are related to the need for new material streams, waste reduction, and efficient recycling processes.	(Jaeger and Upadhyay, 2020; Rizos *et al.*, 2016; Tura *et al.*, 2019)
Lack of stock due to logistics difficulties	SMEs rely on regular and timely material flows for smooth production for CBMs but often face logistic difficulties.	(Jensen *et al.*, 2022; Kumar *et al.*, 2019)
Equipment and waste availability challenges	SMEs need efficient and cost-effective waste processing equipment and technologies for the improvement of their circular material streams.	(Agyemang *et al.*, 2019; European Commission, 2019)
Waste processing challenges	SMEs lack adequate infrastructure, have limited waste streams, and lack technological solutions for employing CBMs.	(Luthra *et al.*, 2022; Sharma *et al.*, 2021)

243

3. Research Methods

A four-phased study was carried out to accomplish the objectives of this study, as depicted in Figure 1. During the first phase, a comprehensive review of relevant literature was conducted to identify the entrepreneurial barriers being faced by SMEs in CBM adoption. Subsequently, a brainstorming session was organized to obtain the viewpoints of experts from academics, industry and policy-making. Three barriers were deducted, and a final list of 23 barriers was prepared, which were further classified under financial, human, market, operational, regulatory, and stakeholder barriers following the integrated HOT-TOE framework. After confirmation of barriers, the same experts were contacted again to rate the barriers according to best-worst importance, and the ranking was prepared. Finally, after consultation with the experts, a framework was proposed to overcome the top-ranked barriers of CBM.

<Insert Figure 1 here>

3.1 Best Worst Method (BWM)

BWM is a revolutionary multi-criteria decision-making (MCDM) approach in which the best criterion is compared to all other criteria, and all other criteria are compared to the worst criterion (Rezaei, 2015). There are numerous other MCDM techniques available such as Analytical Hierarchical Processing (AHP)/Fuzzy AHP, Analytical network Processing (ANP), Multi-Attribute Utility Theory (MAUT), Simple Multiple Attribute Rating Technique (SMART), etc., to rank the criteria. However, compared to other MCDM techniques, such as AHP/Fuzzy AHP, BWM holds an edge over these techniques because it requires fewer pair-wise comparisons (Rezaei, 2015). Discussions in extant literature suggest that AHP is the most commonly used MCDM technique for computing weights of factors/criteria, etc. But the existence of integer values in the ranking reduces computational effort in BWM, in contrast to fractional values in AHP (Tarei *et al.*, 2021). Further, BWM has a lower chance of inconsistency (Rezaei, 2016). The literature may imply that AHP is widely used and adopted in many investigations. However, this does not guarantee its outcomes. For example, Rezaei (2015) has found BWM's results exhibit greater consistency when compared to AHP. In terms of performance, BWM outperforms AHP in four crucial areas: conformity, consistency, minimum violation, and total deviation (Mi *et al.*, 2019). Thus, BWM is a popular, powerful, and easy-to-use MCDM technique for analyzing complex decision-making problems.

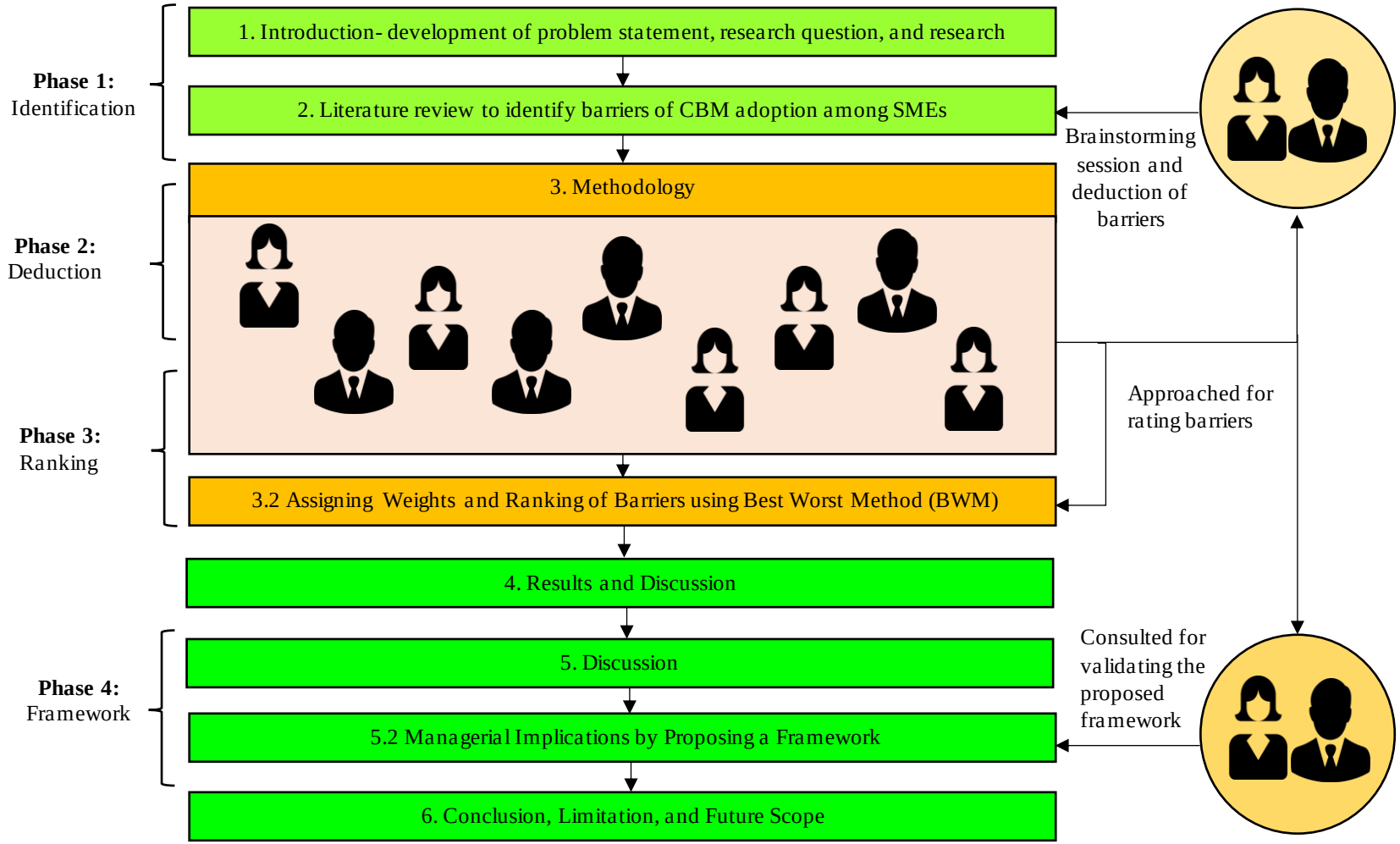

Figure 1: Research design for conducting the study

Not only this, BWM has found widespread application in the scholarship of various research fields, including agriculture, education, environmental science, medical, management, technology, etc. (Mi *et al.*, 2019). In the business and management context, (Moktadir *et al.*, 2023) have employed BWM to assess 'strategic drivers' to overcome the impacts of the COVID-19 pandemic. Similarly in the CE context, (Moktadir *et al.*, 2020) assessed barriers to CE practices in the leather industry using BWM. Whereas, in the entrepreneurship literature, recently, Mondal et al. (2023) and Muneeb et al. (2020) have used BWM to rank enablers of "*green entrepreneurship*" and "*sustainable entrepreneurship*" respectively. Provided successful and widespread application of BMW in the extant literature, it becomes convincing to apply BWM in the current study to effectively find the ranking of entrepreneurial barriers of CBM in SMEs. The following steps of the BWM are used for computation:

Step 1: Determine a suitable set of criteria pertinent to the phenomenon under investigation.

Step 2: Select the best (B) and worst (W) criteria for both main and sub-criteria.

Step 3: Employing a scale ranging from 1 to 9, ask each expert to furnish a pairwise assessment between best criterion B over all the other criteria. This will produce a vector:

$A_B = (a_{B1}, a_{B2}, \dots\dots\dots, a_{Bn})$

Where a_{Bj} indicates the preference of the best criterion B over criteria j. Here a_{BB} = 1.

Step 4: Similar to the above, each of the managers was asked to elicit pairwise ratings of all the other criteria with the worst criterion (W). This will also produce a vector:

$A_W = (a_{1W}, a_{2W}, \dots\dots\dots, a_{nW})^T$

Where a_{jW} indicates the preference of the criteria j over the worst criterion W. Here a_{WW} = 1.

Step 5: Further, to get the optimized weights $(w_1^*, w_2^*, w_3^*, \dots\dots., w_n^*)$ for all the criteria, derive the weights of criteria with the aim of minimizing the highest absolute variations for all j $\{|w_B - a_{Bj}\, w_j|, |w_j - a_{jw}\, w_w|\}$. The below minimax model will be determined:

$$\min max \{|w_B - a_{Bj}\, w_j|, |w_j - a_{jw}\, w_w|\}$$

$$\sum_{w_{j\geq 0,\ for\ all\ j}}^{s.t.} w_j = 1 \qquad \dots(1)$$

Model (1) is transformed into a linear model and is shown as min ξ^L,

Subject to:

$\min \xi^L$

$s.t.$

$|w_B - a_{Bj}\, w_j| \leq \xi^L$, for all j

$|w_j - a_{jw}\, w_w| \leq \xi^L$, for all j

$$\sum_{w_{j\geq 0,\ for\ all\ j}} w_j = 1 \qquad \ldots (2)$$

"Optimal weights" can be acquired by solving Model (2)$(w_1^*, w_2^*, w_3^*, \ldots\ldots, w_n^*)$ and "optimal value" ξ. Consistency (ξ^{L*}) of criteria comparisons close to "0" is desired (Rezaei, 2015, 2016).

4. Analysis

After selecting the barriers from the literature, experts within the pertinent area of the current study were contacted by email and phone. The Sonipat region of India, a prominent player in the SME industry, is home to many skilled professionals. Entrepreneurs of SMEs in Sonipat, are making efforts to adopt some of the circularity features, such as recycling and reusing substances in order to shift from linear to CBMs. Despite this, entrepreneurs have not been able to make a full shift to circularity, prompting us to single out the majority of experts among them. Using snowball sampling, we reached out to over twenty experts, and about 70% (fourteen) consented to take part in the research. The remaining six declined to participate in the study due to unavailability in the city, a busy schedule, and the requirement of their participation in multiple phases of the study. For reliability and consistency of MCDM results, previous studies by Murry and Hammons (1995) recommended data collection from 10-13 experts while Okoli and Pawlowski (2004) recommended 10-18 experts. Moreover, previous studies by Mondal et al. (2023) and Muneeb et al. (2020) using BWM collected data from thirteen and eight experts respectively. This study considered 14 experts which increased the accuracy of the barriers' identification and analysis.

These experts were from industry (for example, start-up owners, heads of circular operations), academia (professors working in circular entrepreneurship), and policymakers (for example, consultants, and senior officers from the Ministry of MSMEs in India). The experts had an average of 12.5 years of experience in their field and had minimum post-graduation and maximum PhD as their educational qualification. Next, in-person face-to-face meetings were arranged with the experts by taking prior appointments over the mobile call. At first, the experts were asked to rate the most appropriate barriers for this investigation from the list of 26 barriers as explained in the next section.

4.1 Finalization of the barriers

For the deduction phase, we followed the research methodology steps suggested by Orji and Liu (2020). A questionnaire was prepared for the experts that featured binary "YES" and "NO" responses to determine the barriers. The questionnaire included these responses to assess the significance of the barriers to circular entrepreneurship in Indian manufacturing SMEs. Depending on their importance, the experts replied with "YES" to retain the barriers and "NO" to remove them. Once the experts' responses were collected, the deduction process was carried out to conclude the various main barriers and their sub-enablers. The deduction of circular entrepreneurship in SMEs was determined by calculating the threshold value as follows: [(Sum of Experts with Yes Response) / (Total Number of responses received for all KSFs including yes and no)] * 100 = [(12 + 10 + 12 + 10 + 2 + 12 + 10 + 10 + 10 + 3 + 10 + 12 + 11 + 10 + 11 + 12 + 10 + 2 + 13 + 10 + 10 + 10 + 12 + 10 + 11 + 12) / (26 * 14)] * 100 = (257/364) * 100 = 70.60%. The outcome of the threshold value calculation demonstrated that options with a threshold value below 70.60% were to be eliminated from the study. The entrepreneurial barrier "*lack of funds for research*" received 2 Yes (14.29%) and 12 No (85.71%) while, named "*lack of a market for CE products*" received 3 Yes (21.43%) and 11 No (78.57%). Furthermore, the entrepreneurial barrier "*employee retention & compensation challenges*" also received 2 Yes (14.29%) and 12 No (85.71%). Since these three barriers had a lower value for "*Yes*" percentage than the threshold value of 70.60%, they were removed from the final list. Table 2 presents the responses to the final remaining 23 barriers after the deduction process.

Additionally, the experts suggested that these entrepreneurial barriers must be classified further. Therefore, to classify the barriers, the current study employed an integrated theoretical framework of TOE and HOT fit. The "*Technology-Organization-Environment (TOE)*" framework (Tornatzky *et al.*, 1990) is a highly regarded and long-standing theory in the study of innovation and technology adoption, particularly as it relates to organizations. TOE has been extensively used to understand technology adoption within CE research contexts. On the other side, "*Human-Organization-Technology (HOT)*" fit model (Yusof *et al.*, 2008) is a dynamic organizational framework that has been utilized in various academic areas to examine the adoption of innovations. The HOT fit model is based on the philosophy that human and organizational factors are equally important to technical aspects for the successful implementation of any innovation diffusion (Ahmadi *et al.*, 2018). Previous research has utilized the combination of the TOE framework and HOT fit model called Human-Organization-Technology-Environment (HOTE) for enablers of green entrepreneurship

389 (Mondal *et al.*, 2023) and circular economy (Le *et al.*, 2022) and recommended the use of an
390 integrated model for the robustness of results. Therefore, after the deduction process, this study
391 classified the remaining 23 entrepreneurial barriers of CBM in SMEs based on the integrated
392 approach of the TOE framework and HOT fit model. These were called main barriers named
393 financial, regulatory, market, human resource, stakeholder, and operational barriers as shown
394 in Table 2. Previously, identified and deduced barriers were named sub-barriers. Once the main
395 and sub-barriers were chosen and eliminated, the next phase was to examine the weights of the
396 barriers as given in the following section.

397

Table 2: Final list of entrepreneurial barriers identified from the literature and their validation scores by experts

			Pertinent to small and medium enterprises (SMEs)				
Main barriers	**Sub-barriers**	**Code**	**"Yes" response**	**"Yes" response (%)**	**"No" response**	**"No" response (%)**	**Sum**
Financial barriers (FB)	Lack of access to funding and capital for CBM	F1	12	85.71	2	14.29	14
	Technology expenses for CBM	F2	10	71.43	4	28.57	14
	Logistical costs and footprint challenge	F3	12	85.71	2	14.29	14
	Reverse logistics costs	F4	10	71.43	4	28.57	14
Regulatory barriers (RB)	Excessive regulations and red tape	R1	12	85.71	2	14.29	14
	Lack of awareness about the taxation system of CE	R2	10	71.43	4	28.57	14
	Lack of awareness about government regulations regarding CE	R3	10	71.43	4	28.57	14
	Challenge of balancing business with environmental impact	R4	10	71.43	4	28.57	14
Market barriers (MB)	Non-acceptance of CE by people	M1	10	71.43	4	28.57	14
	Challenges due to ambiguity of the concept of CE	M2	12	85.71	2	14.29	14
	Volatile market condition	M3	11	78.57	3	21.43	14
Human Resource Barriers (HRB)	Lack of skilled employees	H1	10	71.43	4	28.57	14
	Lack of awareness about waste management	H2	11	78.57	3	21.43	14
	Lack of understanding about 4-R of CE	H3	12	85.71	2	14.29	14
	Employee hiring & training challenges	H4	10	71.43	4	28.57	14
Stakeholder's barriers (SB)	Lack of access to CE networks	S1	13	92.86	1	7.14	14
	Lack of cooperation between stakeholders for CE	S2	10	71.43	4	28.57	14
	Lack of Confidence in CE	S3	10	71.43	4	28.57	14
	Fear of failure of CE	S4	10	71.43	4	28.57	14
Operational barriers (OB)	Manufacturing and recycling challenge	O1	12	85.71	2	14.29	14
	Lack of stock due to logistics difficulties	O2	10	71.43	4	28.57	14
	Equipment and waste availability challenges	O3	11	78.57	3	21.43	14
	Waste processing challenges	O4	12	85.71	2	14.29	14

4.2 BWM analysis

A questionnaire was prepared as per the method proposed by BWM and the same experts who participated in the deduction process were approached again. The experts were asked to select the most and least important barriers to CE among SMEs in India. Next, a pair-wise comparison was done of both main and sub barriers on a 1 to 9 scale, where 1 signifies "equal importance," and 9 signifies "extreme/intense less importance," respectively. This study has been based on the comprehension and judgements of experts; hence, results may be biased. Tables 3 and 4 show the pair-wise comparison of the main barriers.

Table 3: Best to others rating of main entrepreneurial barriers of CBM among SMEs

Expert	Best to Others	FB	RB	MB	HRB	SB	OB
E1	FB	1	2	2	7	5	4
E2	OB	4	2	5	9	7	1
E3	FB	1	2	1	7	8	3
E4	RB	2	1	3	6	5	4
E5	FB	1	2	7	4	4	3
E6	FB	1	4	2	5	7	2
E7	OB	1	3	2	9	5	1
E8	RB	1	1	9	5	8	3
E9	FB	1	2	4	7	6	3
E10	FB	1	4	3	9	6	2
E11	FB	1	3	2	5	6	4
E12	FB	1	5	2	3	9	6
E13	OB	2	5	3	9	6	1
E 14	FB	1	2	3	7	5	3

Table 4: Others to worst rating of main entrepreneurial barriers of CBM among SMEs

Expert	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
Others to the Worst	HRB	HRB	SB	HRB	MB	SB	HRB	MB	HRB	HRB	SB	SB	HRB	HRB
FB	7	5	8	5	7	7	9	8	7	9	6	9	8	7
RB	6	8	7	6	6	3	5	9	6	3	3	3	4	6
MB	6	4	7	3	1	6	8	1	3	5	4	8	6	4
HRB	1	1	2	1	3	3	1	3	1	1	2	5	1	1
SB	2	3	1	2	3	1	3	2	2	3	1	1	3	3
OB	4	9	4	3	4	6	9	5	3	8	3	4	9	4

Once the ratings for the entire set of main and sub-barriers were obtained, the next phase of BWM is employed to determine the weights of the entire set of barriers using a linear equation (2). Afterwards, a simple average was applied to determine the overall local weights

from the data collected from 12 experts. Later, global weights were calculated by multiplication of the local weights of the main barrier by the local weights of the sub-barrier and obtained ranks on the basis of global weights. The weights and corresponding ranks of all 23 sub-barriers are shown in Table 5. The consistency ratio (Ksi*) of individual experts was calculated for the main entrepreneurial barriers' as reported 0.06, 0.07, 0.05, 0.05, 0.06, 0.05, 0.05, 0.05, 0.06, 0.06, 0.05, 0.07, 0.07, 0.06 respectively for each expert. The values of all were less than 0.10 for each expert and were found to be in the desired range (Mondal *et al.*, 2023; Muneeb *et al.*, 2020). Further, the consistency (Ksi*) of individual experts for all sub-barriers under each main barrier was as follows: Financial barriers (0.05, 0.08, 0.09, 0.05, 0.07, 0.05, 0.09, 0.05, 0.09, 0.07, 0.05, 0.05, 0.08, 0.09), Regulatory barriers (0.07, 0.06, 0.07, 0.04, 0.05, 0.08, 0.07, 0.06, 0.08, 0.07, 0.05, 0.02, 0.08, 0.08), Market barriers (0.06, 0.09, 0.08, 0.04, 0.04, 0.07, 0.08, 0.04, 0.00, 0.09, 0.04, 0.03, 0.06, 0.08), Human resource barriers (0.05, 0.06, 0.05, 0.05, 0.08, 0.08, 0.09, 0.05, 0.07, 0.09, 0.05, 0.05, 0.08, 0.07), Stakeholder barriers (0.04, 0.02, 0.07, 0.05, 0.08, 0.06, 0.09, 0.05, 0.08, 0.09, 0.05, 0.08, 0.06, 0.04), Operational barriers (0.05, 0.07, 0.07, 0.05, 0.08, 0.06, 0.09, 0.05, 0.08, 0.07, 0.05, 0.07, 0.08, 0.05). Further, average consistency for each main barrier was calculated where Financial barriers (0.07), Regulatory barriers (0.06), Market barriers (0.06), Human resource barriers (0.07), Stakeholder barriers (0.06), and Operational barriers (0.07). All the consistency ratio values were below desired 0.10 for both the individual expert and the barrier and were thus highly consistent (Mondal *et al.*, 2023; Muneeb *et al.*, 2020). Moreover, the robustness of BWM results is checked by employing sensitivity analysis.

4.3 Sensitivity Analysis

A sensitivity analysis was performed to assess the robustness of the barriers ranking by varying the weight of the main barrier with the highest weight and checking the impact on the sub-barriers. Previously, scholars have examined the stability in ranks by changing the weight of the highest-ranked criteria from 0.1 to 0.9 and analysing subsequent changes in the ranking of the sub-criteria (Moktadir *et al.*, 2023). In the current study, the weight of the most important barrier "financial barriers" was varied in the range of 0.1 to 0.9 and changes in the ranking of sub-barriers were investigated. The variation of weight among main barriers and sub-barriers according to changes in "financial barriers" from 0.1 to 0.9 is shown in Tables 6 and 7.

444 **Table 5:** Weights and ranking of main and sub-entrepreneurial barriers of CBM among SMEs by the experts.

Main barrier	Weight	Sub-barrier	Local Weights	Global Weights	Rank
Financial barrier (FB)	0.326	Lack of access to funding and capital for CBM (F1)	0.535	0.174	1
		Technology expenses for CBM (F2)	0.120	0.039	10
		Logistical costs and footprint challenge (F3)	0.181	0.059	7
		Reverse logistics costs (F4)	0.164	0.053	9
Regulatory barriers (RB)	0.194	Excessive regulations and red tape (R1)	0.448	0.087	2
		Lack of awareness about taxation system of CBM (R2)	0.082	0.016	20
		Lack of awareness about government regulations regarding CBM (R3)	0.124	0.024	14
		Challenge of balancing business with environmental impact (R4)	0.346	0.067	5
Market barriers (MB)	0.159	Non-acceptance of CE by people (M1)	0.126	0.020	16
		Challenges due to ambiguity of the concept CE (M2)	0.530	0.084	3
		Volatile market condition (M3)	0.344	0.055	8
Human Resource Barriers (HRB)	0.064	Lack of skilled employees (H1)	0.254	0.016	18
		Lack of awareness about waste management (H2)	0.251	0.016	19
		Lack of understanding about 4-R of CE (H3)	0.417	0.027	12
		Employee hiring & training challenges (H4)	0.078	0.005	23
Stakeholder's barriers (SB)	0.068	Lack of access to CE networks (S1)	0.428	0.029	11
		Lack of cooperation between stakeholders for CE (S2)	0.378	0.026	13
		Lack of Confidence in CE (S3)	0.103	0.007	21
		Fear of failure of CE (S4)	0.092	0.006	22
Operational Barriers (OB)	0.189	Manufacturing and recycling challenge (O1)	0.349	0.066	6
		Lack of stock due to logistics difficulties (O2)	0.087	0.016	17
		Equipment and waste availability challenges (O3)	0.123	0.023	15
		Waste processing challenges (O4)	0.441	0.084	4

445

446 **Table 6:** Variation in the weight of other main barriers when weights of financial barriers are
447 increased for sensitivity analysis.

Main Barriers	**0.1**	**0.2**	**0.3**	**BWM Results**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
Financial barrier	0.100	0.200	0.300	**0.326**	0.400	0.500	0.600	0.700	0.800	0.900
Regulatory barriers	0.259	0.230	0.201	**0.194**	0.173	0.144	0.115	0.086	0.058	0.029
Market barriers	0.212	0.189	0.165	**0.159**	0.142	0.118	0.094	0.071	0.047	0.024
Human Resource Barriers	0.085	0.076	0.066	**0.064**	0.057	0.047	0.038	0.028	0.019	0.009
Stakeholder's barriers	0.091	0.081	0.071	**0.068**	0.061	0.050	0.040	0.028	0.020	0.010
Operational Barriers	0.252	0.224	0.196	**0.189**	0.168	0.140	0.112	0.084	0.056	0.028

448

449 **Table 7:** Variations of sub-barriers during sensitivity analysis when 'financial barriers' weights
450 range between 0.1 to 0.9.

Sub barriers	**0.1**	**0.2**	**0.3**	**0.326**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
F1	0.053	0.107	0.160	0.174	0.214	0.267	0.321	0.374	0.428	0.481
F2	0.012	0.024	0.036	0.039	0.048	0.060	0.072	0.084	0.096	0.108
F3	0.018	0.036	0.054	0.059	0.072	0.090	0.109	0.127	0.145	0.163
F4	0.016	0.033	0.049	0.053	0.066	0.082	0.098	0.115	0.131	0.148
R1	0.116	0.103	0.090	0.087	0.077	0.064	0.052	0.039	0.026	0.013
R2	0.021	0.019	0.017	0.016	0.014	0.012	0.009	0.007	0.005	0.002
R3	0.032	0.029	0.025	0.024	0.021	0.018	0.014	0.011	0.007	0.004
R4	0.090	0.080	0.070	0.067	0.060	0.050	0.040	0.030	0.020	0.010
M1	0.027	0.024	0.021	0.020	0.022	0.015	0.012	0.009	0.006	0.003
M2	0.113	0.100	0.088	0.084	0.092	0.063	0.050	0.038	0.025	0.013
M3	0.073	0.065	0.057	0.055	0.059	0.041	0.032	0.024	0.016	0.008
H1	0.022	0.019	0.017	0.016	0.014	0.012	0.010	0.007	0.005	0.002
H2	0.021	0.019	0.017	0.016	0.014	0.012	0.010	0.007	0.005	0.002
H3	0.036	0.032	0.028	0.027	0.024	0.020	0.016	0.012	0.008	0.004
H4	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.002	0.001	0.001
S1	0.039	0.035	0.030	0.029	0.026	0.022	0.017	0.012	0.009	0.004
S2	0.034	0.030	0.027	0.026	0.023	0.019	0.015	0.011	0.008	0.004
S3	0.009	0.008	0.007	0.007	0.006	0.005	0.004	0.003	0.002	0.001
S4	0.008	0.007	0.006	0.006	0.006	0.005	0.004	0.003	0.002	0.001
O1	0.088	0.078	0.069	0.066	0.059	0.049	0.039	0.029	0.020	0.010
O2	0.022	0.019	0.017	0.016	0.015	0.012	0.010	0.007	0.005	0.002
O3	0.031	0.028	0.024	0.023	0.021	0.017	0.014	0.010	0.007	0.003
O4	0.111	0.099	0.087	0.084	0.074	0.062	0.049	0.037	0.025	0.012

451

452 At 0.1 weight of financial barriers, the sub-barrier R1 ranks the highest and H4 ranks the lowest.
453 However, R1 is not able to retain the highest position on changing the values of the financial
454 barrier to 0.2 and F1 takes the highest position. Similarly, F1 remains at rank 1 on further
455 varying the weights from 0.3 to 0.9 as shown in Table 8.

Table 8: Ranking of barriers during sensitivity analysis

Sub barriers	0.1	0.2	0.3	0.326	0.4	0.5	0.6	0.7	0.8	0.9
F1	7	1	1	1	1	1	1	1	1	1
F2	20	15	10	10	10	7	4	4	4	4
F3	18	8	8	7	5	2	2	2	2	2
F4	19	10	9	9	6	3	3	3	3	3
R1	1	2	2	2	3	4	5	5	5	5
R2	17	20	20	20	20	20	20	20	20	20
R3	11	13	14	14	15	14	14	14	14	14
R4	4	5	5	5	7	8	8	8	8	8
M1	13	16	16	16	14	16	16	16	16	16
M2	2	3	3	3	2	5	6	6	6	6
M3	6	7	7	8	8	10	10	10	10	10
H1	15	18	18	18	18	18	18	18	18	18
H2	16	19	19	19	19	19	19	19	19	19
H3	9	11	12	12	12	12	12	12	12	12
H4	23	23	23	23	23	23	23	23	23	23
S1	8	9	11	11	11	11	11	11	11	11
S2	10	12	13	13	13	13	13	13	13	13
S3	21	21	21	21	21	21	21	21	21	21
S4	22	22	22	22	22	22	22	22	22	22
O1	5	6	6	6	9	9	9	9	9	9
O2	14	17	17	17	17	17	17	17	17	17
O3	12	14	15	15	16	15	15	15	15	15
O4	3	4	4	4	4	6	7	7	7	7

The global weights of sub-barriers to CBM adoption among SMEs are shown in Figure 2. It can be observed from the figure that the variation is insignificant. Therefore, the proposed ranking of barriers is robust enough in addressing any human bias and uncertainty in data under fuzzy conditions.

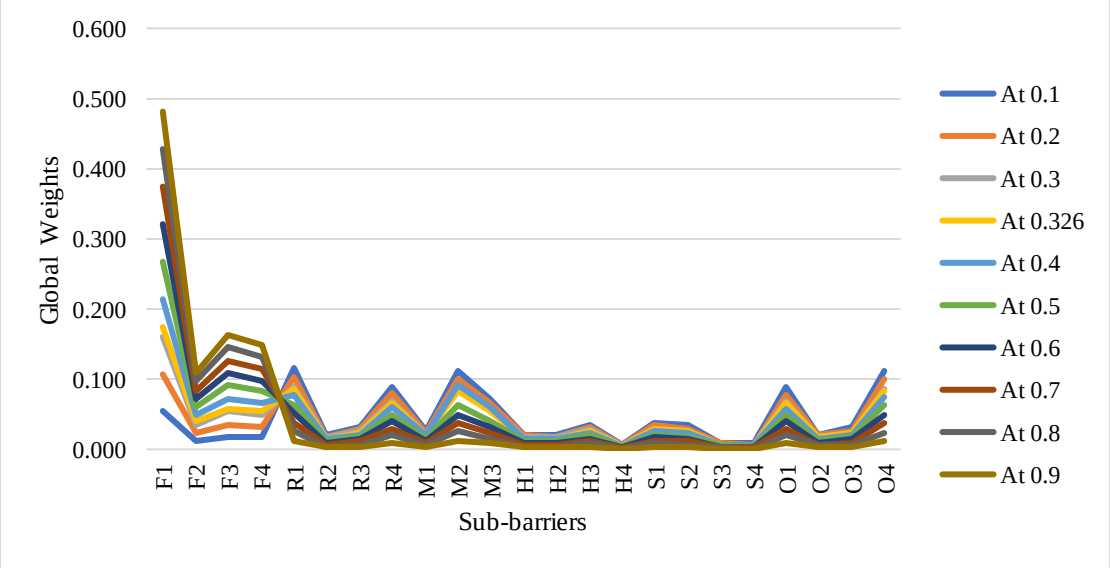

Figure 3: Sensitivity analysis of weights of entrepreneurial barriers of CBM

5. Findings and Discussion

The current study employed a combination of literature review, integrated HOT-TOE framework for classification and expert opinion to investigate entrepreneurial barriers to CBM adoption among SMEs. Chronologically, barriers were identified and classified; deduced and validated with experts; and finally ranked by taking responses from the same experts using the best-worst method.

5.1 Findings of the BWM study

Based on the findings, among the main barriers, financial barriers (FB), with 0.326 assigned weight, were found to be ranked first and the biggest challenge for the adoption of CBM by SMEs. Finance is the oil for running any business. The findings are in line with previous studies (Luthra *et al.*, 2022; Toxopeus *et al.*, 2021) which stressed the participation of private and public sectors in financing CBM. Next, regulatory barriers (RB), with 0.194 assigned weight, were ranked second. Government regulations create a conducive environment for the adoption of new business models. However, the results of this study are contrary to common belief. Previously, Hull et al. (2021) and Jensen et al. (2022) have also highlighted that government regulations create obstacles to a circular economy and need to be altered. Furthermore, operational barriers (OB), with 0.189 assigned weight, were ranked third which could be reasoned for a combination of factors related to manufacturing, technology, and recycling challenges. The findings are in line with prior studies of Agyemang et al. (2019), Sharma et al., (2021), and Tura et al. (2019) which emphasized that firms need to advance their

operational processes to adopt CBM. The combined weight of these three barriers is 0.712 indicating that 71.20% of the CBM adoption among SMEs can be overcome by addressing these barriers. A more detailed and elaborated understanding of the results of sub-enablers is discussed.

Among all 23 sub-barriers, *"lack of access to funding and capital (F1)"* for CBM, with an assigned global weight of 0.174, ranked first indicating that SMEs do not have enough funds for transitioning from linear to circular business models. The findings are in line with the previous studies (Ghisetti and Montresor, 2020; Toxopeus *et al.*, 2021), which have highlighted the importance of finance for CBM adoption in developed countries. Sub-barrier *"excessive regulations and red tape (R1)"*, with an assigned global 0.087, is ranked second, indicating stringent rules and regulations hampering the SMEs transitioning from linear to CBMs. The findings are in line with existing literature (Kumar *et al.*, 2019; Takacs *et al.*, 2022; Zamfir *et al.*, 2017), which has emphasized the inadequate laws and legal systems creating barriers to CBM adoption. Sub-barrier *'challenges due to ambiguity of the concept CE (M2)"*, with assigned global weight 0.084 was ranked third indicating that SMEs like others do not have clarity on what CE is. The findings are in line with the extant literature (García-Quevedo *et al.*, 2020; Henry *et al.*, 2020; Jensen *et al.*, 2022; World Economic Forum, 2023) wherein both practitioners and scholars have an ambiguous understanding of the CBM and CE.

Ranked in the fourth position, *"waste processing challenges (O4)"*, with an assigned global weight of 0.084, require large efforts from SMEs. The findings are similar to previous research of (Hull *et al.*, 2021; Jaeger and Upadhyay, 2020; Mensink *et al.*, 2019; Sharma *et al.*, 2021) who have stated that SMEs face major impediments when it comes to waste management for CBM adoption. Next, the *"challenge of balancing business with environmental impact (R4)"*, with an assigned global weight of 0.067 was ranked fifth. The findings are matching the previous literature (Henry *et al.*, 2022; Hull *et al.*, 2021; Ünal *et al.*, 2019), which has indicated the importance of circular business to reduce the impacts on the environment. If combined, these top 5 ranked entrepreneurial barriers are responsible for almost 50% of roadblocks in CBMs adoption among SMEs. Hence, half of the issues can be resolved only by focusing on these top 5 barriers only. The remaining sub barriers were ranked as follows O1 > F3 > M3 > O4 > R4 > F2 > S1 > H3 > O4 > R4 > M1 > O2 > H1 > H2 > R2 > S3 > S4 > H4.

5.2 Theoretical contribution, implications, and research propositions

The current study presents both theoretical and practical implications, suggesting that certain themes explored in the research could be applied to facilitate the adoption of CBMs among SMEs in emerging economies. First, the study provides a holistic view of the entrepreneurial barriers faced by SMEs in CBM adoption. While extant literature has predominately considered only identifying the barriers to CE practices and CBM adoption among SMEs (Mishra *et al.*, 2022; Sharma *et al.*, 2021; Takacs *et al.*, 2022). This study first identified the barriers from the literature and verified, with the help of experts, the importance of all barriers for Indian SMEs. Second, this study has contributed to the literature by providing a perspective on challenges faced in the adoption of CBM by SMEs from an emerging economy. Previously, the literature has majorly concentrated on identifying challenges SMEs from developed economies only (Kumar *et al.*, 2019; Moktadir *et al.*, 2020; Takacs *et al.*, 2022). These barriers may also be important to other emerging economies where SMEs operate in a similar business environment. Third, the study classified the barriers under the HOT-TOE framework, assigned weights and ranked the barriers according to their best-worst importance. As per the authors' knowledge, no previous study has attempted to assign weights and rank entrepreneurial barriers to CBM adoption among SMEs from developing economies. Fourth, this study provides propositions for the implication and further exploration. The implications based on the theory are provided next.

Proposition 1: Both policymakers and SMEs from emerging economies should work in tandem for easy access to capital

Borrowing from public funds by SMEs exhibits a greater impact in facilitating the adoption of CBM than self-funding but a lesser impact than debt funding (Ghisetti and Montresor, 2020). Thus, it is imperative for the government and the finance industry to devise novel financial instruments or mechanisms that enable SMEs to effectuate a resilient transition towards CE (Ghisetti and Montresor, 2020; Toxopeus *et al.*, 2021). Nonetheless, SMEs should be proactive and step forward to benefit from these financial instruments. Luthra *et al.* (2022) suggested that SMEs from emerging economies should prepare a monthly or yearly report highlighting firms' efforts for the adoption of CE, this can give confidence to involved stakeholders to invest in CE efforts. Further, to obtain finance for CBM, SMEs from emerging economies can use a mix of these three strategies that are signalling future cash flow

expectations, relationship building with banks and suppliers, and designing standardized, durable circular assets that can be used as bank's collateral (Toxopeus *et al.*, 2021).

Proposition 2: Bring changes in government rules and regulations to transform a linear economy into a circular economy

Zamfir *et al.* (2017) argue that the location of SMEs in the EU shapes the decision to adopt CBM due to various factors including economic growth, national policies, finance mechanisms, institutional interventions and incentives available in the member country. Hence, learning from developed economies, the government and policymakers from developing economies should relax laws related to CE at both state and national levels. Further, incentives for the adoption of CBM can motivate SMEs to CE readiness (Singh *et al.*, 2018). For the same, while procuring products government agencies such as on Government e-Marketplace (GeM) - an online public procurement platform in India - can prefer circular products for their use. Similarly, other e-commerce websites can create separate sections for circular products.

Moreover, the governments in emerging economies should create a standardized mechanism for CE performance evaluation including data collection, analysis, and punishment for CBM adoption among SMEs (Kumar *et al.*, 2019). For this purpose, already existing agencies such as the Quality Council of India (QCI) and the Central Pollution Control Board (CPCB) in India can provide certification of circularity to SMEs. However, these assessments should be easy to understand by SMEs as the complexity of regulations engenders ambiguity and perplexity among SMEs and results in a state of uncertainty for CE implementation (Takacs *et al.*, 2022). Here, SME associations can bridge the gap and should put clear demands in front of policymakers to boost CE.

Proposition 3: Standardized definition of CBM can reduce challenges arising due to the ambiguity of the CE concept

World Economic Forum (2023) states that regardless of its full potential, firms perceive themselves as adhering to CE principles only if they include recycled material in a finely tuned and entirely optimized supply chain. Likewise, recycling or reusing waste or merely selling it to other companies is confused with CBM by SMEs (García-Quevedo *et al.*, 2020). Moreover, the ambiguity encompassing the CE concept leads to confusion among customers and creates uncertainty regarding the environmental and social benefits of circular products, thus inhibiting demand in the market (Jensen *et al.*, 2022).

Not only this, but scholars are also confused about defining the CBM, Henry *et al.* (2020) collated 128 different definitions of types of CE start-ups. Hence, by adopting a proper definition, governments can set the scope of CE and CBMs for SMEs and encourage them to adopt CE and CBMs. Furthermore, the governments of emerging economies should take a bottom-up approach and advertise the benefits of circular products to spread awareness among customers and boost demand which will attract new entrepreneurial ventures for circular products.

Proposition 4: Industry should prepare strategies and solutions for the waste processing challenge

The waste is generated at various stages of the production process; however, the end-of-product life waste management is very complex. The complexity arises from various factors including an increased number of materials, the use of small but significant materials, and the presence of multiple components with diverse characteristics (Jaeger and Upadhyay, 2020). SMEs from emerging economies lack the expertise to segregate and recover different materials from the waste (Sharma *et al.*, 2021). As per an estimate by Mensink *et al.* (2019) to sustain a plastic waste processing facility operating at a scale of 1 million tonne per annum, it would be necessary to have a catchment area of approximately 33,000 square kilometres within a standard metropolitan agglomeration. Operating at such a scale is a herculean task for SMEs. Sharma *et al.* (2021) emphasized that waste processing is expensive and based on investments. However, SMEs can have a competitive advantage over large firms by setting up smaller and mobile waste processing units.

Firms from emerging economies need to have a long-term vision (Luthra *et al.*, 2022) and consider the end life of product management at the product planning and development phase. For the same, firms should clearly mark the ratio of materials in the produced product and provide the information for its proper disposal beforehand (Jaeger and Upadhyay, 2020). Government agencies like Metrology Department can stay forefront and provide industry-wise measurement standards for different waste materials to promote fairness, transparency, and trust in waste trade activities. Nonetheless, academics can help SMEs and play an important role in developing and transferring knowledge on waste management (Hull *et al.*, 2021).

Proposition 5: Challenges of balancing business with environmental impact

SMEs generally have fewer resources and capabilities compared to larger firms, and they often encounter difficulties in adopting and implementing environmentally friendly

practices for the extraction of material from waste (Henry *et al.*, 2022). But, value creation by extracting certain waste materials - having positive impacts on the environment and society - may be costly for a firm to even operate at, on the other hand, there are certain materials (for example bio-waste) which costs low but are hazardous to environment and society (Ünal *et al.*, 2019). This results in a decision paradox for SMEs particularly as they have a resource crunch. Therefore, SMEs need to be motivated to proactively focus on integrating circular strategies for balancing business with environmental impact (Hull *et al.*, 2021). For the same SMEs can integrate their processes of circularity with the standard practices suggested by ISO 14001 to address environmental issues such as climate change, net zero, and sustainability.

The analysis of barriers and proposed solutions to the adoption of CBM in this study will be helpful for the practitioners to design feasible CBMs for SMEs.

6. Conclusion, limitations, and future research direction

Circularity has been an emergent topic even for SMEs in developing nations. The emergence of circularity has pressured various entrepreneurs to adopt the CBM to sustain themselves in the market. Therefore, many entrepreneurs have started their SMEs' transition from linear to CBM without even the proper awareness and knowledge of circularity. These haste-oriented actions of adoption of CBM lead entrepreneurs to fail or partially fulfilled the circularity projects. The entrepreneurs or circular entrepreneurs have ignored the different factors that came as a barrier during the adoption of circularity.

The present research has identified the barriers to adopting CBM from the literature and used a deductive approach to filter and finalise the barriers which are more relevant to SMEs and circularity settings. Finally, BWM is implemented based on the experts, which are majorly associated with these barriers, and prioritised the barriers in adopting CBM. The study was conducted on Indian SMEs entrepreneurs, specially oriented to the Sonipat region, which greatly contributes to SMEs. The findings indicate “financial barrier” as the top barrier and “lack of access to funding and capital” as a top sub-barrier for entrepreneurs in adopting CBM in SMEs. Therefore, the study offers a comprehensive look at various barriers and delivers the most influential barriers and sub-barriers, which will help entrepreneurs of SMEs to plan the actions needed to be taken for handling these barriers for effective adoption and implementation of CBM in the emerging nation’s setting.

Like any other study, this study also has some limitations. Given that the study's responses are inherently subjective and reliant upon expert’s beliefs, experiences, judgments,

and values there exists a potential for the final outcome to be influenced by biases. However, it is probable to mitigate potential biases by implementing conducting an exploratory factor analysis to combine interrelated barriers set into a composite set of barriers. Also, this study has not emphasized the interrelationships between the barriers, therefore, future studies can apply methodology such as interpretive structural modelling (ISM) to establish interrelationships.

Further statistical investigations (for example structural equation modelling) might be added to this research to help with generalisation and validation. Although this is a ground-breaking study, more research into the challenges that will inevitably arise after putting this research into practice in the industry is needed to ensure its usefulness in overcoming the barriers to circularity adoption in SMEs in the Indian context. Hence, this study might look at the same activity again in the future to investigate some other developing theme in entrepreneurial action towards net zero capabilities.

References

Agyemang, M., Kusi-Sarpong, S., Khan, S.A., Mani, V., Rehman, S.T. and Kusi-Sarpong, H. (2019), "Drivers and barriers to circular economy implementation", *Management Decision*, Vol. 57 No. 4, pp. 971–994, doi: 10.1108/MD-11-2018-1178.

Ahmadi, H., Nilashi, M., Shahmoradi, L., Ibrahim, O., Sadoughi, F., Alizadeh, M. and Alizadeh, A. (2018), "The moderating effect of hospital size on inter and intra-organizational factors of Hospital Information System adoption", *Technological Forecasting and Social Change*, Vol. 134, pp. 124–149, doi: 10.1016/j.techfore.2018.05.021.

de Angelis, R. (2021), "Circular economy: laying the foundations for conceptual and theoretical development in management studies", *Management Decision*, Vol. 59 No. 6, pp. 1209–1227, doi: 10.1108/MD-05-2019-0587.

Circle Economy. (2022), *The Circularity Gap Report 2022*, Amsterdam.

Cullen, U.A. and de Angelis, R. (2021), "Circular entrepreneurship: A business model perspective", *Resources, Conservation and Recycling*, Vol. 168, p. 105300, doi: 10.1016/j.resconrec.2020.105300.

Dzhengiz, T., Miller, E.M., Ovaska, J. and Patala, S. (2023), "Unpacking the circular economy: A problematizing review", *International Journal of Management Reviews*, Vol. 25 No. 2, pp. 270–296, doi: 10.1111/ijmr.12329.

Ellen MacArthur Foundation. (2016), "Circular economy in India: Rethinking growth for long-term prosperity", *Https://Ellenmacarthurfoundation.Org/Circular-Economy-in-India*, 5 December.

European Commission. (2019), *Accelerating the Transition to the Circular Economy: Improving Access to Finance for Circular Economy Projects*, doi: 10.2777/983129.

García-Quevedo, J., Jové-Llopis, E. and Martínez-Ros, E. (2020), "Barriers to the circular economy in European small and medium-sized firms", *Business Strategy and the Environment*, Vol. 29 No. 6, pp. 2450–2464, doi: 10.1002/bse.2513.

Geissdoerfer, M., Pieroni, M.P.P., Pigosso, D.C.A. and Soufani, K. (2020), "Circular business models: a review", *Journal of Cleaner Production*, Vol. 277, p. 123741, doi: 10.1016/j.jclepro.2020.123741.

Ghenta, M. and Matei, A. (2018), "SMEs and the circular economy: from policy to difficulties encountered during implementation", *Amfiteatru Economic*, Vol. 20 No. 48, pp. 294–309, doi: 10.24818/EA/2018/48/294.

Ghisetti, C. and Montresor, S. (2020), "On the adoption of circular economy practices by small and medium-size enterprises (SMEs): does 'financing-as-usual' still matter?", *Journal of Evolutionary Economics*, Vol. 30 No. 2, pp. 559–586, doi: 10.1007/s00191-019-00651-w.

Henry, M., Bauwens, T., Hekkert, M. and Kirchherr, J. (2020), "A typology of circular start-ups: An analysis of 128 circular business models", *Journal of Cleaner Production*, Vol. 245, p. 118528, doi: 10.1016/j.jclepro.2019.118528.

Henry, M., Hoogenstrijd, T. and Kirchherr, J. (2022), "Motivations and identities of 'grassroots' circular entrepreneurs: an initial exploration", *Business Strategy and the Environment*, pp. 1–20, doi: 10.1002/bse.3097.

Hull, C.E., Millette, S. and Williams, E. (2021), "Challenges and opportunities in building circular-economy incubators: Stakeholder perspectives in Trinidad and Tobago", *Journal of Cleaner Production*, Vol. 296, p. 126412, doi: 10.1016/j.jclepro.2021.126412.

Jaeger, B. and Upadhyay, A. (2020), "Understanding barriers to circular economy: cases from the manufacturing industry", *Journal of Enterprise Information Management*, Vol. 33 No. 4, pp. 729–745, doi: 10.1108/JEIM-02-2019-0047.

Jensen, S.F., Kristensen, J.H., Uhrenholt, J.N., Rincón, M.C., Adamsen, S. and Waehrens, B.V. (2022), "Unlocking barriers to circular economy: an ISM-based approach to contextualizing dependencies", *Sustainability*, Vol. 14 No. 15, p. 9523, doi: 10.3390/su14159523.

Khan, E.A., Chowdhury, Md.M.H., Hossain, M.A., Mahmud, A.K.M.S., Baabdullah, A.M. and Dwivedi, Y.K. (2022), "Performance of small firms in a circular economy: configuring challenges and entrepreneurial orientation", *Management Decision*, Vol. ahead-of-print, doi: 10.1108/MD-05-2022-0731.

Kumar, V., Sezersan, I., Garza-Reyes, J.A., Gonzalez, E.D.R.S. and AL-Shboul, M.A. (2019), "Circular economy in the manufacturing sector: benefits, opportunities and barriers", *Management Decision*, Vol. 57 No. 4, pp. 1067–1086, doi: 10.1108/MD-09-2018-1070.

Le, T.T., Behl, A. and Pereira, V. (2022), "Establishing linkages between circular economy practices and sustainable performance: the moderating role of circular economy entrepreneurship", *Management Decision*, doi: 10.1108/MD-02-2022-0150.

Luthra, S., Kumar, A., Sharma, M., Arturo Garza-Reyes, J. and Kumar, V. (2022), "An analysis of operational behavioural factors and circular economy practices in SMEs: An emerging economy perspective", *Journal of Business Research*, Vol. 141, pp. 321–336, doi: 10.1016/j.jbusres.2021.12.014.

Mensink, M., Bartels, R., Elser, B. and Ulbrich, M. (2019), *Winning in a Circular Economy: Practical Steps for the European Chemical Industry*.

Mi, X., Tang, M., Liao, H., Shen, W. and Lev, B. (2019), "The state-of-the-art survey on integrations and applications of the best worst method in decision making: Why, what, what for and what's next?", *Omega*, Vol. 87, pp. 205–225, doi: 10.1016/j.omega.2019.01.009.

Mishra, R., Singh, R.K. and Govindan, K. (2022), "Barriers to the adoption of circular economy practices in Micro, Small and Medium Enterprises: Instrument development, measurement and validation", *Journal of Cleaner Production*, Vol. 351, p. 131389, doi: 10.1016/j.jclepro.2022.131389.

Moktadir, Md.A., Ahmadi, H.B., Sultana, R., Zohra, F.-T.-, Liou, J.J.H. and Rezaei, J. (2020), "Circular economy practices in the leather industry: A practical step towards sustainable development", *Journal of Cleaner Production*, Vol. 251, p. 119737, doi: 10.1016/j.jclepro.2019.119737.

Moktadir, Md.A., Paul, S.K., Kumar, A., Luthra, S., Ali, S.M. and Sultana, R. (2023), "Strategic drivers to overcome the impacts of the COVID-19 pandemic: implications for ensuring resilience in supply chains", *Operations Management Research*, Vol. 16 No. 1, pp. 466–488, doi: 10.1007/s12063-022-00301-8.

Mondal, S., Singh, S. and Gupta, H. (2023), "Assessing enablers of green entrepreneurship in circular economy: An integrated approach", *Journal of Cleaner Production*, Vol. 388, p. 135999, doi: 10.1016/j.jclepro.2023.135999.

Muneeb, F.M., Yazdi, A.K., Wanke, P., Yiyin, C. and Chughtai, M. (2020), "Critical success factors for sustainable entrepreneurship in Pakistani Telecommunications industry: a hybrid grey systems theory/best-worst method approach", *Management Decision*, Vol. 58 No. 11, pp. 2565–2591, doi: 10.1108/MD-08-2019-1133.

Murry, J.W. and Hammons, J.O. (1995), "Delphi: A versatile methodology for conducting qualitative research", *The Review of Higher Education*, Vol. 18 No. 4, pp. 423–436, doi: 10.1353/rhe.1995.0008.

Okoli, C. and Pawlowski, S.D. (2004), "The Delphi method as a research tool: an example, design considerations and applications", *Information & Management*, Vol. 42 No. 1, pp. 15–29, doi: 10.1016/j.im.2003.11.002.

PIB. (2023), "First Environment and Climate Sustainability Working Group (ECSWG) meeting concludes in Bengaluru with all G20 countries showing commitment to constructively work towards the objective of the three priority areas", *Press Investigation Bureau*, 11 February, available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=1898304 (accessed 13 February 2023).

Pla-Julián, I. and Guevara, S. (2018), "Is circular economy the key to transitioning towards sustainable development? Challenges from the perspective of care ethics", *Futures*, Vol. 105, pp. 67–77, doi: 10.1016/j.futures.2018.09.001.

Reim, W., Sjödin, D. and Parida, V. (2021), "Circular business model implementation: a capability development case study from the manufacturing industry", *Business Strategy and the Environment*, Vol. 30 No. 6, pp. 2745–2757, doi: 10.1002/bse.2891.

Rezaei, J. (2015), "Best-worst multi-criteria decision-making method", *Omega (United Kingdom)*, Elsevier, Vol. 53, pp. 49–57, doi: 10.1016/j.omega.2014.11.009.

Rezaei, J. (2016), "Best-worst multi-criteria decision-making method: Some properties and a linear model", *Omega*, Vol. 64, pp. 126–130, doi: 10.1016/j.omega.2015.12.001.

Rizos, V., Behrens, A., Kafyeke, T., Hirschnitz-Garbers, M. and Ioannou, A. (2016), "The circular economy: barriers and opportunities for SMEs", *CEPS Working Documents*.

Sharma, N.K., Govindan, K., Lai, K.K., Chen, W.K. and Kumar, V. (2021), "The transition from linear economy to circular economy for sustainability among SMEs: A study on prospects, impediments, and prerequisites", *Business Strategy and the Environment*, Vol. 30 No. 4, pp. 1803–1822, doi: 10.1002/bse.2717.

Singh, M.P., Chakraborty, A. and Roy, M. (2018), "Developing an extended theory of planned behavior model to explore circular economy readiness in manufacturing MSMEs, India", *Resources, Conservation and Recycling*, Vol. 135, pp. 313–322, doi: 10.1016/j.resconrec.2017.07.015.

Suchek, N., Ferreira, J.J. and Fernandes, P.O. (2022), "A review of entrepreneurship and circular economy research: state of the art and future directions", *Business Strategy and the Environment*, Vol. 31 No. 5, pp. 2256–2283, doi: 10.1002/bse.3020.

Takacs, F., Brunner, D. and Frankenberger, K. (2022), "Barriers to a circular economy in small- and medium-sized enterprises and their integration in a sustainable strategic management framework", *Journal of Cleaner Production*, Vol. 362, p. 132227, doi: 10.1016/j.jclepro.2022.132227.

Tarei, P.K., Chand, P. and Gupta, H. (2021), "Barriers to the adoption of electric vehicles: Evidence from India", *Journal of Cleaner Production*, Vol. 291, p. 125847, doi: 10.1016/j.jclepro.2021.125847.

Tornatzky, L., Fleischer, M. and Chakrabarti, A.K. (1990), *The Process of Technology Innovation*, Lexington Books.

Toxopeus, H., Achterberg, E. and Polzin, F. (2021), "How can firms access bank finance for circular business model innovation?", *Business Strategy and the Environment*, Vol. 30 No. 6, pp. 2773–2795, doi: 10.1002/bse.2893.

Tunn, V.S.C., Van den Hende, E.A., Bocken, N.M.P. and Schoormans, J.P.L. (2021), "Consumer adoption of access-based product-service systems: the influence of duration of use and type of product", *Business Strategy and the Environment*, Vol. 30 No. 6, pp. 2796–2813, doi: 10.1002/bse.2894.

Tura, N., Hanski, J., Ahola, T., Ståhle, M., Piiparinen, S. and Valkokari, P. (2019), "Unlocking circular business: A framework of barriers and drivers", *Journal of Cleaner Production*, Vol. 212, pp. 90–98, doi: 10.1016/j.jclepro.2018.11.202.

Ünal, E., Urbinati, A., Chiaroni, D. and Manzini, R. (2019), "Value creation in circular business models: the case of a US small medium enterprise in the building sector", *Resources, Conservation and Recycling*, Vol. 146, pp. 291–307, doi: 10.1016/j.resconrec.2018.12.034.

Vermunt, D.A., Negro, S.O., Verweij, P.A., Kuppens, D.V. and Hekkert, M.P. (2019), "Exploring barriers to implementing different circular business models", *Journal of Cleaner Production*, Vol. 222, pp. 891–902, doi: 10.1016/j.jclepro.2019.03.052.

World Economic Forum. (2023), *Circular Transformation of Industries: Unlocking New Value in a Resource Constrained World*, Geneva.

Yusof, M.Mohd., Papazafeiropoulou, A., Paul, R.J. and Stergioulas, L.K. (2008), "Investigating evaluation frameworks for health information systems", *International Journal of Medical Informatics*, Vol. 77 No. 6, pp. 377–385, doi: 10.1016/j.ijmedinf.2007.08.004.

803 Zamfir, A.-M., Mocanu, C. and Grigorescu, A. (2017), "Circular economy and decision models among
804 European SMEs", *Sustainability*, Vol. 9 No. 9, p. 1507, doi: 10.3390/su9091507.

805 Zucchella, A. and Urban, S. (2019), *Circular Entrepreneurship: Creating Responsible Enterprise*,
806 Springer International Publishing, Cham, doi: 10.1007/978-3-030-18999-0.

807