The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/1463-5771.htm

Analyzing the indicators of green entrepreneurship for the sustainable circular economy: a mixed-method approach

Benchmarking: An International Journal

Sourav Mondal
Department of Management Studies, Indian School of Mines, Dhanbad, India, and
Saumya Singh and Himanshu Gupta
Department of Management Studies, IIT (ISM), Dhanbad, India

Received 27 April 2024
Revised 15 October 2024
Accepted 12 May 2025

Abstract

Purpose – This study aims to identify and conduct an in-depth analysis of barriers and drivers influencing "Green Entrepreneurship" (GE) and "Circular Economy" (CE) in relation to "sustainable development" (SD) using a systematic review and comprehensive analysis (through case studies, prioritizing and making contextual relationships).

Design/methodology/approach – To fulfill research objectives, "Stakeholder Theory" (ST), "Circular Economy Theory" (CET) and "Dynamic Resource-Based View" (DRBV) theories have been used as theoretical frameworks. In addition to this, the "Fuzzy Analytic Hierarchy Process" (F-AHP) was used to prioritize drivers and barriers and "Interpretive Structural Modelling" (ISM) was used to study interrelationships. Further, "Matrice D'impacts Croisés Multiplication Appliquée á Un Classment" (MICMAC) is used to cluster drivers and barriers based on the "driving power" and "dependence power."

Findings – The study's findings reveal that supply chain and logistics-related barriers, including inefficient transportation networks and fragmented value chains, are identified as the foremost challenges hindering the growth of GE and the development of a CE. Conversely, regulatory and norms-related drivers, collaboration and networking and sustainable ecosystem management-related drivers are highlighted as pivotal factors fostering GE and CE for sustainable development.

Practical implications – The study provides valuable insights for policymakers, entrepreneurs and researchers, offering actionable recommendations to accelerate the implementation of sustainable practices in the corporate world. These recommendations contribute to the global pursuit of a greener and more resilient economy, paving the way for a sustainable and inclusive future.

Originality/value – This study identifies, analyzes and provides a framework for the major barriers and enablers to implementing GE for CE in SMEs. It might be useful for businesses that want to turn their production systems to achieve sustainability.

Keywords Green entrepreneurship, Circular economy, Sustainable development, Content analysis, F-AHP, ISM-MICMAC

Paper type Research paper

1. Introduction

In recent years, our planet has faced a dynamic duo of challenges: a booming global population and the lightning-speed growth of industry. As a result, we find ourselves confronted with a host of pressing issues, such as dwindling natural resources, the looming specter of waste, the ominous shadow of climate change, and the relentless march of global warming (Sabale *et al.*, 2023). Amid raising these concerns and recognizing the urgency of addressing these pressing environmental challenges while also fostering economic prosperity, governments have formulated and implemented policies to encourage businesses to adopt innovative and environmentally conscious practices (Luu, 2022; Mondal *et al.*, 2023). These policies encompass a range of initiatives, from incentivizing sustainable production methods and resource efficiency to regulating emissions and waste management. The emergence of several novel concepts, including green entrepreneurship, is aimed at promoting holistic development that prioritizes the well-being of both people and the planet in alignment with the SDGs and the pursuit of prosperity (Zarbakhshnia *et al.*, 2023). The urgency to address pressing

Benchmarking: An International Journal

e-ISSN: 1758-4094
p-ISSN: 1463-5771
DOI 10.1108/BIJ-04-2024-0356

environmental challenges, coupled with the growing need for economic prosperity, has underscored the significance of fostering innovative and environmentally conscious practices within businesses (Marrucci *et al.*, 2022). Green entrepreneurship (GE), a derivative of "green" and "entrepreneurship," refers to the proactive pursuit of environmentally friendly and socially responsible business ventures (Mondal *et al.*, 2023; Mukonza, 2020). In their role as agents of change, entrepreneurs are increasingly recognized for their potential to drive innovation and contribute to CE and SD. The concept of GE refers to creating, managing, and growing businesses that prioritize environmental sustainability and social responsibility alongside financial success (Zarbakhshnia *et al.*, 2023; Zhao *et al.*, 2020). As the world faces unprecedented ecological crises, GE offers a promising avenue to drive transformative change within the business community (Antolin-Lopez *et al.*, 2019; Feng *et al.*, 2022). Therefore, governments and societies increasingly recognize the urgency of tackling climate change and promoting sustainable development, and the role of green entrepreneurs in fostering a more sustainable economy becomes ever more crucial (Zarbakhshnia *et al.*, 2023). Concurrently, the CE paradigm has emerged as a promising alternative to traditional linear economic models (Govindan and Hasanagic, 2018). The CE framework aligns with SD objectives and presents an opportunity for businesses to transition towards more sustainable production and consumption patterns (Agrawal *et al.*, 2021; Moktadir *et al.*, 2020a; Dey *et al.*, 2022). In pursuit of a sustainable future, the intersection of GE and CE in the business landscape has emerged as a focal point for researchers, policymakers, and businesses alike.

The concept of the Sustainable Circular Economy (SCE) refers to an economic model that prioritizes the continuous use of resources through recycling, reusing, and reducing waste, thereby minimizing environmental impact and fostering sustainability (Govindan and Hasanagic, 2018; Skare *et al.*, 2024). Unlike traditional linear economies, which follow a "take-make-dispose" approach, the SCE aims to create closed-loop systems where materials and products are maintained at their highest value for as long as possible (Razzaq *et al.*, 2021). Moreover, SD, as enshrined in the "United Nations' Sustainable Development Goals" (UNSDGs), addresses pressing global challenges, including poverty, inequality, climate change, and environmental degradation (Naderi *et al.*, 2022). Based on a World Bank report, there has been a concerning trend of increasing pollution and waste generation in recent years. A study by Razzaq *et al.* (2021) found that between 2015 and 2019, there was a staggering 243 million metric tonnes (Mt) of waste generation. Of this total, 45% of the waste came from developed countries, while the remaining 55% originated from developing countries. Consequently, GE plays a pivotal role in advancing SCE by promoting eco-innovations and business models that align economic growth with environmental preservation, thus addressing resource scarcity and reducing ecological footprints (Zhao *et al.*, 2020; Arsawan *et al.*, 2024). Through the development of sustainable products, efficient resource management, and waste reduction strategies, green entrepreneurs contribute to the realization of SCE goals, driving both economic and environmental sustainability (Mondal *et al.*, 2023). These practices reduce waste and material consumption and create employment opportunities (Mondal *et al.*, 2023; Moktadir *et al.*, 2020a).

Despite the growing interest in GE, current literature highlights several barriers hindering its full potential in SMEs. These barriers range from logistical inefficiencies to the lack of supportive regulatory frameworks and fragmented supply chains, particularly within developing economies (Amankwah and Sesen, 2021). Moreover, existing studies (for example, Amankwah and Sesen, 2021; Badhotiya *et al.*, 2022; Behl *et al.*, 2023; Lotfi *et al.*, 2018; Mishra *et al.*, 2022; Priyadarshini *et al.*, 2024; Singh *et al.*, 2020) have predominantly focused on individual aspects of these topics, often lacking a holistic and integrated analysis that would provide an in-depth understanding of their interrelationships. Govindan and Hasanagic (2018) systematically analyze drivers, barriers, and practices for CE using bibliometric and content analysis. The study also shows that this method is crucial to identifying trends, gaps, and potential areas of collaboration. Moreover, while individual research works have explored the impact of GE on SD or the adoption of CE principles by businesses, there is limited research that examines the intersection of these concepts (Nayal *et al.*, 2022; Piila *et al.*, 2022). Razzaq *et al.* (2021) show the importance and interrelationship of waste management and CE for energy efficiency and economic growth. Another study by Antolin-Lopez *et al.* (2019), Behl *et al.* (2023), Chauhan *et al.* (2022), Elf *et al.* (2022), and Zarbakhshnia *et al.* (2023) shows the importance of CE in several scenarios. In addition, several studies (Feng *et al.*, 2022; Karimi and NabaviChashmi, 2019; Zhao *et al.*, 2020) show the importance of GE in several aspects. While each of these topics (GE and SCE) in business has received significant attention from scholars and practitioners, a comprehensive synthesis of the existing literature still needs to be developed (Amankwah and Sesen, 2021). Whereas Singh *et al.* (2020), Mishra *et al.* (2022), and Gedam *et al.* (2021) studied barriers, Piila *et al.* (2022) drivers and challenges, and Moktadir *et al.* (2020a) critical success factors of CE, From the above discussion, it is clear that the existing literature primarily focusses on individual aspects of GE and SCE, often lacking a holistic and integrated analysis. Past research has predominantly focused on green practices rather than on green entrepreneurship as a distinct field, resulting in a fragmented understanding of the specific factors that drive or inhibit its success. The limited research explicitly addressing GE has further compounded these challenges, with gaps in understanding the critical barriers and enablers that influence its adoption in SMEs (Chauhan *et al.*, 2022; Lotfi *et al.*, 2018). However, research on the intersection of GE and SCE remains fragmented, with limited studies offering a comprehensive analysis of the key drivers and barriers shaping this relationship, particularly in the context of SMEs (Mondal *et al.*, 2023; Lotfi *et al.*, 2018). There is a gap in synthesizing these concepts to provide a comprehensive understanding of their interrelationships and the intersection of these concepts. In addition to this, most of the past studies are narrative in nature and lack quantitative assessments of research growth, patterns, and trends. A bibliometric analysis is needed to provide a more data-driven perspective on the state of the field. Further, most of the past studies were qualitative in nature; however, the quantitative approach adds a new dimension to the analysis. Additionally, most previous literature reviews (for example, Nirmal *et al.*, 2023; Farrukh *et al.*, 2023; Gbako *et al.*, 2024; Chandra *et al.*, 2024) on this subject are narrative, and there is a lack of bibliometric analyses to quantitatively assess the growth, patterns, and trends in published research. A comprehensive analysis will provide a systematic and objective evaluation of the existing literature, identifying key factors that have shaped the field's development. Therefore, this research aims to bridge the existing gap in the literature by conducting a comprehensive bibliometric and content analysis of scholarly articles and publications related to GE, CE, and SD in business. Thus, the present study seeks to address these research gaps by conducting a comprehensive analysis of the key barriers and drivers influencing GE in relation to SCE. The research focuses on SMEs, given their vital role in global economic growth and their potential for innovation in adopting sustainable practices (Moktadir *et al.*, 2020a; Skare *et al.*, 2024; Priyadarshini *et al.*, 2024). By identifying and prioritizing the most critical factors shaping the success of GE, this study aims to provide actionable insights that will enable policymakers, entrepreneurs, and researchers to foster a more sustainable and inclusive economy. To this end, the research poses the following research questions (RQ):

RQ1. What are the significant key barriers and drivers influencing GE and CE in attaining SD in small and medium enterprises (SMEs)?

RQ2. What are the top key barriers and drivers among those that affect most GE and CE in attaining SD?

RQ3. What is the inter-relationship and a level-wise structural model based on the "driving power" and "dependence power" of the abovementioned identified barriers and drivers?

By addressing these research questions, this study contributes to filling the existing knowledge gap regarding the interplay between green entrepreneurship and the development of sustainable circular economic practices. The study further aims to offer a comprehensive framework for understanding the complex relationships between these concepts, thereby informing future research and guiding the development of policies that support the growth of green entrepreneurship in SMEs.

The rest of the paper is organized as follows: Section 2 discusses the literature review, Section 3 discusses the research methodology and data analysis, Section 4 discusses the results of the data analysis, and Section 5 discusses the results. Section 6 discusses the implications. Lastly, Section 7 outlines the conclusion, limitations, and further recommendations of the study.

2. Literature review and theoretical background

The concepts of GE, CE, and sustainability have garnered significant attention in both academic and practical domains, reflecting the growing recognition of the urgent need to address environmental challenges while fostering economic development. This literature review focuses on synthesizing existing research from a bibliometric perspective, aiming to map the intellectual landscape and identify key trends, seminal works, and emerging themes in these interconnected fields.

2.1 Green entrepreneurship (GE)

GE is a subset of business that strongly emphasizes creating new products and services to solve environmental problems (Lotfi *et al*., 2018). The GE has two items: green, which deals with environmental concerns, and entrepreneurship, which deals with creating new products and services to solve problems. Additionally, green entrepreneurs are driven by a combination of societal, economic, and institutional factors. Growing awareness of environmental degradation and resource depletion motivates individuals to seek sustainable alternatives (Lotfi *et al*., 2018). Supportive policies, like incentives for renewable energy adoption and waste reduction targets, create a conducive environment for green businesses (Mondal *et al*., 2023). Numerous studies (e.g. Makhloufi *et al*., 2022; Mondal *et al*., 2023; Shafique *et al*., 2021; Mukonza, 2020) have delved into various aspects of this field, shedding light on the enablers of GE. The study also highlighted the significant role of environmental awareness in shaping green entrepreneurial intentions and explored the connection between green innovation and entrepreneurial orientation. Several factors, like increasing consumer demand for eco-friendly products, drive innovation in sustainable offerings. Access to financial resources, such as venture capital and impact investment, plays a pivotal role in nurturing and scaling green entrepreneurial ventures (Luu, 2022). Innovations in green technologies, like renewable energy solutions and efficient waste management systems, provide opportunities for environmentally friendly solutions as well as CE development (Mondal *et al*., 2023; Mukonza, 2020). Moreover, GE aligns economic prosperity with environmental stewardship and societal development, fostering a sustainable future. It also catalyzes innovation, expands market reach, enhances profitability, and boosts brand reputation. Moreover, it generates employment, addresses social and environmental challenges, raises awareness, conserves resources, mitigates climate change, and promotes biodiversity conservation (Lotfi *et al*., 2018).

2.2 Circular economy (CE)

The CE paradigm is centered on resource efficiency and waste reduction through the promotion of material reuse, recycling, and regeneration (Bocken *et al*., 2019; Dey *et al*., 2022). It offers a departure from the linear “take-make-dispose” model, striving to create a regenerative system where resources are used efficiently and regenerated at the end of their lifecycle (Gupta and Singh, 2021). This approach decouples economic growth from resource depletion, addressing environmental challenges while fostering sustainability (Geissdoerfer *et al.*, 2017, 2022; Mishra *et al.*, 2022). Circular business models, policy frameworks, and digital technologies have expanded the discourse (Bocken *et al.*, 2019; Gupta and Singh, 2021; Khan *et al.*, 2022a, b; Mondal *et al.*, 2023). Reshaping traditional production and consumption models offers a promising path toward sustainability. Its evaluation involves assessing its integration into industries, its impact on resource consumption, and environmental benefits like reduced carbon emissions (Bocken *et al.*, 2019). It also considers social implications, such as job creation in the recycling sector. Several factors drive its adoption, including resource scarcity, environmental awareness, policies, technology, consumer preferences, and product design strategies (Bocken *et al.*, 2019; Kazancoglu *et al.*, 2021b; Priyadarshini *et al.*, 2024). Transitioning to a CE requires collaboration between industry, society, business, and management to minimize waste, conserve resources, and promote sustainable growth (Geissdoerfer *et al.*, 2017). In the realm of CE literature, key themes emerge, such as resource efficiency, closed-loop systems, product design for longevity, innovative business models, stakeholder collaboration, policy frameworks, consumer awareness, technological advancements, financial mechanisms, education, life cycle assessment, and cultural shifts (Bocken *et al.*, 2019; Geissdoerfer *et al.*, 2017; Mishra *et al.*, 2022). In addition to this, the CE, as a regenerative economic paradigm, holds the potential to address pressing environmental challenges while generating societal and economic benefits (Govindan and Hasanagic, 2018; Moktadir *et al.*, 2020a; Singh *et al.*, 2020).

2.3 Sustainable development (SD)

Sustainability, a broad concept, encapsulates the pursuit of economic, social, and environmental equilibrium for current and future generations (Lotfi *et al.*, 2018). SD is a multifaceted concept and business process to preserve finite resources, meet human needs, safeguard ecosystems, and promote economic and environmental harmony for future generations (Bonfanti *et al.*, 2023; Schaltegger *et al.*, 2012). This concept provides a holistic framework that guides global efforts toward economic prosperity, social equity, and environmental stewardship, ultimately working to address pressing global challenges in a coordinated and comprehensive manner. Therefore, it aligns with the UNSDGs, as both are the same concept that considers “people,” “planet,” and “profit” (or the 3P bottom line) (Gatti *et al.*, 2019). The SDGs, adopted in 2015 as part of the 2030 Agenda for Sustainable Development, provide a comprehensive framework addressing global challenges such as poverty, health, gender equality, and climate action (de Oliveira and Oliveira, 2023). They emphasize the interdependence of development aspects, encourage global cooperation, and set ambitious targets to be achieved by 2030. Through specific targets and indicators. With this, several global factors are enabling the development of sustainability activities, like the “United Nations Development Programme” (UNDP), the global level (G20), and the Paris Agreement aims (UNFCCC). This helps limit global warming, enable monitoring, promote accountability, and build resilience against global challenges like climate change. Various organizations play pivotal roles in promoting SD. The United Nations facilitates global dialogue and supports countries in SDG implementation. Transitioning to a CE and adopting green practices is crucial for all countries (de Oliveira and Oliveira, 2023; Dey *et al.*, 2022). Developing countries can utilize resources efficiently and create jobs (Bocken *et al.*, 2019). Several sustainability practices (GE) driven by government norms, policies, awareness, funding, and businesses drive these transitions.

2.4 Theoretical framework

A well-defined theoretical framework serves as a compass, guiding the exploration of GE and SCE by systematically dissecting barriers, drivers, enablers, and critical success factors. It illuminates the intricate relationships and interdependencies within these domains, enhancing our understanding of how they interact and impact one another. Ultimately, this framework empowers stakeholders to make informed decisions, foster innovation, and catalyze transformative change toward a more environmentally conscious and economically resilient future.

2.4.1 Stakeholder theory (ST). ST posits that businesses should consider the interests and concerns of all parties affected by their operations, not just shareholders, in their decision-making processes. Jabbour *et al.* (2020) argue that the theory helps in understanding the role of a diverse set of stakeholders in business and the development of sustainability activities. The study also highlights that the theory also helps provide a theoretical lens to understand contemporary sustainability concepts, i.e. CE. A study by Hina *et al.* (2023) and Le (2022) also highlights different stakeholders' contributions and roles in identifying opportunities for eco-friendly product innovation and sustainable resource management, thereby reducing environmental impacts and enhancing competitiveness. Moreover, Elkington's "Triple Bottom Line" concept (1997) emphasizes the importance of considering environmental and social factors alongside financial performance, aligning with stakeholder theory's principles (Hubbard, 2009).

2.4.2 Circular economy theory (CET). The CET advocates for an economic model that minimizes waste and promotes sustainability through resource longevity and regeneration. It departs from the linear "take-make-dispose" approach and prioritizes recycling, reusing, and remanufacturing strategies to maintain resource value (Xu *et al.*, 2022). This theory supports developing a framework for entrepreneurs to create businesses aligned with environmental stewardship, designing products and services that reduce resource consumption and waste (Stumpf *et al.*, 2021). Further, this theory guides businesses towards sustainable production by encouraging material reuse and recycling, reducing environmental impact. In addition, this theory also aligns with SD principles, balancing economic growth, social well-being, and environmental conservation (Stumpf *et al.*, 2021; Xu *et al.*, 2022).

2.4.3 Dynamic resource-based view theory (DRBV). This theory is an extension of the traditional resource-based view theory in strategic management (Helfat and Peteraf, 2003). The RBV framework focuses on how a firm's unique resources and capabilities can lead to sustained competitive advantage. DRBV theory builds upon this foundation but emphasizes the dynamic nature of resources and capabilities (Huang *et al.*, 2023). It recognizes that in a rapidly changing business environment, what may be a source of competitive advantage today may not be sustainable in the long term. Therefore, it focuses on a firm's ability to adapt, evolve, and renew its strategies, resources, and capabilities with sustainability goals to gain a competitive edge in green markets and contribute to long-term environmental and economic sustainability (Helfat and Peteraf, 2003; Huang *et al.*, 2023).

Therefore, this theoretical framework is used to identify barriers and drivers, and it also considers organizational adaptability, innovation, and SD, which align with multiple SDGs and drive sustainable growth and environmental stewardship.

2.5 Previous literature review

In the face of escalating environmental challenges and an increasing demand for sustainable economic growth, businesses recognize the need to shift towards greener practices. This shift is largely driven by the integration of GE and the SCE, which promise to deliver innovative business models that address both ecological concerns and sustainable development (Bilal *et al.*, 2020; Böhmecke-Schwafert *et al.*, 2022; Elf *et al.*, 2022; Karimi and NabaviChashmi, 2019; Skare *et al.*, 2024). Despite the rise in academic and practical interest in GE and SCE, there is still a significant gap in understanding how these concepts can be systematically implemented within industries, particularly in relation to SMEs. Existing literature on these areas (for example, Mukonza, 2020; Mishra *et al.*, 2022; Singh *et al.*, 2020) often focuses on theoretical discussions or isolated case studies without offering a holistic view of the key drivers, barriers, and critical success factors necessary for successful integration. A systematic review conducted by García-Quevedo *et al*. (2020) and Priyadarshini *et al*. (2024) highlights that although many businesses are keen to adopt CE initiatives, the practical hurdles, such as fragmented supply chains, regulatory constraints, and logistical challenges, are rarely addressed in the literature. Similarly, Govindan and Hasanagic (2018) point out that while bibliometric and content analyses on CE have been undertaken, these studies often fail to provide actionable insights into overcoming these barriers in real-world applications. In contrast, Kumar *et al*. (2023) emphasize the need for empirical studies that can provide a clearer understanding of the contextual factors shaping the adoption of CE, particularly in developing countries and SMEs. However, much of the research remains confined to larger enterprises or macro-level policy discussions, neglecting the nuanced challenges that smaller businesses face when integrating sustainable practices. The literature also reveals a fragmentation in the analysis of GE and CE, with many studies examining these concepts in isolation (Amankwah and Sesen, 2021; Behl *et al*., 2023). For instance, while CE frameworks often emphasize the importance of waste reduction and resource efficiency, they seldom consider the entrepreneurial initiatives required to implement these practices within diverse supply chains (Marrucci *et al*., 2022; Singh *et al*., 2020; Dey *et al*., 2022). Similarly, studies on GE tend to focus on the potential for innovation without considering the broader economic and logistical ecosystem needed to support such ventures (Mondal *et al*., 2023). This compartmentalized approach results in a lack of cohesion, which prevents businesses from understanding the key barriers and drivers influencing the implementation of sustainable practices. Furthermore, despite acknowledging GE and CE as critical factors for achieving UN-SDGs, the existing body of research does not adequately address their intersection from an operational perspective (Nayal *et al*., 2022). A critical gap in the literature is the lack of quantitative analysis and prioritization of these drivers and barriers using multi-criteria decision-making methods. Studies such as those by Moktadir *et al*. (2020a) and Zarbakhshnia *et al*. (2023) underscore the importance of structured decision-making tools like the F-AHP and ISM to systematically identify and categorize these factors. However, few studies have employed such methodologies to explore the interrelationship between GE and CE within SMEs, thus missing an opportunity to provide a data-driven foundation for policy recommendations and practical business strategies. This research addresses these gaps by offering a comprehensive and integrated analysis of GE and CE within the SME context. By incorporating F-AHP and ISM methods, this study will prioritize and establish contextual relationships among the drivers and barriers identified, providing valuable insights for both academic inquiry and practical application. Additionally, it will contribute to the growing body of literature by using MICMAC analysis to categorize these factors based on their “driving power” and “dependence,” thus laying the groundwork for more targeted interventions to foster sustainable entrepreneurship and circularity in business practices. The focus on SMEs, often overlooked in existing research, provides a unique and necessary lens through which to view the intersection of GE and SCE, with global implications for sustainable economic development. Hence, previous studies have contributed valuable insights into either GE or CE, but they have predominantly lacked an integrated analysis that could reveal the critical interdependencies between these concepts. This research seeks to fill that void by focusing on SMEs and utilizing advanced quantitative techniques to provide a nuanced understanding of the drivers, barriers, and success factors that will enable businesses to successfully transition toward a more sustainable circular economy.

3. Research methods

A hybrid four-phase methodology was used to accomplish the research objectives, starting with a carefully structured research design and sampling design, then data collection and analysis. A comprehensive literature review and content analysis were conducted in the initial phase. This phase also involved establishing a theoretical framework and expert opinions from SMEs to finalize the identified barriers and drivers. Moving to the next phase, the “multi-criteria decision-making" (MCDM) approach, i.e. F-AHP, was applied to sift through critical barriers and drivers extracted from existing literature. This approach helped prioritize these factors based on their relative importance. In the third phase, ISM was used to establish interrelationships and construct a multi-tiered framework for the critical barriers and drivers. Finally, in the last phase, the MICMAC analysis was employed to cluster barriers and drivers, considering their "driving power" and "dependence." This step helped understand the dynamic interaction between different factors and their overall impact on the system. The complete step-by-step research methodology is illustrated in Figure 1.

3.1 Data collection

The initial phase of a systematic review and content analysis involves identifying relevant research domains and keywords to be included, as well as excluding studies that do not meet

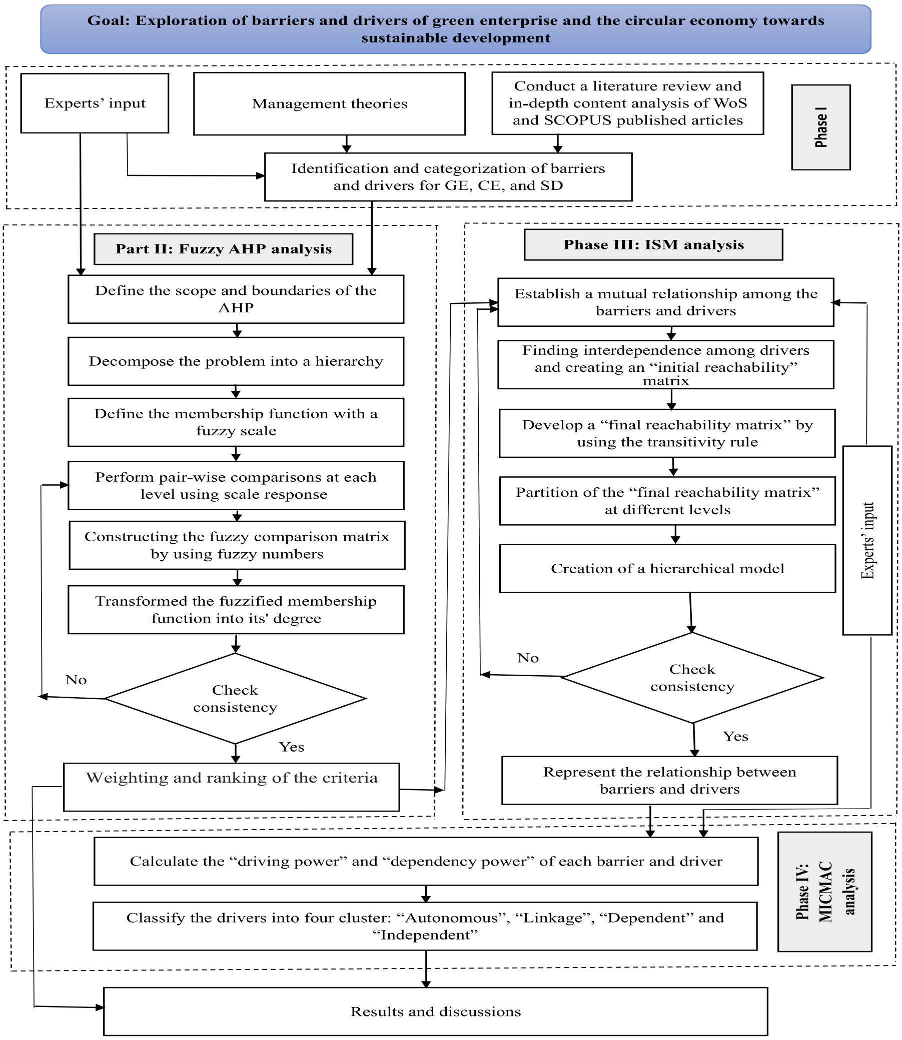

Figure 1. Steps of research methodology. Authors' compilation

the criteria. The evaluation should begin by clearly delineating the specific domains that will be examined. The review provided pre-determined criteria for the selection of papers to be included. Furthermore, for prioritization and establishing interrelationships, data were collected from the experts from different SMEs.

3.2 Data analysis

The study used a transparent methodology, ensuring the integrity of the data by carefully selecting a particular database and restricting the analysis to specified years. The criteria for this study are as follows: To identify articles and associated bibliometric and bibliographic data for content analysis, the expert opinion and theoretical framework were also used to fix the search keywords. The goal was to amalgamate the concepts of "green entrepreneurship" and "circular economy," as they are two critical sustainability factors for which there are no existing studies. To ensure a thorough search, the search string should consist of TITLE-ABS-KEY, including combinations such as ("Green entrepre*" AND "Sustainab*") OR ("Green entepren*" AND "Circular economy") OR ("Circular economy" AND "Sustainab*") OR ("Green entrepre*" AND "Circular economy" AND "Sustainab*"). This search yielded 13,387 documents from SCOPUS and 11,510 from the Web of Science (WoS) database. The search was restricted to articles published in English journals between 2007 and July 2023. This review comprises only research articles, excluding newspaper reports, research reports, conferences, books, etc. Based on the research objectives and scope, 93 articles were selected for further content analysis (see Figure 2). The data were obtained from SCOPUS and WoS,

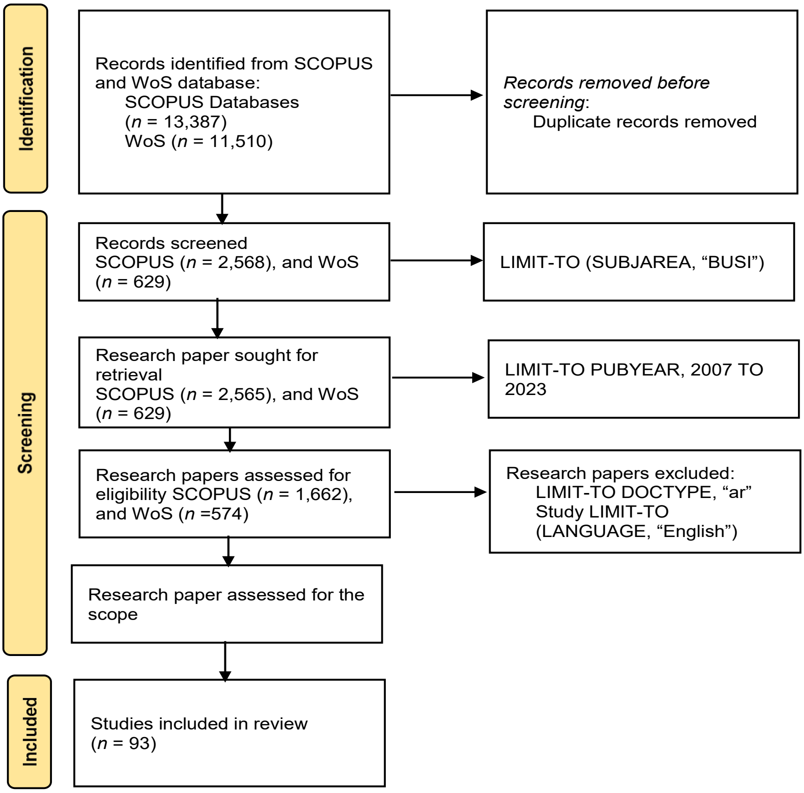

Figure 2. Search string and search results and inclusion and exclusion criteria. Source: Created by authors

reputable scientific databases for peer-reviewed research publications (Govindan and Hasanagic, 2018; Kumar *et al.*, 2023). The inclusion and exclusion criteria used for shortlisting the relevant articles are shown in Figure 2.

After this stage, 574 papers were collected, and all the articles were assessed to confirm that the research articles considered only the key terms and aligned with the research objectives. Any research paper that does not deal with the research domain or has less topic coverage is not considered. In addition, to perform an advanced search, several additional keywords have been used, i.e. “barriers,” “drivers,” “enablers,” “critical success factor,” and “influential factor.” Nevertheless, articles in which the subject emerged as a notable underlying theme were incorporated. Following this phase, 481 articles were excluded, resulting in a final selection of 93 articles considered for further analysis. The year-over-year publications provide reliable indicators for assessing research trends in that field. Figure 3 depicts a graphical representation of the annual and cumulative number of publications in the domains of GE and SCE. The plot analysis suggested that research on the application of green enterprise in CE and SD has been an emerging field of research since 2007, and this field of research has gained popularity in recent years. This field of study has grown at an exponential rate since 2017. Furthermore, the cumulative publication graph suggests that academics across the globe have started paying attention to the fields of GE, CE, and SD.

3.2.1 Phase I: content analysis. Content analysis is a research method used to identify and document critical factors objectively, ensuring consistency across various situations and periods (Govindan and Hasanagic, 2018). As described by Neuendorf and Skalski (2009), this methodology aims to uncover inherent attributes within communications. This study investigated the barriers and drivers of GE and CE. These were categorized as internal and external factors relevant to different organizational contexts (Tables A2 and A3 (Appendix A)). For effective GE and CE implementation, we recognized the need for alignment at both internal and external operational levels. Internally, businesses should integrate GE and CE practices into their production strategies. Externally, collaboration between industries and industrial parks is crucial for environmentally friendly production practices. Our primary objective was to create a coherent conceptual framework that transparently illustrates the interconnectedness of drivers, barriers, and practices.

To better understand why businesses adopt GE and CE for SD, we looked at some barriers and drivers that encourage this adoption. We analyzed these factors in Tables 1 and 2. Thirteen distinct barriers and drivers were identified and categorized into internal and external dimensions. The internal dimension focuses on actions within the enterprise. In contrast, the

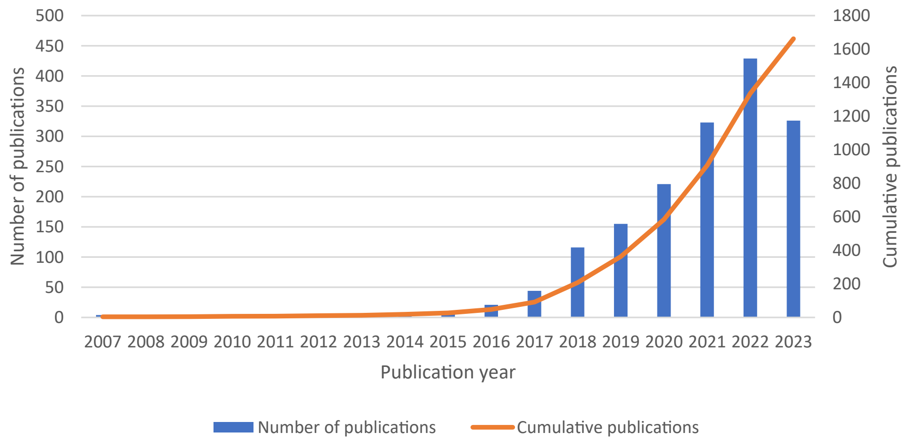

Figure 3. Plot of number of publications and cumulative publications. N.B. Source: SCOPUS database

Table 1. Identifying barriers

Barriers	Aggregate dimensions	Stakeholders	Literatures
Market-related barriers (B1)	External	Organizations/ society	Agrawal *et al.* (2021, 2022), Chhabra and Singh (2022), Geissdoerfer *et al.* (2022), Govindan *et al.* (2022), Govindan and Hasanagic (2018), Karimi and NabaviChashmi (2019), Kumar *et al.* (2023)
Environmental-related barriers (B2)	External/ internal	Organizations/ society	Agrawal *et al.* (2021), Chhabra and Singh (2022), Dwivedi *et al.* (2022a), Geissdoerfer *et al.* (2022), Guo (2022), Hu *et al.* (2023), Jaeger and Upadhyay (2020), Kazancoglu *et al.* (2021a, b)
Financial-related barriers (B3)	External/ internal	Organizations/ society	Agrawal *et al.* (2021), Bhatia *et al.* (2022), Chhabra and Singh (2022), Dwivedi *et al.* (2022a), Geissdoerfer *et al.* (2022), Govindan *et al.* (2022), Govindan and Hasanagic (2018), Jaeger and Upadhyay (2020), Kashav *et al.* (2022), Kazancoglu *et al.* (2021a, b), Kumar *et al.* (2022, 2023), Marrucci *et al.* (2022), Shang *et al.* (2022), Shrivastava and Tamvada (2019), Zarbakhshnia *et al.* (2023)
Technological-related barriers (B4)	Internal	Organizations	Agrawal *et al.* (2021), Bhatia *et al.* (2022), Chhabra and Singh (2022), Geissdoerfer *et al.* (2022), Govindan (2022), Hu *et al.* (2023), Kashav *et al.* (2022), Kazancoglu *et al.* (2021b), Kumar *et al.* (2022, 2023), Shang *et al.* (2022)
Business model and infrastructure-related barriers (B5)	Internal	Organizations	Agrawal *et al.* (2022), Alkaraan *et al.* (2023), Antolin-Lopez *et al.* (2019), Govindan *et al.* (2022), Kashav *et al.* (2022), Kazancoglu *et al.* (2021b), Vimal *et al.* (2023)
Strategy related barriers (B6)	Internal	Organizations	Agrawal *et al.* (2021), Dixon and Clifford (2007), Dwivedi *et al.* (2022a), Govindan *et al.* (2022), Govindan and Hasanagic (2018), Kazancoglu *et al.* (2021a), Kumar *et al.* (2023)
Rule, regulations and policies related barriers (B7)	Internal/ external	Organizations/ government	Chhabra and Singh (2022), Geissdoerfer *et al.* (2022), Govindan *et al.* (2022), Govindan (2022), Kashav *et al.* (2022), Kazancoglu *et al.* (2021b), Kumar *et al.* (2023), Shang *et al.* (2022), Zarbakhshnia *et al.* (2023)
Institutional related barriers (B8)	Internal	Organizational	Bhatia *et al.* (2022), Chhabra and Singh (2022), Dwivedi *et al.* (2022a), Geissdoerfer *et al.* (2022), Govindan *et al.* (2022), Jaeger and Upadhyay (2020), Kashav *et al.* (2022), Kazancoglu *et al.* (2021b), Kumar *et al.* (2023), Shang *et al.* (2022), Tunn *et al.* (2021), Zarbakhshnia *et al.* (2023)

(*continued*)

Table 1. Continued

Barriers	Aggregate dimensions	Stakeholders	Literatures
Social and Cultural related barriers (B9)	External	Society	Agrawal *et al.* (2021), Bhatia *et al.* (2022), Chhabra and Singh (2022), Dwivedi *et al.* (2022a), Erol *et al.* (2023), Geissdoerfer *et al.* (2022), Govindan *et al.* (2022), Govindan (2022), Jaeger and Upadhyay (2020), Kazancoglu *et al.* (2021b), Zarbakhshnia *et al.* (2023)
Supply chain and logistics related barriers (B10)	External	Supplier	Agrawal *et al.* (2021), Geissdoerfer *et al.* (2022), Govindan and Hasanagic (2018), Jaeger and Upadhyay (2020), Kazancoglu *et al.* (2021a, b), Kumar *et al.* (2023)
Knowledge and collaborations related barriers (B11)	Internal/ external	Organizational	Agrawal *et al.* (2021), Dwivedi *et al.* (2022b), Erol *et al.* (2023), Govindan *et al.* (2022), Govindan (2022), Govindan and Hasanagic (2018), Jaeger and Upadhyay (2020), Shang *et al.* (2022), Vimal *et al.* (2023)
Operational and design-related barriers (B12)	Internal	Organizational	Agrawal *et al.* (2021), Chhabra and Singh (2022), Govindan *et al.* (2022), Jaeger and Upadhyay (2020), Kazancoglu *et al.* (2021a), Kumar *et al.* (2023)
Circular economy practices and adoption-related barriers (B13)	Internal/ external	Organizational	Agrawal *et al.* (2021), Chhabra and Singh (2022), Geissdoerfer *et al.* (2022), Govindan and Hasanagic (2018), Kazancoglu *et al.* (2021a), Vimal *et al.* (2023)

Source(s): Authors' own work

external dimension considers factors external to the enterprise that impact the adoption of GE and CE principles in sustainable development. In addition to this, Figure 4 summarizes the plot of these drivers and barriers and demonstrates how the theoretical framework supports them.

3.2.2 Phase II: fuzzy analytic hierarchy process (F-AHP). The F-AHP is an extension of the classical AHP, designed to handle the inherent uncertainty and imprecision in decision-making processes. F-AHP combines the principles of AHP with fuzzy logic, allowing decision-makers to express their judgments in linguistic terms or fuzzy numbers (Saaty, 1980) (see Table A1 (Appendix A)) (triangular fuzzy number (TFN) (Figure A1 (Appendix A)). The steps of the fuzzy AHP have been provided in Appendix A. This identification and prioritization of barriers and drivers, with the help of this method, provides a more realistic representation of complex decision contexts where precise data might be lacking. The F-AHP decision problem has a hierarchical structure with the primary objective at the top, followed by criteria, sub-criteria, and alternatives. Pairwise comparisons are made between elements within each level of the hierarchy. These comparisons involve assigning linguistic terms (e.g. "equal," "slightly more important," "very important") or fuzzy numbers to capture the degree of preference or importance. Aggregation techniques are applied to derive the overall priorities of alternatives and aid in decision-making. This methodology has several advantages, like:

(1) F-AHP addresses uncertain and imprecise information by allowing decision-makers to express their judgments in fuzzy terms. This ability to handle ambiguity differentiates it from traditional methods that assume crisp values.

Table 2. Identifying drivers

Drivers	Aggregate dimensions	Stakeholders	Literatures
Green entrepreneurial orientations-related drivers (D1)	Internal/ external	Organizational	Feng *et al*. (2022), Hina *et al*. (2023), Hu *et al*. (2023), Karimi and NabaviChashmi (2019), Kouhizadeh *et al*. (2023), Luoma *et al*. (2023), Makhloufi *et al*. (2022), Shafique *et al*. (2021), Tze San *et al*. (2022)
Regulatory and norms related drivers (D2)	External	Government	Das *et al*. (2023), Erol *et al*. (2023), Karimi and NabaviChashmi (2019), Khan *et al*. (2020), Mathivathanan *et al*. (2022), Neri *et al*. (2023), Roberts *et al*. (2023), Singh *et al*. (2022), Vecchio *et al*. (2022), Zaidi *et al*. (2019)
Corporate and managerial-related drivers (D3)	Internal	Organizational	Chavez *et al*. (2023), Dwivedi *et al*. (2023), Erol *et al*. (2023), Feng *et al*. (2022), Ghadimi *et al*. (2021), Gupta and Singh (2021), Karimi and NabaviChashmi (2019), Kayikci *et al*. (2022a), Khan *et al*. (2020), Luthra *et al*. (2022), Mathivathanan *et al*. (2022), Obeidat *et al*. (2023), Walker *et al*. (2023)
Market monitoring related drivers (D4)	External	Society	Das *et al*. (2023), Dwivedi *et al*. (2023), Elf *et al*. (2022), Feng *et al*. (2022), Haleem *et al*. (2021), Karimi and NabaviChashmi (2019), Kouhizadeh *et al*. (2023), Kristoffersen *et al*. (2021), Luthra *et al*. (2022), Mathivathanan *et al*. (2022), Mazzucchelli *et al*. (2022), Mostaghel and Chirumalla (2021), Nayal *et al*. (2022), Pansare and Yadav (2022), Stumpf *et al*. (2023)
Social Responsibility and Ethics (D5)	External	Society	Chauhan *et al*. (2022), Erol *et al*. (2023), Govindan and Hasanagic (2018), Gupta and Singh (2021), Hu *et al*. (2023), Kajtazi *et al*. (2023), Karimi and NabaviChashmi (2019), Kayikci *et al*. (2022a), Kristoffersen *et al*. (2021), Luthra *et al*. (2022), Makhloufi *et al*. (2022), Mathivathanan *et al*. (2022), Naderi *et al*. (2022), Shafique *et al*. (2021), Vecchio *et al*. (2022), Zaidi *et al*. (2019)
Eco-financial synergy-related driver (D6)	Internal/ external	Organizational/ society	Antolin-Lopez *et al*. (2019), Das *et al*. (2023), Haleem *et al*. (2021), Hu *et al*. (2023), Karimi and NabaviChashmi (2019), Khan *et al*. (2022a, b), Mathivathanan *et al*. (2022), Mazzucchelli *et al*. (2022), Piila *et al*. (2022), Puglieri *et al*. (2022), Shrivastava and Tamvada (2019), Tze San *et al*. (2022), Zhao *et al*. (2020)
Collaboration and networking-related driver (D7)	Internal/ external	Organizational	Das *et al*. (2023), Del Giudice *et al*. (2021), Dixon and Clifford (2007), Elf *et al*. (2022), Feng *et al*. (2022), Khan *et al*. (2020), Naderi *et al*. (2022)

(*continued*)

Table 2. Continued

Drivers	Aggregate dimensions	Stakeholders	Literatures
Supply Chain Transparency and Traceability (D8)	Internal/ external	Organizational/ supplier	Behl *et al.* (2023), Böhmecke-Schwafert *et al.* (2022), Del Giudice *et al.* (2021), Dwivedi *et al.* (2022a, 2023), Faisal (2023), Feng *et al.* (2022), Govindan and Hasanagic (2018), Kayikci *et al.* (2022a), Mathivathanan *et al.* (2022), Nayal *et al.* (2022), Stumpf *et al.* (2023)
Digital transformation and technology-related drivers (D9)	Internal	Organizational	Das *et al.* (2023), Del Giudice *et al.* (2021), Dohale *et al.* (2023), Dwivedi *et al.* (2022a, 2023), Erol *et al.* (2023), Faisal (2023), Haleem *et al.* (2021), Hu *et al.* (2023), Kamble *et al.* (2021), Khan *et al.* (2022a, b), Kristoffersen *et al.* (2021), Luthra *et al.* (2022), Marrucci *et al.* (2021), Mathivathanan *et al.* (2022), Nayal *et al.* (2022), Scarpellini *et al.* (2020)
Sustainable ecosystem management-related drivers (D10)	Internal	Organizational	Antolin-Lopez *et al.* (2019), Böhmecke-Schwafert *et al.* (2022), Chavez *et al.* (2023), Hina *et al.* (2023), Kayikci *et al.* (2022a, b), Khan *et al.* (2022a), Klein *et al.* (2022), Kristoffersen *et al.* (2021), Luthra *et al.* (2022), Macchion *et al.* (2023), Mathivathanan *et al.* (2022), Mazzucchelli *et al.* (2022), Moktadir *et al.* (2020a), Münch *et al.* (2022), Puglieri *et al.* (2022), Sharma *et al.* (2019), Tze San *et al.* (2022)
Circular economy integration and optimization-related drivers (D11)	Internal	Organizational	Del Giudice *et al.* (2021), Dohale *et al.* (2023), Dwivedi *et al.* (2022a), Hina *et al.* (2023), Husain *et al.* (2021), Kayikci *et al.* (2022a), Khan *et al.* (2022a, b), Kristoffersen *et al.* (2021), Le *et al.* (2022), Mathivathanan *et al.* (2022), Puglieri *et al.* (2022), Riggs *et al.* (2023), Singh *et al.* (2022)
Sustainability strategy and business ecosystem-related drivers (D12)	Internal	Organizational	Aarikka-Stenroos *et al.* (2022), Behl *et al.* (2023), Del Giudice *et al.* (2021), Elf *et al.* (2022), Erol *et al.* (2023), Gupta and Singh (2021), Hina *et al.* (2023), Kamble *et al.* (2021), Khan *et al.* (2020), Klein *et al.* (2022), Luthra *et al.* (2022), Mathivathanan *et al.* (2022), Obeidat *et al.* (2023), Pinheiro *et al.* (2022), Puntillo (2023)
Sustainable business practices-related drivers (D13)	Internal/ external	Organizational	Aarikka-Stenroos *et al.* (2022), Chavez *et al.* (2023), Chou *et al.* (2023), Dohale *et al.* (2023), Elf *et al.* (2022), Erol *et al.* (2023), Faisal (2023), Hina *et al.* (2023), Hsu (2023), Husain *et al.* (2021), Kayikci *et al.* (2022b), Klein *et al.* (2022), Macchion *et al.* (2023), Mazzucchelli *et al.* (2022), Mukherjee *et al.* (2022), Riggs *et al.* (2023), Walker *et al.* (2023), Zaidi *et al.* (2019)

Source(s): Authors' own work

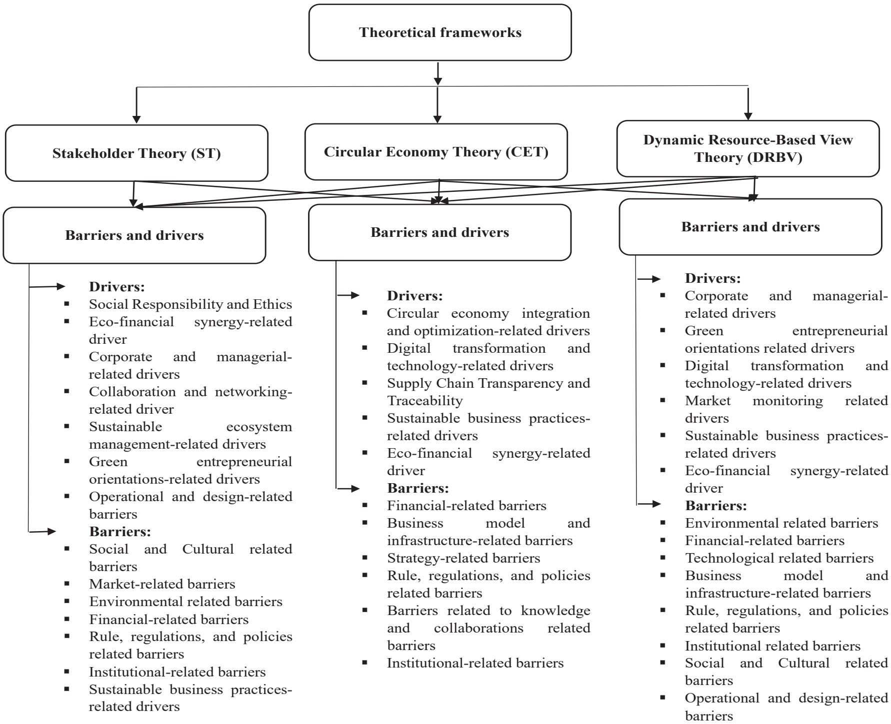

Figure 4. Theoretical framework. Source: Authors' own work

(2) F-AHP accommodates both qualitative and quantitative data, enabling it to handle various types of information, such as expert opinions, subjective assessments, and numerical data. This makes it adaptable to a wide range of decision scenarios.

(3) F-AHP integrates the insights of experts and stakeholders, providing a more holistic and human-centric approach to decision-making. This enhances the accuracy of the decision process.

(4) F-AHP's hierarchical structure is beneficial for addressing complex decision contexts with interdependent criteria and alternatives. It allows decision-makers to break down intricate problems into manageable components.

Therefore, this study employs a fuzzy-based AHP technique to identify CE barriers and drivers. The steps of F-AHP were adopted from Saaty (1980), and the scale was adopted from *et al*. (2007).

3.2.3 Phase III and IV: interpretive structural modeling (ISM) and MICMAC analysis. The application of ISM has proven invaluable in tackling intricate decision-making challenges, particularly involving multiple criteria in complex research objectives. ISM has been embraced by researchers to elucidate diverse scenarios within the automotive domain. Noteworthy applications include deciphering supply chain complexity drivers (Tarei *et al.*, 2021; Kavilal *et al.*, 2018), uncovering barriers to CE adoption (Bilal *et al.*, 2020), investigating hindrances to entrepreneurship (Banha *et al.*, 2017), analyzing the interplay of sustainable manufacturing factors for SMEs (Mondal *et al.*, 2023; Thirupathi and Vinodh, 2016), and devising strategies for enhancing automotive supply chains (Govindan *et al.*, 2013). While other tools like "Decision Making Trial and Evaluation Laboratory" (DEMATEL) and "Fuzzy Cognitive Mapping" (FCM) also consider interrelationships among decision criteria, ISM stands out for its capability to deconstruct intricate systems into multiple subsystems and subsequently construct a "multi-layer structural model" (Bai and Satir, 2020). ISM's effectiveness lies in its ability to establish multi-layered interconnections among drivers and barriers, achieved by determining driving and dependence powers through systematic ISM steps. In the context of GE, CE, and SD, the ISM approach finds a crucial niche. To delve into the interrelationships of identified barriers and drivers, experts who had participated in the F-AHP method were considered for ISM and MICMAC analyses. This involved face-to-face meetings and discussions, with the dynamics of mutual influence and relationships between each barrier and driver captured through affirmative ("Yes") and negative ("No") responses (Banha *et al.*, 2017; Mondal *et al.*, 2023). Furthermore, the ISM methodology helps to develop an interrelationship and conceptual hierarchical model among the barriers and drivers obtained (Tables 1 and 2). This technique becomes even more potent when coupled with the MICMAC analysis. The MICMAC analysis dissects elements into categories like "autonomous," "dependent," "linked," and "driving," unveiling hidden relationships and offering more profound insights into the system's functioning. This is particularly crucial in grasping the nuances of GE, CE dynamics, and SD trajectories.

For the data collection, the panel of experts chosen for this study was carefully curated to represent three critical domains: a) companies engaged in manufacturing with a focus on GE, CE practices, and SD in SMEs; b) academic institutions; and c) government and businesses. The experts were considered based on their extensive expertise spanning over a decade in the subject matter. Out of the 27 experts initially approached, 11 of them (refer to Table 3 for experts' profiles) ultimately agreed to participate (hence the response rate of 41%). Each participant was provided with a comprehensive overview of the research's context and motivating factors. The focal point of this study is an academic institution in India. To effectively achieve the study's objectives, a group of eleven experts from diverse academic institutions was assembled. This cohort of experts has a diverse range of profiles, encompassing varying levels of experience and affiliations with different organizations. The selection process purposefully ensured the inclusion of a spectrum of expertise to enhance the generalizability of findings to businesses across various industrial facets. Notably, the expert team consists of eleven senior managers and professors from distinguished institutions,

Table 3. Experts background and details

Expert	Expertise	Year of experience	Education	Industry/ academics	Type of organization
Expert 1	Entrepreneur	7	Btech	Industry	Textile Industry
Expert 2	Entrepreneur	4	Btech	Industry	Manufacturing Industry
Expert 3	Technical managers	15	Btech	Industry	Electronics good Manufacturing Industry
Expert 4	Operation managers	14	MTech	Industry	Steel processing industry
Expert 5	Senior manager	17	MBA	Industry	Auto part manufacturing
Expert 6	CEO	10	PHD	Industry	Manufacturing Industry
Expert 7	Senior manager	15	MBA	Industry	Logistics and Transportation
Expert 8	Professors	17	PHD	Academia	–
Expert 9	Professors	20	PHD	Academia	–
Expert 10	Professors	13	PHD	Academia	–
Expert 11	Associate Professors	7	PHD	Academia	–

Source(s): Authors' own work

each possessing substantial consulting experience in the realm (Table 3). This collective's profound knowledge and expertise lay a strong foundation for the study's data collection phase. For the data collection process, the Delphi technique was employed, drawing insights from experts with backgrounds encompassing GE, CE strategies, and SD perspectives. This expert cohort comprises four professors, three individuals holding vice president and CEO roles, and four community entrepreneurs who boast extensive experience in their respective domains. The Delphi Method, renowned for its systematic approach to soliciting expert viewpoints and achieving consensus on intricate topics and future projections, was applied here. The Delphi methodology involves expert selection, question formulation, and iterative feedback loops. By involving a diverse panel of experts, the Delphi approach effectively neutralizes biases and prevailing perspectives, facilitating the exploration of many viewpoints (Gupta *et al.*, 2020; Mondal *et al.*, 2023). Moreover, it identifies points of alignment and divergence among experts. The Delphi method leverages collective intelligence, expediting decision-making, enhancing forecasting accuracy, making well-informed predictions, and fostering effective problem-solving.

4. Result

To fulfill the research objective, the four-phase methodology is used in the initial phase of the content analysis, literature review, and case study to identify barriers and drivers of GE and CE toward SD. As discussed, earlier data collected for this study showed different levels of expertise (see Table 3). This section operationalized the evaluation methodology for firm CE at a case firm. Based on expert opinion, barriers and drivers were finalized. After gathering data from experts across various manufacturing organizations, an integrated methodology was applied. F-AHP analysis was used to prioritize the drivers, followed by ISM to establish interrelationships among them. This approach was selected because it facilitates the evaluation of key drivers and barriers, contributing to more informed and effective decision-making processes. The details of the results are discussed below:

4.1 Result of fuzzy AHP (F-AHP)

Fuzzy AHP methodologies were used to rank barriers and drivers. The "fuzzy linguistic scale" consisted of linguistic expressions (Wang *et al*., 2007) that were used to evaluate the barriers and drivers of GE and CE (Tables A4 and A5). To establish the final pairwise assessment matrices, the researchers considered the majority opinion of the experts. Subsequently, all the pairwise assessment matrices, which represented the linguistic judgments of the experts, were converted into positive fuzzy number matrices using the standard "Triangular Fuzzy Numbers" (TFNs). Chang's Extent Analysis method was utilized to determine preference weights for both barriers and drivers (Table 4).

4.2 ISM result

4.2.1 Structural self-interaction matrix (SSIM). In the development of SSIM, the interplay between chosen barriers and drivers, denoted as i and j, is represented using the symbols "V," "A," "X," and "O" (Table 5). These symbols reflect the manner in which their interconnectedness influences driving dependencies, as outlined in Table 6.

4.2.2 Developing reachability matrix. After substituting the "V," "A," "X," and "O" values (0 or 1) in Table 6, we got the "initial reachability matrix" (IRM) (Tables A6 and A7 (Appendix A)). After developing IRM and using the "transitivity principle," we subsequently arrive at the "final reachability matrix" (FRM), exemplified in Table 7. The transitivity rule, a foundational tenet in the realms of logic and mathematics, posits that if "X" is linked to "Y" and "Y" is linked to "Z," then "X" is inherently linked to "Z." This principle serves as a cornerstone for the establishment of relationships and underpins reasoning within diverse academic disciplines. Notably, the cells in Table 7 that have been denoted as "marked" signify the

Table 4. Rating of barriers and drivers

Barriers	Weight	Rank	Drivers	Weight	Rank
B1	0.067	10	D1	0.064	11
B2	0.083	5	D2	0.093	1
B3	0.072	7	D3	0.069	10
B4	0.071	9	D4	0.053	13
B5	0.055	13	D5	0.061	12
B6	0.095	2	D6	0.087	4
B7	0.092	4	D7	0.089	3
B8	0.076	6	D8	0.082	7
B9	0.064	12	D9	0.083	6
B10	0.095	1	D10	0.091	2
B11	0.072	8	D11	0.070	9
B12	0.065	11	D12	0.072	8
B13	0.093	3	D13	0.085	5

Source(s): Authors' own work

Table 5. Explanation of VAXO symbol

Symbol	Explanation	(i,j)th value	(j,i)th value
V	Factor "i" influence factor "j"	1 ("Yes"/✓)	0 ("No"/×)
A	Factor "j" influence factor "i"	0 ("No"/×)	1 ("Yes"/✓)
X	Factor "i" and factor "j" influence each other	1 ("Yes"/✓)	1 ("Yes"/✓)
O	Factor "i" and factor "j" not influence each other	0 ("No"/×)	0 ("No"/×)

Source(s): Authors' own work

"transitive elements," where the values have been modified from "0" to "1" in accordance with the principles of "transitivity."

4.2.3 Level partitioning. The hierarchical arrangement of barriers and drivers is established by employing a technique known as level partitioning. In this approach, the "reachability sets" (RS) and "antecedent sets" (AS) for individual barriers and drivers are determined using the FRM. The "intersection set" (IS) is subsequently derived by combining the RS and AS for each barrier and driver. Barriers and drivers that share common RS and IS are categorized at the "first level." This method is consistently applied to all elements of the FRM. We can find a detailed depiction of the entire level partitioning process in Table 7. This process of level partitioning is extended to all barriers and drivers, resulting in a consolidated representation with five levels for barriers and six levels for drivers.

4.2.4 Formation of ISM digraph. From the FRM and "level partitioning," the five-level "hierarchical structure" for barriers (Table 7 and Figure 5) and the six-level structure for drivers (Table 7 and Figure 6) were obtained. In addition to establishing the structural model, the reciprocal interaction between the barriers and drivers (node) is obtained from the FRM and corresponds with directed lines. A "unidirectional arrow" pointing from node "A" to node "B" denotes that "A" goes to "B". A bidirectional line connecting "A" and "B" nodes represents "A" and "B" mutually leading each other and emphasizes the existence of reciprocal connections between "A" and "B." Figures 5 and 6 demonstrate an ISM diagram of the identified barriers and drivers.

4.2.5 MICMAC analysis. A MICMAC analysis was conducted to explore the "driving power" and "dependent power" of barriers and drivers. The strength of barriers and drivers of "dependence power" is plotted on the "X-axis," while "driving power" is plotted on the "Y-axis" in the graph. By plotting the barriers and drivers, they are then categorized into four

Table 6. SSIM for barriers and drivers

Barriers	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
B1	O	O	A	O	V	V	O	X	O	X	X	X	–
B2	O	O	A	O	V	V	O	X	O	X	X	–	
B3	O	O	A	O	V	V	O	X	O	X	–		
B4	O	O	A	O	V	V	O	X	O	–			
B5	A	A	V	X	O	O	A	O	–				
B6	O	O	A	O	V	V	O	–					
B7	X	X	O	V	O	O	–						
B8	O	O	O	O	X	–							
B9	O	O	O	O	–								
B10	A	A	V	–									
B11	O	O	–										
B12	X	–											
B13	–												

Drivers	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1
D1	V	X	A	A	O	O	O	O	O	O	O	O	
D2	O	O	O	O	V	V	V	O	O	X	X	–	
D3	O	O	O	O	V	V	V	O	O	X	–		
D4	O	O	O	O	V	V	V	O	O	–			
D5	O	O	V	V	A	A	A	X	–				
D6	O	O	V	V	A	A	A	–					
D7	O	O	O	O	X	X	–						
D8	O	O	O	O	X	–							
D9	O	O	O	O	–								
D10	O	V	X	–									
D11	O	V	–										
D12	V	–											
D13	–												

Source(s): Authors' own work

distinct groups, namely "autonomous," "dependent," "linkage," and driving, as illustrated in Figures 7 and 8, respectively.

Based on the "driving power" and "dependence power" of barriers and drivers, it can be inferred that among the barriers, operational and design-related barriers (B12), circular economy practices and adoption-related barriers (B13), and rule, regulations, and policy-related barriers (B7) have the highest driving power, whereas institutional-related barriers (B8) and social and cultural-related barriers (B9) have the highest dependence power. For drivers, regulatory and norms-related drivers (D2), corporate and managerial-related drivers (D3), and market monitoring-related drivers (D4) have the highest driving power, whereas sustainable business practices-related drivers (D13), sustainability strategy- and business ecosystem-related drivers (D12), and green entrepreneurial orientations-related drivers (D1) have the maximum "dependent drivers."

4.2.5.1 From the MICMAC analysis, the details of clustering are shown below. Cluster 1: Autonomous Barriers and Drivers: These cluster factors denote the weak "driving power" and weak "dependence power" in the first quadrant (I). In our study, no factors fall into this cluster; it indicates all the drivers and barriers considered in this study are essential.

Cluster 2: Driving Barriers and Drivers: This cluster is characterized by strong "driving power" with weak "dependence power," as categorized in this cluster and in the second quadrant (II). Three drivers, i.e. regulatory and norms-related drivers (D2), corporate and managerial-related drivers (D3), and market monitoring-related drivers (D4), belong to this

Table 7. FRM for barriers and drivers

Reachability matrix for barriers	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	Dependence	Driving power	Level
B1	1	1	1	1	0	1	0	1	1	0	0	0	0	8	*7*	*II*
B2	1	1	1	1	0	1	0	1	1	0	0	0	0	8	*7*	*II*
B3	1	1	1	1	0	1	0	1	1	0	0	0	0	8	*7*	*II*
B4	1	1	1	1	0	1	0	1	1	0	0	0	0	8	*7*	*II*
B5	1*	1*	1*	1*	1	1*	0	0	0	1	1	0	0	5	*8*	*IV*
B6	1	1	1	1	0	1	0	1	1	0	0	0	0	8	*7*	*II*
B7	0	0	0	0	1	0	1	0	0	1	1*	1	1	3	*6*	*V*
B8	0	0	0	0	0	0	0	1	1	0	0	0	0	8	*2*	*I*
B9	0	0	0	0	0	0	0	1	1	0	0	0	0	8	*2*	*I*
B10	1*	1*	1*	1*	1	1*	0	0	0	1	1	0	0	5	*8*	*IV*
B11	1	1	1	1	0	1	0	1*	1*	0	1	0	0	6	*8*	*III*
B12	0	0	0	0	1	0	1	0	0	1	1*	1	1	3	*6*	*V*
B13	0	0	0	0	1	0	1	0	0	1	1*	1	1	3	*6*	*V*

Reachability matrix for drivers	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13			
D1	1	0	0	0	0	0	0	0	0	0	0	1	1	6	*3*	*II*
D2	0	1	1	1	1*	1*	1	1	1	0	0	0	0	3	*8*	*VI*
D3	0	1	1	1	1*	1*	1	1	1	0	0	0	0	3	*8*	*VI*
D4	0	1	1	1	1*	1*	1	1	1	0	0	0	0	3	*8*	*VI*
D5	1*	0	0	0	1	1	0	0	0	1	1	1*	0	8	*6*	*IV*
D6	1*	0	0	0	1	1	0	0	0	1	1	1*	0	8	*6*	*IV*
D7	0	0	0	0	1	1	1	1	1	1*	1*	0	0	6	*7*	*V*
D8	0	0	0	0	1	1	1	1	1	1*	1*	0	0	6	*7*	*V*
D9	0	0	0	0	1	1	1	1	1	1*	1*	0	0	6	*7*	*V*
D10	1	0	0	0	0	0	0	0	0	1	1	1	1*	7	*5*	*III*
D11	1	0	0	0	0	0	0	0	0	1	1	1	1*	7	*5*	*III*
D12	1	0	0	0	0	0	0	0	0	0	0	1	1	6	*3*	*II*
D13	0	0	0	0	0	0	0	0	0	0	0	0	1	5	*1*	*I*

Source(s): Authors' own work

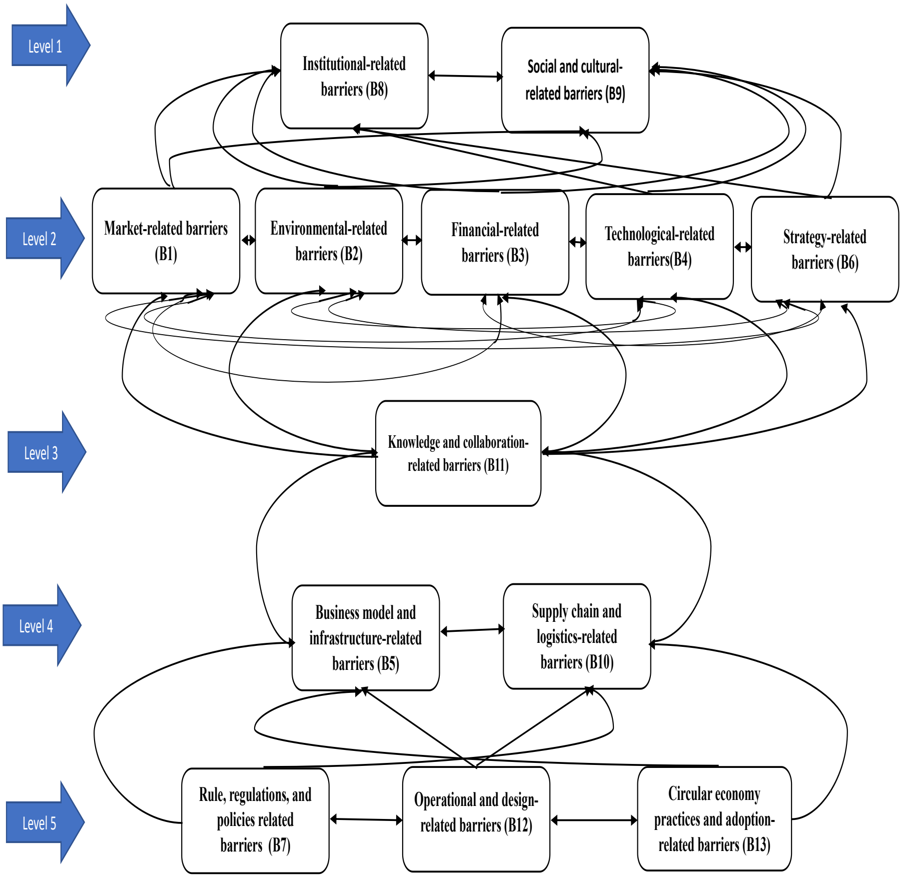

Figure 5. ISM result for barriers. Source: Authors' own creation

group. Operational and design-related barriers (B12), circular economy practices and adoption-related barriers (B13), and rule, regulation, and policy-related barriers (B7) fall into this cluster.

Cluster 3: Linkage Barriers and Drivers: This category has high "driving power" and higher "dependence power" and is located in quadrant III. Among the barriers, market-related barriers (B1), environmental-related barriers (B2), financial-related barriers (B3), technologically related barriers (B4), business model and infrastructure-related barriers (B5), strategy-related barriers (B6), supply chain and logistics-related barriers (B10), and barriers related to knowledge and collaboration-related barriers (B11) fall under this group. Among the drivers are social responsibility and ethics (D5), eco-financial synergy-related drivers (D6), collaboration and networking-related drivers (D7), supply chain transparency and traceability (D8), digital transformation and technology-related drivers (D9), sustainable ecosystem management-related drivers (D10), and circular economy integration and optimization-related drivers (D11) belong to this group. This cluster acts as a linkage variable (sometimes acting as a moderator or mediator).

Cluster 4: Dependent Barriers and Drivers: These cluster barriers have strong "dependent power" and weak "driving power" located in the fourth quadrant. Institutional-related barriers (B8) and social and cultural-related barriers (B9) fall into this cluster. The green

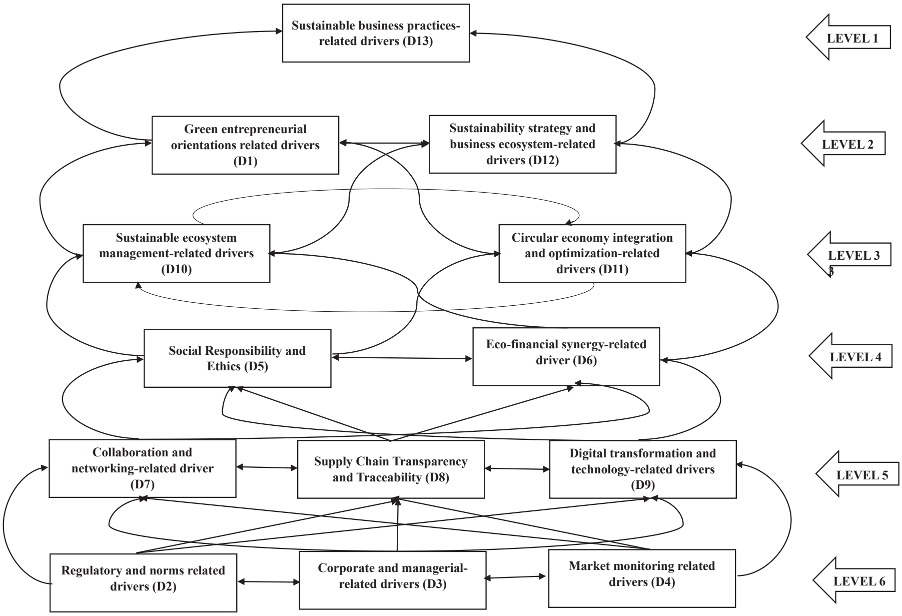

Figure 6. ISM result for drivers. Source: Authors' own creation

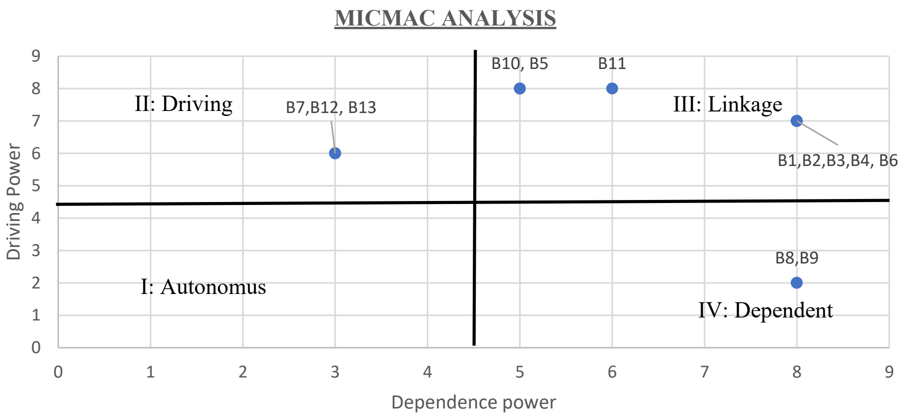

Figure 7. Plotting of barrier. Source: Authors' own creation

entrepreneurial orientation-related drivers (D1), sustainability strategy- and business ecosystem-related drivers (D12), and sustainable business practices-related drivers (D13) belong to this cluster.

5. Discussions of results

The study uses a four-phase methodology. For the identification of barriers and drivers, a literature review, content analysis, and theories (ST, CET, and DRBV) were used. The order of rank of barriers and drivers (Table 4) is the F-AHP used. Further ISM-MICMAC analysis is needed to identify interrelationships and cluster them. A group of experts (Table 3) was used to

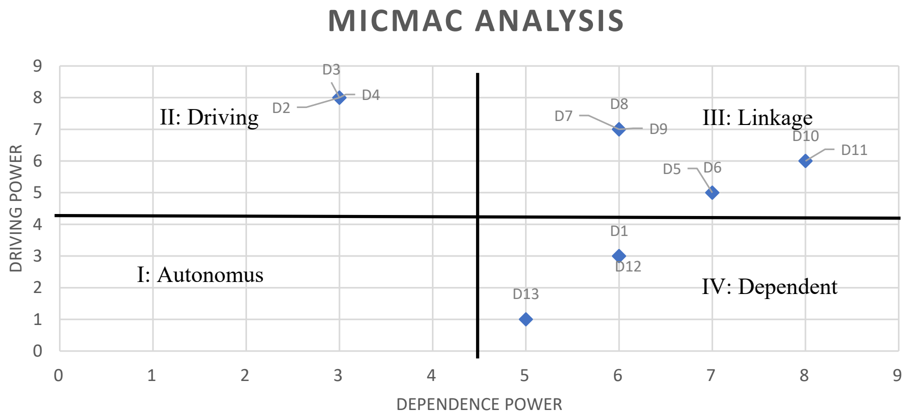

Figure 8. Plotting of drivers. Source: Authors' own creation

get responses for the analysis and collection of data. In the F-AHP, the opinions of the experts are measured using a "fuzzy numerical scale." This technique was used to minimize the influence of uncertainty associated with the decision-making process—the evaluation of experts' opinions on a fuzzy scale with respect to the pairwise comparison matrix. The consistency check was conducted on the pairwise comparison matrix, and the resulting "consistency ratio" (CR) was computed. The findings of the consistency ratio suggest that the comparison shows consistency, as the CR value is below 0.1. The result obtained from F-AHP shows that "supply chain and logistics-related barriers" (B10) obtained the top rank (Table 4). Supply chain and logistics-related barriers, such as inefficient transportation networks and fragmented value chains, can hinder the growth of GE and the development of CE, which are essential for achieving the SDGs. These barriers increase operational costs, limit access to sustainable inputs, and impede the efficient circulation of resources, making it challenging for businesses to adopt eco-friendly practices and contribute to a more sustainable future (Govindan and Hasanagic, 2018). In contrast, Liu *et al.* (2022) and Moktadir *et al.* (2020b) found regulatory and institutional factors to be the primary barriers in the context of Chinese industries, highlighting the regional variation in the prominence of different challenges. While our study places supply chain issues at the forefront, these inconsistencies suggest that industries in emerging economies, particularly those with limited infrastructure, are more severely affected by logistical barriers than those in more developed regions. Internationally, the impact of these barriers is especially pronounced in industries with global supply chains, such as manufacturing, retail, and agriculture. Addressing these barriers through technological innovations and integrated supply chain management can accelerate the global transition to GE and CE practices. Findings also show that strategy-related barriers (B6) obtained second rank through F-AHP analysis. Strategy-related barriers can impede the progress of GE and CE development in achieving the SDGs by limiting the alignment of organizational objectives with environmental and societal priorities. These barriers often arise from a lack of clear sustainability strategies, inadequate resource allocation, and a failure to integrate sustainability principles into core business strategies, thereby hindering the full potential of these initiatives (Govindan and Hasanagic, 2018, Govindan *et al.*, 2022, 2018). Jensen *et al.* (2022) argue that financial barriers are more pressing for SMEs pursuing CE. While our study emphasizes strategic misalignment, financial constraints appear more critical in industries where initial investments in sustainable technologies are unaffordable for many businesses. This divergence reflects how different sectors prioritize challenges, with larger corporations focusing on strategic issues and SMEs facing financial hurdles. Globally, businesses operating in different regulatory environments encounter additional complexities when aligning sustainability strategies across multiple regions, affecting their ability to scale green initiatives effectively. In addition, CE practices and adoption-related barriers (B13) obtained the third rank through F-AHP analysis. CE practices can create barriers to GE by requiring significant initial investments in sustainable technologies and processes, which may deter aspiring entrepreneurs with limited resources. Additionally, adopting CE practices often requires significant upfront investments, which can deter companies—especially SMEs with limited financial resources—from pursuing GE initiatives. Moreover, industries face substantial regulatory hurdles and a lack of consumer awareness, which impedes the broader adoption of CE principles (Geissdoerfer *et al*., 2017). In an international context, regulatory environments vary greatly, adding complexity to the global adoption of CE. Industries in emerging economies, for example, may struggle with regulatory hurdles and insufficient financial resources, making the transition to circular models slower compared to their counterparts in developed economies. Based on the result analysis among the barriers, the findings show that the rest of the ranking barriers are B10> B6> B13> B7> B2> B8> B3> B11> B4> B1> B12> B9> B5.

Among the drivers, regulatory and norms-related drivers (D2) obtained the first rank through F-AHP analysis (see Table 4). These drivers play a pivotal role in fostering GE and advancing CE, thereby contributing to achieving the SDGs. These drivers encompass policies, standards, and societal expectations that incentivize environmentally responsible business practices and stimulate innovation in sustainable technologies (Agudelo *et al*., 2020). Chandra *et al*. (2024) found that regulatory frameworks are crucial for GE development in developed countries, where businesses are more responsive to compliance-driven policies. In contrast, our study suggests that regulatory drivers are also critical in emerging markets, where government incentives and supportive policies can create favorable conditions for GE. These drivers are particularly relevant in industries that operate across borders, as regulatory incentives can either facilitate or hinder the transition to sustainable models. The international relevance of these drivers is significant, as global environmental agreements and policies, such as the Paris Agreement, increasingly push industries towards adopting sustainable practices. Sustainable ecosystem management-related drivers (D10) ranked second, pointing to the industrial relevance of preserving biodiversity and managing resources sustainably. D10 drivers, such as preserving biodiversity and responsible resource utilization, can stimulate GE by fostering innovation in eco-friendly products and services. This, in turn, contributes to developing a SCE that minimizes waste and promotes sustainable consumption patterns, aligning with achieving the SDGs (Bonfanti *et al*., 2023). However, while Bonfanti's work emphasizes ecosystem management primarily in agriculture and natural resource sectors, our study found that this driver is also relevant across industrial and service sectors. This broader relevance suggests that ecosystem management principles are increasingly being applied beyond traditional environmental sectors, influencing a more comprehensive range of industries looking to minimize waste and optimize resource use. In this context, industries prioritizing sustainable resource management contribute to environmental preservation and enhance their competitiveness in the international market by aligning with the global shift towards sustainability. Moreover, the collaboration and networking-related driver obtained the third rank through F-AHP analysis. Collaboration and networking among green entrepreneurs and businesses foster knowledge sharing, resource pooling, and innovative partnerships, thus accelerating the transition towards a CE and the achievement of the SDGs. Research by Hockerts and Wüstenhagen (2010), who emphasize the significance of networks in driving CE initiatives, and Schaltegger *et al*. (2012), who emphasize the role of collaboration in sustainable entrepreneurship, support this. In the context of SMEs, collaboration and networking serve as catalysts for GE and CE development by enabling resource-efficient practices, knowledge exchange, and access to sustainable supply chains. However, our study contrasts with Hockerts and Wüstenhagen (2010), Matsukawa (2012), and Lotfi *et al*. (2018), who argue that market-based drivers, such as consumer demand, are more influential than collaboration in driving GE. While both studies recognize the importance of collaboration, our findings suggest that in industries with high resource dependency and complex supply chains, collaboration plays a more crucial role than market-based factors, especially in the early stages of SCE adoption. From the global perspective, collaboration also fosters innovation by bridging gaps between markets with varying levels of adoption of sustainability, thereby accelerating progress towards SDGs. At the same time, the ranking of the rest of the drivers is as follows: D2> D10> D7> D6>D13> D9> D8> D12> D11> D3> D1> D5> D4.

Also, rules, regulations, and policy-related barriers (B7), operational and design-related behaviors (B12), and circular economy practices and adoption-related barriers (B13) are all important barriers that an organization has to face when developing sustainability activities like GE and CE (see Figures 5 and 7). Gupta *et al*. (2020) show that complex rules, regulations, and policies create barriers to innovation and sustainability activities in manufacturing industries. These increasing compliance costs and administrative burdens are inhibiting innovation and agility. A study by Jensen *et al*. (2022) shows operational and design-related barriers, i.e. financial constraints, lack of technical expertise in recycling, regulatory compliance, and other issues, create substantial challenges for SMEs looking to engage in GE and CE practices. Moreover, a study by Gedam *et al*. (2021) studied barriers related to the adoption of CE. Among the drivers, regulatory and norms-related drivers (D2), corporate and managerial-related drivers (D3), and market monitoring-related drivers (D4) are in the driving category (see Figures 6 and 8). A study by Piila *et al*. (2022) and Yadav *et al*. (2023) shows that corporate and managerial-related factors influence incubators and drive SCE.

According to the study's findings, among the linkage barriers are market-related barriers (B1), environmental-related barriers (B2), financial-related barriers (B3), technologically related barriers (B4), business model and infrastructure-related barriers (B5), strategy-related barriers (B6), supply chain and logistics-related barriers (B10), and barriers related to knowledge and collaboration-related barriers (B11). Market-related barriers include limited consumer demand for green products, inadequate consumer information and awareness, and market competition (Jensen *et al*., 2022). The study also shows that environmental, financial-related, technology-related, and strategy-related barriers prevent businesses from developing. In another study (Badhotiya *et al*., 2022), organizations also face barriers related to supply chains and knowledge-related barriers to SCE development. However, while both studies identify the cumulative impact of these barriers, our study highlights a more nuanced interaction between policy and operational constraints, especially in industries where regulatory and logistical challenges coexist. Among the drivers, social responsibility and ethics (D5), eco-financial synergy-related drivers (D6), collaboration and networking-related drivers (D7), supply chain transparency and traceability (D8), digital transformation and technology-related drivers (D9), sustainable ecosystem management-related drivers (D10), and circular economy integration and optimization-related drivers (D11) belong to this group. D5 plays a crucial role in green entrepreneurship by fostering a culture of sustainability, where businesses integrate environmental and social concerns into their core operations. For instance, companies emphasize ethical production practices, prioritizing environmental stewardship and fair labor conditions, thus aligning their business model with circular economy principles (Schaltegger and Burritt, 2018). In addition, research by Yu *et al*. (2022) shows that companies leveraging renewable energy not only minimize environmental impact but also reduce operational costs, thereby facilitating an SCE. Further collaboration and networking enhance green entrepreneurship by promoting knowledge exchange and resource sharing among stakeholders, fostering innovation. A notable example is the Ellen MacArthur Foundation, which connects businesses and policymakers to advance the adoption of circular economy models (Hockerts and Wüstenhagen, 2010). Research by Jensen *et al*. (2022) illustrates how companies in the fashion industry are adopting blockchain technologies to ensure sustainability in their supply chains, promoting a circular economy. Hence, these drivers play pivotal roles in fostering GE and promoting SCE development. Corporate sustainability and ethics create a foundation for responsible business practices, ensuring that environmental and social considerations are integrated into entrepreneurial ventures.

Eco-financial synergy, as emphasized by Yu *et al*. (2022), enables businesses to leverage eco-efficiencies for financial gains, aligning profitability with sustainable practices.

Out of thirteen barriers, institutional-related (B8) and social and cultural-related (B9) are the dependent barriers. Institutional-related barriers (B8), such as cumbersome regulatory frameworks and a lack of policy support, can significantly impede the growth of GE and hinder the development of CE. A study by Liu *et al*. (2021) found that stringent environmental regulations can increase compliance costs for green entrepreneurs, limiting their ability to innovate and scale their businesses. Additionally, social and cultural-related barriers can pose challenges, as societal attitudes towards sustainability may impact consumer preferences. Research by Schaltegger and Burritt (2018) highlights that cultural norms and values can affect consumer acceptance of sustainable products, potentially limiting the market for CE initiatives. These institutional and socio-cultural barriers underscore the importance of tailored policies and awareness campaigns to promote GE and CE development (Bocken *et al*., 2019). However, the green entrepreneurial orientation-related drivers (D1), sustainability strategy- and business ecosystem-related drivers (D12), and sustainable business practices-related drivers (D13) belong to the dependent cluster. Research by Hockerts and Wüstenhagen (2010) highlights the importance of entrepreneurial orientations that emphasize environmental sustainability in driving green business initiatives. These interconnected drivers collectively facilitate the growth of environmentally responsible businesses and contribute to the broader objectives of sustainability and CE development in the corporate sector. The findings of this study offer several key implications for industries aiming to transition towards GE and CE. Regulatory support, strategic alignment, and collaborative efforts are pivotal in overcoming the identified barriers. Policymakers and industry leaders should focus on creating an enabling environment that supports sustainable business practices through clear policies, incentives, and financial support. For industries, especially those with global supply chains, addressing inefficiencies in logistics and aligning business strategies with sustainability goals will be critical. Moreover, fostering collaboration between businesses, governments, and international organizations can accelerate the adoption of CE practices and drive innovation in green technologies.

6. Implications

This study's findings make a substantial and noteworthy contribution to the existing body of knowledge in the field of entrepreneurship. The mixed-methods approach allows researchers to explore a comprehensive understanding of the challenges faced by academic institutions when engaging in CE. Integrating theories provides a comprehensive framework for understanding these ventures in a multidimensional context.

6.1 Theoretical contributions

This study offers many theoretical contributions that greatly enhance our comprehension of GE, the CE, and SD. These contributions bolster our grasp of these pivotal concepts and lay a foundation for further research and theoretical advancement. One of the primary theoretical advancements of this study lies in its adept integration of diverse theoretical frameworks, such as the Circular Economy theory, Dynamic Resource-Based View, and Stakeholder theory. This integration enables a holistic understanding of the multifaceted factors that shape GE, CE, and SD. The study fosters a comprehensive perspective that accounts for economic, environmental, and social dimensions—a critical recognition of the interconnected nature of sustainability challenges, emphasizing the imperative for multifaceted solutions. The incorporation of multi-criteria decision-making techniques adds depth to the theoretical framework. This research contributes significantly to our theoretical understanding of how drivers and barriers interact and influence one another by employing tools like fuzzy analytic hierarchy and ISM. These techniques permit a nuanced exploration of the intricate relationships between various factors, shedding light on the complexities of decision-making within sustainable development.

Furthermore, this study provides theoretical insights by prioritizing drivers and barriers. The research uses the fuzzy analytic hierarchy process to assign weights to different factors, underscoring those with the most substantial impact. This theoretical insight can serve as a compass for decision-makers in resource allocation and strategy development, allowing for the targeted addressing of key barriers and harnessing critical drivers. The application of ISM is instrumental in uncovering the interrelationships between these drivers and barriers. This theoretical contribution elucidates the complex web of dependencies and influences among factors affecting GE, CE, and SD, aiding in identifying leverage points for interventions that can yield the most substantial positive impact. The study employs MICMAC for cluster analysis, categorizing factors based on their driving and dependence power. This structured framework aids decision-makers in prioritizing their efforts, distinguishing factors directly influenced from those contingent on other variables, thus guiding strategic planning and resource allocation.

Moreover, incorporating stakeholder perspectives into the analysis enhances the theoretical framework. This approach aligns with contemporary theories of stakeholder engagement and corporate social responsibility, emphasizing that sustainability initiatives should be inclusive and responsive to diverse voices, further enriching our theoretical understanding of sustainable development. Lastly, the study's identification of key factors for green entrepreneurs is a noteworthy theoretical contribution. It offers a roadmap for aspiring entrepreneurs and established businesses embarking on sustainable ventures, advancing theoretical discussions on the determinants of environmentally responsible entrepreneurship. Additionally, this study presents a wealth of theoretical contributions to green entrepreneurship, the circular economy, and sustainable development. Through the integration of various theoretical frameworks, advanced decision-making techniques, prioritization, interrelationship analysis, clustering, stakeholder perspectives, and identification of critical factors, it enriches our theoretical understanding of sustainability's intricate landscape, providing a robust foundation for future research and practical application in the pursuit of a more sustainable and inclusive future.

6.2 Managerial contributions

The study's managerial implications are pivotal for advancing sustainability activities toward achieving the UNSDGs. These insights serve as a roadmap for various stakeholders, including policymakers, entrepreneurs, and researchers, aiming to accelerate the adoption of sustainable practices and contribute to a more resilient and environmentally conscious global economy. One standout managerial implication underscores the paramount importance of governmental engagement. The study highlights that the governmental perspective exerts the most substantial positive impact on implementing GE and CE. This insight directs policymakers toward adopting robust regulations and incentives that favor environmentally conscious business practices. Governments can create an enabling policy environment by fostering partnerships between the public and private sectors, driving innovation, establishing standards, and facilitating resource-efficient practices. For entrepreneurs, access to funding emerges as a critical driver for implementing environmentally sustainable initiatives. Entrepreneurs often face financial constraints due to the higher initial costs associated with eco-friendly technologies. Financial institutions and impact investors can develop specialized financing mechanisms to alleviate this burden and incentivize the adoption of green solutions. The study also provides successful examples of circular economy implementation across diverse industries, offering entrepreneurs inspiration and insights into innovative business models that prioritize resource efficiency and waste reduction. Capacity building and skill development are highlighted as essential for organizations. Entrepreneurs and corporate leaders must prioritize continuous learning and skill acquisition to leverage the benefits of sustainable practices.

Partnerships with educational institutions can be formed to offer specialized courses, training programs, and workshops that cultivate expertise in sustainable business strategies. Recognizing the growing demand for eco-friendly products and services is crucial for businesses. Aligning offerings with these preferences can confer a competitive advantage and open new market opportunities. Transparent communication about commitment to sustainability can build trust and loyalty among environmentally conscious consumers. Collaboration and knowledge-sharing across sectors are emphasized. Creating a platform for information exchange enables stakeholders to address challenges and co-create innovative solutions. Stakeholders can collaborate to develop sustainable supply chains, streamline waste management practices, and promote sharing best practices. A shift in mindset among entrepreneurs and corporate leaders is necessary, viewing environmental challenges as opportunities for innovation and positive change. Visionary leadership that prioritizes long-term value creation fosters a culture of sustainability throughout organizations. Managers can address barriers by fostering partnerships, advocating for policy changes, enhancing support infrastructure, and monitoring progress. By leveraging these insights, the stakeholder's role is essential in advancing the global transition toward a more inclusive, resilient, and environmentally conscious economy.

7. Conclusion, limitations, and further recommendations

This research paper investigated the barriers and drivers of academic institution-based GE and CE for SD through a mixed-method approach. Drawing upon a comprehensive literature review, expert opinions, and integrating various theoretical frameworks such as CET, DRBV, and ST, this study seeks to provide a profound understanding of the subject matter by identifying and categorizing barriers and drivers. These theories effectively elucidate the significance of resource availability and dependency relationships, emphasize the importance of considering both technical and social aspects within entrepreneurial endeavors, and elucidate the interplay between technological systems and human behavior. The study employed a rigorous methodology, including F-AHP, ISM, and MICMAC analysis, to unravel the complex relationships among these factors.

One of the key findings of this study is the paramount importance of regulatory and norm-related drivers in fostering GE and CE initiatives. Policies, standards, and societal expectations emerged as pivotal forces driving environmentally responsible business practices and stimulating innovation in sustainable technologies. This underscores the role of government and regulatory bodies in shaping the landscape of SD. Collaboration and networking-related drivers were identified as crucial catalysts for progress. The power of knowledge sharing, resource pooling, and innovative partnerships among green entrepreneurs and businesses cannot be underestimated. These collaborative efforts accelerate the transition towards a CE and align with the SDGs. On the other hand, barriers like supply chain and logistics-related barriers topped the list, highlighting the significance of efficient transportation networks and value chain integration in the pursuit of eco-friendly practices. Strategy-related barriers, including the lack of clear sustainability strategies, also hindered the full potential of these initiatives. Institutional-related barriers, such as cumbersome regulatory frameworks, and socio-cultural-related barriers, driven by societal attitudes, were identified as dependent obstacles. These findings emphasize the drivers such as social responsibility and ethics, eco-financial synergy, and sustainability-oriented business practices. These drivers create a strong foundation for responsible and sustainable business activities, aligning profitability with environmental and social considerations. This study contributes to the global pursuit of a greener and more resilient economy, paving the way for a sustainable and inclusive future.

The study investigating barriers and drivers of GE and SCE for SDGs acknowledges several limitations. These constraints affect the study's scope, methodology, and potential impact. One fundamental limitation revolves around the study's theoretical framework, which, while valuable, may not comprehensively encompass the multifaceted nature of GE and CE within the context of

SD. The methodology employed in this research also presents constraints, as it relies heavily on case studies and surveys. These methods, while informative, could introduce biases if the sample size or representativeness falls short. Furthermore, the study recognizes potential data bias due to limited data sources, which could compromise the objectivity of its findings. The rapidly evolving landscape of sustainability practices poses a challenge, as the study's conclusions may become less relevant over time. Additionally, theoretical frameworks and decision-making techniques may introduce subjectivity into the analysis, impacting outcomes. Several recommendations can be considered to address these limitations and enhance future research in this domain. Researchers could narrow the study's scope to specific facets of academic institution-based GE and CE for SD, allowing for more in-depth analysis within a focused context. Qualitative research methods like interviews or case studies could provide richer, more contextual data. Moreover, future research should explore contextual factors influencing barriers and drivers across different regions and cultural settings, fostering a more comprehensive understanding. Longitudinal studies could offer insights into the evolving dynamics of these barriers and drivers over time. Collaborative research involving multiple academic institutions and stakeholders could enhance the generalizability and validity of findings, promoting diverse perspectives. Developing and testing models, potentially through structural equation modeling, could contribute to a more robust understanding of the subject matter.

References

Aarikka-Stenroos, L., Chiaroni, D., Kaipainen, J. and Urbinati, A. (2022), "Companies' circular business models enabled by supply chain collaborations: an empirical-based framework, synthesis, and research agenda", *Industrial Marketing Management*, Vol. 105, pp. 322-339, doi: 10.1016/j.indmarman.2022.06.015.

Agrawal, R., Wankhede, V.A., Kumar, A. and Luthra, S. (2021), "Analysing the roadblocks of circular economy adoption in the automobile sector: reducing waste and environmental perspectives", *Business Strategy and the Environment*, Vol. 30 No. 2, pp. 1051-1066, doi: 10.1002/bse.2669.

Agrawal, R., Wankhede, V.A., Kumar, A., Luthra, S. and Huisingh, D. (2022), "Progress and trends in integrating Industry 4.0 within circular economy: a comprehensive literature review and future research propositions", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 559-579, doi: 10.1002/bse.2910.

Agudelo, M.A.L., Johannsdottir, L. and Davidsdottir, B. (2020), "Drivers that motivate energy companies to be responsible. A systematic literature review of corporate social responsibility in the energy sector", *Journal of Cleaner Production*, Vol. 247, 119094, doi: 10.1016/j.jclepro.2019.119094.

Alkaraan, F., Elmarzouky, M., Hussainey, K. and Venkatesh, V.G. (2023), "Sustainable strategic investment decision-making practices in UK companies: the influence of governance mechanisms on synergy between Industry 4.0 and circular economy", *Technological Forecasting and Social Change*, Vol. 187, 122187, doi: 10.1016/j.techfore.2022.122187.

Amankwah, J. and Sesen, H. (2021), "On the relation between green entrepreneurship intention and behavior", *Sustainability (Switzerland)*, Vol. 13 No. 13, p. 7474, doi: 10.3390/su13137474.

Antolin-Lopez, R., Martinez-del-Rio, J. and Cespedes-Lorente, J.J. (2019), "Environmental entrepreneurship as a multi-component and dynamic construct: duality of goals, environmental agency, and environmental value creation", *Business Ethics – A European Review*, Vol. 28 No. 4, pp. 407-422, doi: 10.1111/beer.12229.

Arsawan, I.W.E., Koval, V., Suhartanto, D., Hariyanti, N.K.D., Polishchuk, N. and Bondar, V. (2024), "Circular economy practices in SMEs: aligning model of green economic incentives and environmental commitment", *International Journal of Productivity and Performance Management*, Vol. 73 No. 3, pp. 775-793, doi: 10.1108/ijppm-03-2022-0144.

Badhotiya, G.K., Avikal, S., Soni, G. and Sengar, N. (2022), "Analyzing barriers for the adoption of circular economy in the manufacturing sector", *International Journal of Productivity and Performance Management*, Vol. 71 No. 3, pp. 912-931, doi: 10.1108/ijppm-01-2021-0021.

Bai, C. and Satir, A. (2020), "Barriers for green supplier development programs in manufacturing industry", *Resources Conservation and Recycling*, Vol. 158, 104756, doi: 10.1016/j.resconrec.2020.104756.

Banha, F.M., Almeida, M.H., Rebelo, E.L. and Ramos, A.O. (2017), "The main barriers of Portuguese entrepreneurship ecosystem: Interpretive Structural Modeling (ISM) approach", *Tourism and Management Studies*, Vol. 13 No. 2, pp. 60-70, doi: 10.18089/tms.2017.13206.

Behl, A., Singh, R., Pereira, V. and Laker, B. (2023), "Analysis of Industry 4.0 and circular economy enablers: a step towards resilient sustainable operations management", *Technological Forecasting and Social Change*, Vol. 189, 122363, doi: 10.1016/j.techfore.2023.122363.

Bhatia, M.S., Jakhar, S.K. and Dora, M. (2022), "Analysis of barriers to closed-loop supply chain: a case of the Indian automotive industry", *IEEE Transactions on Engineering Management*, Vol. 69 No. 5, pp. 1999-2013, doi: 10.1109/tem.2020.2998794.

Bilal, M., Khan, K.I.A., Thaheem, M.J. and Nasir, A.R. (2020), "Current state and barriers to the circular economy in the building sector: towards a mitigation framework", *Journal of Cleaner Production*, Vol. 276, 123250, doi: 10.1016/j.jclepro.2020.123250.

Bocken, N., Strupeit, L., Whalen, K. and Nußholz, J. (2019), "A review and evaluation of circular business model innovation tools", *Sustainability*, Vol. 11 No. 8, 2210, doi: 10.3390/su11082210.

Böhmecke-Schwafert, M., Wehinger, M. and Teigland, R. (2022), "Blockchain for the circular economy: theorizing blockchain's role in the transition to a circular economy through an empirical investigation", *Business Strategy and the Environment*, Vol. 31 No. 8, pp. 3786-3801, doi: 10.1002/bse.3032.

Bonfanti, A., Mion, G., Brunetti, F. and Vargas-Sánchez, A. (2023), "The contribution of manufacturing companies to the achievement of sustainable development goals: an empirical analysis of the operationalization of sustainable business models", *Business Strategy and the Environment*, Vol. 32 No. 4, pp. 2490-2508, doi: 10.1002/bse.3260.

Chandra, A., Shukla, D.M., Sharma, S. and Dwivedi, G. (2024), "Fostering environmentally sustainable business: analysis of factors from entrepreneurial ecosystem perspective", *Journal of Cleaner Production*, Vol. 476, 143667, doi: 10.1016/j.jclepro.2024.143667.

Chauhan, C., Parida, V. and Dhir, A. (2022), "Linking circular economy and digitalisation technologies: a systematic literature review of past achievements and future promises", *Technological Forecasting and Social Change*, Vol. 177, 121508, doi: 10.1016/j.techfore.2022.121508E.

Chavez, R., Malik, M., Ghaderi, H. and Yu, W. (2023), "Environmental collaboration with suppliers and cost performance: exploring the contingency role of digital orientation from a circular economy perspective", *International Journal of Operations and Production Management*, Vol. 43 No. 4, pp. 651-675, doi: 10.1108/ijopm-01-2022-0072.

Chhabra, D. and Kr Singh, R. (2022), "Analyzing barriers to green logistics in context of circular economy and Industry 4.0 in the Indian manufacturing industry", *International Journal of Logistics Research and Applications*, Vol. 27 No. 11, pp. 1939-1952, doi: 10.1080/13675567.2022.2134847.

Chou, C.Y., Leo, W.W.C., Tsarenko, Y. and Chen, T. (2023), "When feeling good counts! Impact of consumer gratitude and life satisfaction in access-based services", *European Journal of Marketing*, Vol. 57 No. 2, pp. 626-652, doi: 10.1108/ejm-08-2021-0655.

Das, S., Barve, A., Sahu, N.C. and Muduli, K. (2023), "Enabling artificial intelligence for sustainable food grain supply chains: an Agri 5.0 and circular economy perspective", *Operations Management Research*, Vol. 16 No. 4, pp. 2104-2124, doi: 10.1007/s12063-023-00390-z.

de Oliveira, C.T. and Oliveira, G.G.A. (2023), "What circular economy indicators really measure? An overview of circular economy principles and sustainable development goals", *Resources, Conservation and Recycling*, Vol. 190, 106850, doi: 10.1016/j.resconrec.2022.106850.

Del Giudice, M., Chierici, R., Mazzucchelli, A. and Fiano, F. (2021), "Supply chain management in the era of circular economy: the moderating effect of big data", *International Journal of Logistics Management*, Vol. 32 No. 2, pp. 337-356, doi: 10.1108/ijlm-03-2020-0119.

Dey, P.K., Malesios, C., De, D., Budhwar, P., Chowdhury, S. and Cheffi, W. (2022), "Circular economy to enhance sustainability of small and medium sized enterprises", in *In Supply Chain Sustainability in Small and Medium Sized Enterprises*, Routledge, pp. 10-45.

Dixon, S.E.A. and Clifford, A. (2007), "Ecopreneurship – a new approach to managing the triple bottom line", *Journal of Organizational Change Management*, Vol. 20 No. 3, pp. 326-345, doi: 10.1108/09534810710740164.

Dohale, V., Ambilkar, P., Kumar, A., Mangla, S.K. and Bilolikar, V. (2023), "Analyzing the enablers of circular supply chain using neutrosophic-ISM method: lessons from the Indian apparel industry", *International Journal of Logistics Management*, Vol. 34 No. 3, pp. 611-643, doi: 10.1108/ijlm-03-2022-0141.

Dwivedi, A., Madaan, J., Santibanez Gonzalez, E.D.R. and Moktadir, M.A. (2022a), "A two-phase approach to efficiently support product recovery systems in a circular economy context", *Management Decision*, Vol. 60 No. 7, pp. 2060-2091, doi: 10.1108/md-01-2021-0030.

Dwivedi, A., Moktadir, M.A., Chiappetta Jabbour, C.J. and de Carvalho, D.E. (2022b), "Integrating the circular economy and Industry 4.0 for sustainable development: implications for responsible footwear production in a big data-driven world", *Technological Forecasting and Social Change*, Vol. 175, 121335, doi: 10.1016/j.techfore.2021.121335.

Dwivedi, A., Chowdhury, P., Paul, S.K. and Agrawal, D. (2023), "Sustaining circular economy practices in supply chains during a global disruption", *International Journal of Logistics Management*, Vol. 34 No. 3, pp. 644-673, doi: 10.1108/ijlm-04-2022-0154.

Elf, P., Werner, A. and Black, S. (2022), "Advancing the circular economy through dynamic capabilities and extended customer engagement: insights from small sustainable fashion enterprises in the UK", *Business Strategy and the Environment*, Vol. 31 No. 6, pp. 2682-2699, doi: 10.1002/bse.2999.

Erol, I., Peker, I., Ar, I.M. and Searcy, C. (2023), "Examining the role of urban-industrial symbiosis in the circular economy: an approach based on N-Force Field Theory of change and N-ISM-Micmac", *Operations Management Research*, Vol. 16 No. 4, pp. 2125-2147, doi: 10.1007/s12063-023-00393-w.

Faisal, M.N. (2023), "Role of Industry 4.0 in circular supply chain management: a mixed-method analysis", *Journal of Enterprise Information Management*, Vol. 36 No. 1, pp. 303-322, doi: 10.1108/jeim-07-2021-0335.

Farrukh, M., Raza, A., Mansoor, A., Khan, M.S. and Lee, J.W.C. (2023), "Trends and patterns in pro-environmental behaviour research: a bibliometric review and research agenda", *Benchmarking: An International Journal*, Vol. 30 No. 3, pp. 681-696, doi: 10.1108/bij-10-2020-0521.

Feng, T., Li, Z., Shi, H. and Jiang, W. (2022), "Translating leader sustainability orientation into green supply chain integration: a missing link of green entrepreneurial orientation", *Journal of Business and Industrial Marketing*, Vol. 37 No. 12, pp. 2515-2532, doi: 10.1108/jbim-05-2021-0241.

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.

Gatti, L., Ulrich, M. and Seele, P. (2019), "Education for sustainable development through business simulation games: an exploratory study of sustainability gamification and its effects on students' learning outcomes", *Journal of Cleaner Production*, Vol. 207, pp. 667-678, doi: 10.1016/j.jclepro.2018.09.130.

Gbako, S., Paraskevadakis, D., Ren, J., Wang, J. and Radmilovic, Z. (2024), "A systematic literature review of technological developments and challenges for inland waterways freight transport in intermodal supply chain management", *Benchmarking: An International Journal*, Vol. 32 No. 1, pp. 398-431, doi: 10.1108/bij-03-2023-0164.

Gedam, V.V., Raut, R.D., Lopes de Sousa Jabbour, A.B., Tanksale, A.N. and Narkhede, B.E. (2021), "Circular economy practices in a developing economy: barriers to be defeated", *Journal of Cleaner Production*, Vol. 311, 127670, doi: 10.1016/j.jclepro.2021.127670.

Geissdoerfer, M., Savaget, P., Bocken, N.M. and Hultink, E.J. (2017), "The circular economy–a new sustainability paradigm?", *Journal of Cleaner Production*, Vol. 143, pp. 757-768, doi: 10.1016/j.jclepro.2016.12.048.

Geissdoerfer, M., Santa-Maria, T., Kirchherr, J. and Pelzeter, C. (2022), "Drivers and barriers for circular business model innovation", *Business Strategy and the Environment*, Vol. 32 No. 6, pp. 3814-3832, doi: 10.1002/bse.3339.

Ghadimi, P., O'Neill, S., Wang, C. and Sutherland, J.W. (2021), "Analysis of enablers on the successful implementation of green manufacturing for Irish SMEs", *Journal of Manufacturing Technology Management*, Vol. 32 No. 1, pp. 85-109, doi: 10.1108/jmtm-10-2019-0382.

Govindan, K. (2022), "Tunneling the barriers of blockchain technology in remanufacturing for achieving sustainable development goals: a circular manufacturing perspective", *Business Strategy and the Environment*, Vol. 31 No. 8, pp. 3769-3785, doi: 10.1002/bse.3031.

Govindan, K., Cheng, T., Mishra, N. and Shukla, N. (2018), "Big data analytics and application for logistics and supply chain management", *Transportation Research Part E Logistics and Transportation Review*, Vol. 114, pp. 343-349, doi: 10.1016/j.tre.2018.03.011.

Govindan, K. and Hasanagic, M. (2018), "A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective", *International Journal of Production Research*, Vol. 56 Nos 1-2, pp. 278-311, doi: 10.1080/00207543.2017.1402141.

Govindan, K., Kannan, D., Mathiyazhagan, K., De Sousa Jabbour, A.B.L. and Jabbour, C.J.C. (2013), "Analysing green supply chain management practices in Brazil's electrical/electronics industry using interpretive structural modelling", *International Journal of Environmental Studies*, Vol. 70 No. 4, pp. 477-493, doi: 10.1080/00207233.2013.798494.

Govindan, K., Nasr, A.K., Karimi, F. and Mina, H. (2022), "Circular economy adoption barriers: an extended fuzzy best–worst method using fuzzy DEMATEL and Supermatrix structure", *Business Strategy and the Environment*, Vol. 31 No. 4, pp. 1566-1586, doi: 10.1002/bse.2970.

Guo, H.L. (2022), "Analysing the barriers to green apparel manufacturing implementation", *Journal of Fashion Marketing and Management*, Vol. 27 No. 3, pp. 531-560, doi: 10.1108/jfmm-09-2021-0226.

Gupta, A. and Singh, R.K. (2021), "Applications of emerging technologies in logistics sector for achieving circular economy goals during COVID 19 pandemic: analysis of critical success factors", *International Journal of Logistics: Research and Applications*, Vol. 27 No. 4, pp. 1-22, doi: 10.1080/13675567.2021.1985095.

Gupta, H., Kusi-Sarpong, S. and Rezaei, J. (2020), "Barriers and overcoming strategies to supply chain sustainability innovation", *Resources, Conservation and Recycling*, Vol. 161, 104819, doi: 10.1016/j.resconrec.2020.104819.

Haleem, A., Khan, S., Luthra, S., Varshney, H., Alam, M. and Khan, M.I. (2021), "Supplier evaluation in the context of circular economy: a forward step for resilient business and environment concern", *Business Strategy and the Environment*, Vol. 30 No. 4, pp. 2119-2146, doi: 10.1002/bse.2736.

Helfat, C.E. and Peteraf, M.A. (2003), "The dynamic resource-based view: capability lifecycles", *Strategic Management Journal*, Vol. 24 No. 10, pp. 997-1010, doi: 10.1002/smj.332.

Hina, M., Chauhan, C., Sharma, R. and Dhir, A. (2023), "Circular economy business models as pillars of sustainability: where are we now, and where are we heading?", *Business Strategy and the Environment*, Vol. 32 No. 8, pp. 6182-6209, doi: 10.1002/bse.3480.

Hockerts, K. and Wüstenhagen, R. (2010), "Greening goliaths versus emerging Davids—theorizing about the role of incumbents and new entrants in sustainable entrepreneurship", *Journal of Business Venturing*, Vol. 25 No. 5, pp. 481-492, doi: 10.1016/j.jbusvent.2009.07.005.

Hsu, C.C. (2023), "The role of the core competence and core resource features of a sharing economy on the achievement of SDGs 2030", *Journal of Innovation and Knowledge*, Vol. 8 No. 1, 100283, doi: 10.1016/j.jik.2022.100283.

Hu, C., Xu, Z. and Chen, S. (2023), "How do businesses achieve sustainable success and improve the quality of products in the green competitive era?", *Total Quality Management and Business Excellence*, Vol. 34 Nos 3-4, pp. 496-514, doi: 10.1080/14783363.2022.2071693.

Huang, K., Wang, K., Lee, P.K. and Yeung, A.C. (2023), "The impact of Industry 4.0 on supply chain capability and supply chain resilience: a dynamic resource-based view", *International Journal of Production Economics*, Vol. 262, 108913, doi: 10.1016/j.ijpe.2023.108913.

Hubbard, G. (2009), "Measuring organizational performance: beyond the triple bottom line", *Business Strategy and the Environment*, Vol. 18 No. 3, pp. 177-191, doi: 10.1002/bse.564.

Husain, Z., Maqbool, A., Haleem, A., Pathak, R.D. and Samson, D. (2021), "Analyzing the business models for circular economy implementation: a fuzzy TOPSIS approach", *Operations Management Research*, Vol. 14 Nos 3-4, pp. 256-271, doi: 10.1007/s12063-021-00197-w.

Jabbour, C.J.C., Seuring, S., de Sousa Jabbour, A.B.L., Jugend, D., Fiorini, P.D.C., Latan, H. and Izeppi, W.C. (2020), "Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids", *Journal of Environmental Management*, Vol. 264, 110416, doi: 10.1016/j.jenvman.2020.110416.

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 (Switzerland)*, Vol. 14 No. 15, pp. 1-17, doi: 10.3390/su14159523.

Kajtazi, K., Rexhepi, G., Sharif, A. and Ozturk, I. (2023), "Business model innovation and its impact on corporate sustainability", *Journal of Business Research*, Vol. 166, 114082, doi: 10.1016/j.jbusres.2023.114082.

Kamble, S.S., Belhadi, A., Gunasekaran, A., Ganapathy, L. and Verma, S. (2021), "A large multi-group decision-making technique for prioritizing the big data-driven circular economy practices in the automobile component manufacturing industry", *Technological Forecasting and Social Change*, Vol. 165, 120567, doi: 10.1016/j.techfore.2020.120567.

Karimi, R.F. and NabaviChashmi, S.A. (2019), "Designing green entrepreneurship model in sustainable development consistent with the performance of Tehran industrial towns", *Journal of Business-to-Business Marketing*, Vol. 26 No. 1, pp. 95-102, doi: 10.1080/1051712x.2019.1565143.

Kashav, V., Garg, C.P., Kumar, R. and Sharma, A. (2022), "Management and analysis of barriers in the maritime supply chains (MSCs) of containerized freight under fuzzy environment", *Research In Transportation Business and Management*, Vol. 43, 100793, doi: 10.1016/j.rtbm.2022.100793.

Kavilal, E.G., Venkatesan, S.P. and Sanket, J. (2018), "An integrated interpretive structural modeling and a graph-theoretic approach for measuring the supply chain complexity in the Indian automotive industry", *Journal of Manufacturing Technology Management*, Vol. 29 No. 3, pp. 478-514, doi: 10.1108/jmtm-03-2017-0032.

Kayikci, Y., Kazancoglu, Y., Gozacan-Chase, N. and Lafci, C. (2022a), "Analyzing the drivers of smart sustainable circular supply chain for sustainable development goals through stakeholder theory", *Business Strategy and the Environment*, Vol. 31 No. 7, pp. 3335-3353, doi: 10.1002/bse.3087.

Kayikci, Y., Kazancoglu, Y., Lafci, C., Gozacan-Chase, N. and Mangla, S.K. (2022b), "Smart circular supply chains to achieving SDGs for post-pandemic preparedness", *Journal of Enterprise Information Management*, Vol. 35 No. 1, pp. 237-265, doi: 10.1108/jeim-06-2021-0271.

Kazancoglu, I., Sagnak, M., Mangla, S.K. and Kazancoglu, Y. (2021a), "Circular economy and the policy: a framework for improving the corporate environmental management in supply chains", *Business Strategy and the Environment*, Vol. 30 No. 1, pp. 590-608, doi: 10.1002/bse.2641.

Kazancoglu, Y., Sagnak, M., Mangla, S.K., Sezer, M.D. and Pala, M.O. (2021b), "A fuzzy based hybrid decision framework to circularity in dairy supply chains through big data solutions", *Technological Forecasting and Social Change*, Vol. 170, 120927, doi: 10.1016/j.techfore.2021.120927.

Khan, O., Daddi, T. and Iraldo, F. (2020), "The role of dynamic capabilities in circular economy implementation and performance of companies", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 6, pp. 3018-3033, doi: 10.1002/csr.2020.

Khan, S.A.R., Piprani, A.Z. and Yu, Z. (2022a), "Digital technology and circular economy practices: future of supply chains", *Operations Management Research*, Vol. 15 Nos 3-4, pp. 676-688, doi: 10.1007/s12063-021-00247-3.

Khan, S.A.R., Yu, Z., Sarwat, S., Godil, D.I., Amin, S. and Shujaat, S. (2022b), "The role of block chain technology in circular economy practices to improve organisational performance", *International Journal of Logistics-Research and Applications*, Vol. 25 Nos 4-5, pp. 605-622, doi: 10.1080/13675567.2021.1872512.

Klein, N., Ramos, T.B. and Deutz, P. (2022), "Factors and strategies for circularity implementation in the public sector: an organisational change management approach for sustainability", *Corporate Social Responsibility and Environmental Management*, Vol. 29 No. 3, pp. 509-523, doi: 10.1002/csr.2215.

Kouhizadeh, M., Zhu, Q. and Sarkis, J. (2023), "Circular economy performance measurements and blockchain technology: an examination of relationships", *International Journal of Logistics Management*, Vol. 34 No. 3, pp. 720-743, doi: 10.1108/ijlm-04-2022-0145.

Kristoffersen, E., Mikalef, P., Blomsma, F. and Li, J. (2021), "Towards a business analytics capability for the circular economy", *Technological Forecasting and Social Change*, Vol. 171, 120957, doi: 10.1016/j.techfore.2021.120957.

Kumar, N., Kumar, G. and Singh, R.K. (2022), "Analysis of barriers intensity for investment in big data analytics for sustainable manufacturing operations in post-COVID-19 pandemic era", *Journal of Enterprise Information Management*, Vol. 35 No. 1, pp. 179-213, doi: 10.1108/jeim-03-2021-0154.

Kumar, M., Raut, R.D., Jagtap, S. and Choubey, V.K. (2023), "Circular economy adoption challenges in the food supply chain for sustainable development", *Business Strategy and the Environment*, Vol. 32 No. 4, pp. 1334-1356, doi: 10.1002/bse.3191.

Le, T.T. (2022), "How humane entrepreneurship fosters sustainable supply chain management for a circular economy moving towards sustainable corporate performance", *Journal of Cleaner Production*, Vol. 368, 133178, doi: 10.1016/j.jclepro.2022.133178.

Le, T.H., Hoang, P.D. and To, T.T. (2022), "Is product proximity a driver for better energy security? Global evidence of nonlinear relationships between product proximity and energy security", *International Journal of Sustainable Development and World Ecology*, Vol. 29 No. 4, pp. 366-386, doi: 10.1080/13504509.2022.2025500.

Liu, S., He, N., Cao, X., Li, G. and Jian, M. (2022), "Logistics cluster and its future development: a comprehensive research review", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 168, 102974, doi: 10.1016/j.tre.2022.102974.

Liu, Y., Wood, L.C., Venkatesh, V.G., Zhang, A. and Farooque, M. (2021), "Barriers to sustainable food consumption and production in China: a fuzzy DEMATEL analysis from a circular economy perspective", *Sustainable Production and Consumption*, Vol. 28, pp. 1114-1129, doi: 10.1016/j.spc.2021.07.028.

Lotfi, M., Yousefi, A. and Jafari, S. (2018), "The effect of emerging green market on green entrepreneurship and sustainable development in knowledge-based companies", *Sustainability*, Vol. 10 No. 7, 2308, doi: 10.3390/su10072308.

Luoma, P., Rauter, R., Penttinen, E. and Toppinen, A. (2023), "The value of data for environmental sustainability as perceived by the customers of a tissue-paper supplier", *Corporate Social Responsibility and Environmental Management*, Vol. 30 No. 6, pp. 3110-3123, doi: 10.1002/csr.2541.

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.

Luu, T.T. (2022), "Fostering green service innovation perceptions through green entrepreneurial orientation: the roles of employee green creativity and customer involvement", *International Journal of Contemporary Hospitality Management*, Vol. 34 No. 7, pp. 2640-2663, doi: 10.1108/ijchm-09-2021-1136.

Macchion, L., Toscani, A.C. and Vinelli, A. (2023), "Sustainable business models of small and medium-sized enterprises and the relationships to be established within the supply chain to support these models", *Corporate Social Responsibility and Environmental Management*, Vol. 30 No. 2, pp. 563-573, doi: 10.1002/csr.2374.

Makhloufi, L., Laghouag, A.A., Meirun, T. and Belaid, F. (2022), "Impact of green entrepreneurship orientation on environmental performance: the natural resource-based view and environmental policy perspective", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 425-444, doi: 10.1002/bse.2902.

Marrucci, L., Iannone, F., Daddi, T. and Iraldo, F. (2021), "Antecedents of absorptive capacity in the development of circular economy business models of small and medium enterprises", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 532-544, doi: 10.1002/bse.2908.

Marrucci, L., Daddi, T. and Iraldo, F. (2022), "Do dynamic capabilities matter? A study on environmental performance and the circular economy in European certified organisations", *Business Strategy and the Environment*, Vol. 31 No. 6, pp. 2641-2657, doi: 10.1002/bse.2997.

Mathivathanan, D., Mathiyazhagan, K., Khorana, S., Rana, N.P. and Arora, B. (2022), "Drivers of circular economy for small and medium enterprises: case study on the Indian state of Tamil Nadu", *Journal of Business Research*, Vol. 149, pp. 997-1015, doi: 10.1016/j.jbusres.2022.06.007.

Matsukawa, I. (2012), "The welfare effects of environmental taxation on a green market where consumers emit a pollutant", *Environmental and Resource Economics*, Vol. 52 No. 1, pp. 87-107, doi: 10.1007/s10640-011-9521-7.

Mazzucchelli, A., Chierici, R., Del Giudice, M. and Bua, I. (2022), "Do circular economy practices affect corporate performance? Evidence from Italian large-sized manufacturing firms", *Corporate Social Responsibility and Environmental Management*, Vol. 29 No. 6, pp. 1-14, doi: 10.1002/csr.2298.

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, 131389, doi: 10.1016/j.jclepro.2022.131389.

Moktadir, M.A., Dwivedi, A., Rahman, A., Jabbour, C.J.C., Paul, S.K., Sultana, R. and Madaan, J. (2020a), "An investigation of key performance indicators for operational excellence towards sustainability in the leather products industry", *Business Strategy and the Environment*, Vol. 29 No. 8, pp. 3331-3351, doi: 10.1002/bse.2575.

Moktadir, M.A., Rahman, T., Ali, S.M., Nahar, N. and Paul, S.K. (2020b), "Examining barriers to reverse logistics practices in the leather footwear industry", *Annals of Operations Research*, Vol. 293 No. 2, pp. 715-746, doi: 10.1007/s10479-019-03449-y.

Mondal, S., Singh, S. and Gupta, H. (2023), "Green entrepreneurship and digitalization enabling the circular economy through sustainable waste management-an exploratory study of emerging economy", *Journal of Cleaner Production*, Vol. 422, 138433, doi: 10.1016/j.jclepro.2023.138433.

Mostaghel, R. and Chirumalla, K. (2021), "Role of customers in circular business models", *Journal of Business Research*, Vol. 127, pp. 35-44, doi: 10.1016/j.jbusres.2020.12.053.

Mukherjee, A.A., Singh, R.K., Mishra, R. and Bag, S. (2022), "Application of blockchain technology for sustainability development in agricultural supply chain: justification framework", *Operations Management Research*, Vol. 15 Nos 1-2, pp. 46-61, doi: 10.1007/s12063-021-00180-5.

Mukonza, C. (2020), "An analysis of factors influencing green entrepreneurship activities in South Africa", in *Inclusive Green Growth: Challenges and Opportunities for Green Business in Rural Africa*, pp. 47-67.

Münch, C., Benz, L.A. and Hartmann, E. (2022), "Exploring the circular economy paradigm: a natural resource-based view on supplier selection criteria", *Journal of Purchasing and Supply Management*, Vol. 28 No. 4, 100793, doi: 10.1016/j.pursup.2022.100793.

Naderi, N., Monavvarifard, F. and Salehi, L. (2022), "Fostering sustainability-oriented knowledge-sharing in academic environment: a key strategic process to achieving SDGs through development of students' sustainable entrepreneurship competences", *International Journal of Management Education*, Vol. 20 No. 1, 100603, doi: 10.1016/j.ijme.2022.100603.

Nayal, K., Kumar, S., Raut, R.D., Queiroz, M.M., Priyadarshinee, P. and Narkhede, B.E. (2022), "Supply chain firm performance in circular economy and digital era to achieve sustainable development goals", *Business Strategy and the Environment*, Vol. 31 No. 3, pp. 1058-1073, doi: 10.1002/bse.2935.

Neri, A., Negri, M., Cagno, E., Kumar, V. and Garza-Reyes, J.A. (2023), "What digital-enabled dynamic capabilities support the circular economy? A multiple case study approach", *Business Strategy and the Environment*, Vol. 32 No. 7, pp. 5083-5101, doi: 10.1002/bse.3409.

Neuendorf, K.A. and Skalski, P.D. (2009), "Quantitative content analysis and the measurement of collective identity", in *Measuring Identity: a Guide for Social Scientists*, pp. 203-236.

Nirmal, D.D., Nageswara Reddy, K. and Singh, S.K. (2023), "Application of fuzzy methods in green and sustainable supply chains: critical insights from a systematic review and bibliometric analysis", *Benchmarking: An International Journal*, Vol. 31 No. 5, pp. 1700-1748, doi: 10.1108/bij-09-2022-0563.

Obeidat, S.M., Abdalla, S. and Al Bakri, A.A.K. (2023), "Integrating green human resource management and circular economy to enhance sustainable performance: an empirical study from the Qatari service sector", *Employee Relations*, Vol. 45 No. 2, pp. 535-563, doi: 10.1108/er-01-2022-0041.

Pansare, R. and Yadav, G. (2022), "Repurposing production operations during COVID-19 pandemic by integrating Industry 4.0 and reconfigurable manufacturing practices: an emerging economy perspective", *Operations Management Research*, Vol. 15 Nos 3-4, pp. 1270-1289, doi: 10.1007/s12063-022-00310-7.

Piila, N., Sarja, M., Onkila, T. and Mäkelä, M. (2022), "Organisational drivers and challenges in circular economy implementation: an issue life cycle approach", *Organization and Environment*, Vol. 35 No. 4, pp. 523-550, doi: 10.1177/10860266221099658.

Pinheiro, M.A.P., Jugend, D., Jabbour, A., Jabbour, C.J.C. and Latan, H. (2022), "Circular economy-based new products and company performance: the role of stakeholders and Industry 4.0 technologies", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 483-499, doi: 10.1002/bse.2905.

Priyadarshini, J., Singh, R.K., Mishra, R., He, Q. and Braganza, A. (2024), "Implementation of additive manufacturing in the healthcare supply chain for circular economy goals: paradoxical tensions and solutions from an Industry 5.0 perspective", *Information Systems Frontiers*, pp. 1-23, doi: 10.1007/s10796-024-10482-1.

Puglieri, F.N., Salvador, R., Romero-Hernandez, O., Escrivão Filho, E., Piekarski, C.M., de Francisco, A.C. and Ometto, A.R. (2022), "Strategic planning oriented to circular business models: a decision framework to promote sustainable development", *Business Strategy and the Environment*, Vol. 31 No. 7, pp. 3254-3273, doi: 10.1002/bse.3074.

Puntillo, P. (2023), "Circular economy business models: towards achieving sustainable development goals in the waste management sector—empirical evidence and theoretical implications", *Corporate Social Responsibility and Environmental Management*, Vol. 30 No. 2, pp. 941-954, doi: 10.1002/csr.2398.

Razzaq, A., Sharif, A., Najmi, A., Tseng, M.L. and Lim, M.K. (2021), "Dynamic and causality interrelationships from municipal solid waste recycling to economic growth, carbon emissions and energy efficiency using a novel bootstrapping autoregressive distributed lag", *Resources, Conservation and Recycling*, Vol. 166, 105372, doi: 10.1016/j.resconrec.2020.105372.

Riggs, R., Roldán, J.L., Real, J.C. and Felipe, C.M. (2023), "Opening the black box of big data sustainable value creation: the mediating role of supply chain management capabilities and circular economy practices", *International Journal of Physical Distribution and Logistics Management*, Vol. 53 Nos 7/8, pp. 762-788, doi: 10.1108/ijpdlm-03-2022-0098.

Roberts, L., Georgiou, N. and Hassan, A.M. (2023), "Investigating biodiversity and circular economy disclosure practices: insights from global firms", *Corporate Social Responsibility and Environmental Management*, Vol. 30 No. 3, pp. 1053-1069, doi: 10.1002/csr.2402.

Saaty, T.L. (1980), "The analytic hierarchy process (AHP)", *The Journal of the Operational Research Society*, Vol. 41 No. 11, pp. 1073-1076.

Sabale, D.B., Kaswan, M.S., Rathi, R. and Yadav, V. (2023), "Investigating and modeling the circular economy enablers in product development process: net zero as a moderator", *Benchmarking: An International Journal*, Vol. 32 No. 1, pp. 241-260, doi: 10.1108/bij-06-2023-0401.

Scarpellini, S., Valero-Gil, J., Moneva, J.M. and Andreaus, M. (2020), "Environmental management capabilities for a 'circular eco-innovation'", *Business Strategy and the Environment*, Vol. 29 No. 5, pp. 1850-1864, doi: 10.1002/bse.2472.

Schaltegger, S. and Burritt, R. (2018), "Business cases and corporate engagement with sustainability: differentiating ethical motivations", *Journal of Business Ethics*, Vol. 147 No. 2, pp. 241-259, doi: 10.1007/s10551-015-2938-0.

Schaltegger, S., Lüdeke-Freund, F. and Hansen, E.G. (2012), "Business cases for sustainability: the role of business model innovation for corporate sustainability", *International Journal of Innovation and Sustainable Development*, Vol. 6 No. 2, pp. 95-119, doi: 10.1504/ijisd.2012.046944.

Shafique, I., Kalyar, M.N. and Mehwish, N. (2021), "Organizational ambidexterity, green entrepreneurial orientation, and environmental performance in SMEs context: examining the moderating role of perceived CSR", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 1, pp. 446-456, doi: 10.1002/csr.2060.

Shang, C., Saeidi, P. and Goh, C.F. (2022), "Evaluation of circular supply chains barriers in the era of Industry 4.0 transition using an extended decision-making approach", *Journal of Enterprise Information Management*, Vol. 35 Nos 4-5, pp. 1100-1128, doi: 10.1108/jeim-09-2021-0396.

Sharma, Y.K., Mangla, S.K., Patil, P.P. and Liu, S. (2019), "When challenges impede the process: for circular economy-driven sustainability practices in food supply chain", *Management Decision*, Vol. 57 No. 4, pp. 995-1017.

Shrivastava, M. and Tamvada, J.P. (2019), "Which green matters for whom? Greening and firm performance across age and size distribution of firms", *Small Business Economics*, Vol. 52 No. 4, pp. 951-968, doi: 10.1007/s11187-017-9942-y.

Singh, R.K., Kumar, A., Garza-Reyes, J.A. and de Sá, M.M. (2020), "Managing operations for circular economy in the mining sector: an analysis of barriers intensity", *Resources Policy*, Vol. 69, 101752, doi: 10.1016/j.resourpol.2020.101752.

Singh, J., Pandey, K.K., Kumar, A., Naz, F. and Luthra, S. (2022), "Drivers, barriers and practices of net zero economy: an exploratory knowledge based supply chain multi-stakeholder perspective framework", *Operations Management Research*, Vol. 16 No. 3, pp. 1059-1090, doi: 10.1007/s12063-022-00255-x.

Skare, M., Gavurova, B. and Rigelsky, M. (2024), "Quantification of the impact of innovations in industry and infrastructure for sustainable circular economy production and consumption", *Journal of Innovation and Knowledge*, Vol. 9 No. 1, 100456, doi: 10.1016/j.jik.2023.100456.

Stumpf, L., Schöggl, J.P. and Baumgartner, R.J. (2021), "Climbing up the circularity ladder? A mixed-methods analysis of circular economy in business practice", *Journal of Cleaner Production*, Vol. 316, 128158, doi: 10.1016/j.jclepro.2021.128158.

Stumpf, L., Schöggl, J.-P. and Baumgartner, R.J. (2023), "Circular plastics packaging – prioritizing resources and capabilities along the supply chain", *Technological Forecasting and Social Change*, Vol. 188, 122261, doi: 10.1016/j.techfore.2022.122261.

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, 125847, doi: 10.1016/j.jclepro.2021.125847.

Thirupathi, R. and Vinodh, S. (2016), "Application of interpretive structural modelling and structural equation modelling for analysis of sustainable manufacturing factors in Indian automotive component sector", *International Journal of Production Research*, Vol. 54 No. 22, pp. 6661-6682, doi: 10.1080/00207543.2015.1126372.

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.

Tze San, O., Latif, B. and Di Vaio, A. (2022), "GEO and sustainable performance: the moderating role of GTD and environmental consciousness", *Journal of Intellectual Capital*, Vol. 23 No. 7, pp. 38-67, doi: 10.1108/jic-10-2021-0290.

Vecchio, P.D., Urbinati, A. and Kirchherr, J. (2022), "Enablers of managerial practices for circular business model design: an empirical investigation of an agro-energy company in a rural area", *IEEE Transactions on Engineering Management*, Vol. 71, pp. 873-887, doi: 10.1109/tem.2021.3138327.

Vimal, K.E.K., Sivakumar, K., Kandasamy, J., Venkat, V. and Mani, R.S. (2023), "Barriers to the adoption of digital technologies in a functional circular economy network", *Operations Management Research*, Vol. 16 No. 3, pp. 1541-1561, doi: 10.1007/s12063-023-00375-y.

Walker, A.M., Simboli, A., Vermeulen, W.J.V. and Raggi, A. (2023), "A dynamic capabilities perspective on implementing the circular transition indicators: a case study of a multi-national packaging company", *Corporate Social Responsibility and Environmental Management*, Vol. 30 No. 5, pp. 2679-2692, doi: 10.1002/csr.2487.

Wang, L., Chu, J. and Wu, J. (2007), "Selection of optimum maintenance strategies based on a fuzzy analytic hierarchy process", *International Journal of Production Economics*, Vol. 107 No. 1, pp. 151-163, doi: 10.1016/j.ijpe.2006.08.005.

Xu, A., Wang, C., Tang, D. and Ye, W. (2022), "Tourism circular economy: identification and measurement of tourism industry ecologization", *Ecological Indicators*, Vol. 144, 109476, doi: 10.1016/j.ecolind.2022.109476.

Yadav, H., Soni, U. and Kumar, G. (2023), "Analysing challenges to smart waste management for a sustainable circular economy in developing countries: a fuzzy DEMATEL study", *Smart and Sustainable Built Environment*, Vol. 12 No. 2, pp. 361-384, doi: 10.1108/sasbe-06-2021-0097.

Yu, Y., Xu, J., Zhang, J.Z., Wu, Y. and Liao, Z. (2022), "Do circular economy practices matter for financial growth? An empirical study in China", *Journal of Cleaner Production*, Vol. 370, 133255, doi: 10.1016/j.jclepro.2022.133255.

Zaidi, S.A.H., Mirza, F.M., Hou, F. and Ashraf, R.U. (2019), "Addressing the sustainable development through sustainable procurement: what factors resist the implementation of sustainable procurement in Pakistan?", *Socio-Economic Planning Sciences*, Vol. 68, 100671, doi: 10.1016/j.seps.2018.11.008.

Zarbakhshnia, N., Govindan, K., Kannan, D. and Goh, M. (2023), "Outsourcing logistics operations in circular economy towards to sustainable development goals", *Business Strategy and the Environment*, Vol. 32 No. 1, pp. 134-162, doi: 10.1002/bse.3122.

Zhao, X., Shang, Y. and Song, M. (2020), "Industrial structure distortion and urban ecological efficiency from the perspective of green entrepreneurial ecosystems", *Socio-Economic Planning Sciences*, Vol. 72, 100757, doi: 10.1016/j.seps.2019.100757.

Further reading

Chang, D. (1996), "Applications of the extent analysis method on fuzzy AHP", *European Journal of Operational Research*, Vol. 95 No. 3, pp. 649-655, doi: 10.1016/0377-2217(95)00300-2.

Dubois, D. and Prade, H. (1978), "Operations on fuzzy numbers", *International Journal of Systems Science*, Vol. 9 No. 6, pp. 613-626, doi: 10.1080/00207727808941724.

Supplementary material

The supplementary material for this article can be found online.

Corresponding author

Himanshu Gupta can be contacted at: himanshuguptadoms@gmail.com