



Circular value creation: business models and supply chain strategies

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Abstract

This paper aims to advance research on the circular economy, sustainable innovation through adopting a circular business model (CBM), and circular supply chain management (CSCM). The circular economy is gradually acknowledged as promising to attain ecological growth by minimising resource input, waste, emissions and energy loss. This article investigates the environmental efficacy of circular value creation and its implications for business models and supply chain strategies. It intends to incorporate CBM and CSCM for sustainable innovation and ecological growth, relying on a review of the literature and four case analyses. The context identifies five distinct CBM propelling supply chain strategies and sustainable innovation, supply chain loops, which differ in intricacy and worth. The study demonstrates that circular business models (CBM) and circular CSCM models can facilitate organisations in accomplishing ecological objectives. The companies examined in the study have different characteristics, but all face comparable challenges in persuading consumers and suppliers to adopt circular business models and supply chain management. A significant challenge is that customers perceive products made from recycled or remanufactured materials as inferior to traditional products, leading to lower prices despite meeting comparable quality standards. Therefore, we review the current literature on the business model background to technological, organisational and social innovation. Since the existing literature does not provide a general conceptual definition of sustainable innovation and circular business mode for circular supply chain management, we present normative examples of requirements that circular business models should meet to support sustainable innovation. Finally, we outline the research agenda by asking some guiding questions.

Keywords Circular economy (CE) · Circular business model (CBM) · Circular supply chain management (CSCM) · Sustainable innovation · Ecological efficacy · Environmental and economic goals

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Introduction

Ecological growth aims to fulfil current necessities without obstructing future generation potential to satisfy their demands. It considers the restrictions of globe's reserves on human-growth and the working together and trade-offs among monetary, ecological and communal objectives (D. Singh and Verma 2018). The UN has introduced seventeen ecological growth goals to be attained, encompassing areas such as continuing from the Millennium Goals (Işık et al. 2019b). The new targets focus on reducing poverty, achieving gender equality and promoting sustainable urban development. The CE (circular economy) is founded on leveraging private enterprises to facilitate the move towards a more ecological system (Hailiang et al. 2023). As companies have the most significant pool of resources and capabilities, they can considerably drive this change by producing added benefits through an expanded, carefully overseen setup of stakeholders. Specifically, the Failed-Value Interactions awareness is crucial in this framework; it undertakes that by capturing value that is forfeited, ruined, not incorporated or not provided scorn claim in the market, establishments can hypothetically enhance societal well-being while simultaneously achieving a competitive edge (Godil et al. 2020).

The idea of the CE is progressively recognised as a potential mixture to achieve ecologically by minimising waste, emissions and energy leakage in the economic system (Irshad et al. 2019). This notion was initially presented in 1990 to explore the connection between the environment and its financial functions, which include amenity values, resource base and support system. The goal was to develop a self-replenishing plan that limits the input of materials and energy while preventing environmental harm and hindering growth and progress (Chen and Paulraj 2004).

However, it is plausible that the concept of a self-replenishing system was introduced earlier. The idea of a business model gained popularity during the rise of e-commerce in the 1990s to present investors with clear and comprehensive business ideas (Coenen et al. 2022). Although various sources need to be specified, the model inversely, a unified understanding has been established through thorough reviews of these definitions. A business model can be described as a simplified representation of components of an intricate organisational structure and links among these aspects (Cambero and Sowlati 2014). It outlines an organisation's value intention, how quantity is created and delivered and how it is captured. The goal is to facilitate analysis of the appearance of growing intricacy. Most approaches consider the organisational value network to some degree (Begum Siddiqui et al. 2023). Circular business models (CBMs) are designed for the CE and include factors that close means loops to reduce feedback into the association and its cost link while minimising emissions. CBM is linked to circular CSCM to achieve closed loops through different methods.

The primary distinction between traditional corporate models and those intended for the CE is observed mainly in their benefit design and element, especially in the CSCM for sustainable innovation. CSCM involves arranging and coordinating the supply chain to close resource loops (Govindan et al. 2023). Despite its significance for CBM and the circular economy, CSCM is an under-explored research area (Sharif et al. 2020b). And to obtain more comprehension of CSCM and CBM, a framework is suggested to combine these ideas towards ecological growth (Ahi and Searcy 2015), and the economically viable material reuse needs to be complemented by appropriate business models that can commercialise price-competitive products, meet regulatory standards and deliver substantial sustainability benefits. A business model perspective is valuable for studying issues related to related innovation processes, such as how companies create value through new products and technologies, and revised value propositions and value chain networks while adhering to circular economy principles. Other questions of interest in business model analysis include what value a business model creates for the firm and its customers, and other stakeholders such as the environment or society.

Although new business models for material reuse in construction have emerged recently, their spread has been slow. Khokhar et al. (2020a) found that a limited understanding of the impact of material reuse is one of the main barriers for companies to develop circular economy solutions in the construction sector. Developing products using reusable materials that are price-competitive with primary resources remains a challenge, as innovations in material reuse often require technology development and upfront investment. At the same time, a product's market success and sustainability impact is often uncertain. The business and environmental case for material reuse remains underexplored mainly, and rigorous case studies that can validate the value creation of reuse strategies are lacking.

This study includes four case studies: alpha, a recycled office furniture manufacturer; beta, a flat aluminium sheet manufacturer with high reprocessed matter and gamma, which generates trendy decorations from delta, offer motorcycle-sharing assistance. The research paper ends with a summary and a look towards the future.

Literature review

Circular economy: adopting circular business models

The current interpretation of the CE originates from various schools of thought. The key objective of this economic system is to minimise excess and preserve the innate worth of food for as long as feasible. Achieving this goal involves recycling items and energy after usage to prevent them

from escaping the system (Sauer and Seuring 2018). The butterfly diagram illustrates the constant flow of resources through the amount set and emphasises the genetic and technological closed twists rather than any circular loop (Hou et al. 2023).

Incorporating sustainability into business operations through sustainable business models (SBMs) requires integrating three key elements: sustainable value, proactive management of a diverse range of stakeholders and a long-term perspective, as shown in Table 1. These elements are increasingly emphasised in SBM literature. SBMs prioritise exceptional customer value and social and environmental benefits, economic advantages and reducing environmental and social problems (Hossain et al. 2023). Collaboration with various stakeholders is critical for creating social, environmental and economic value and aligning the interests of a broader range of stakeholders, rather

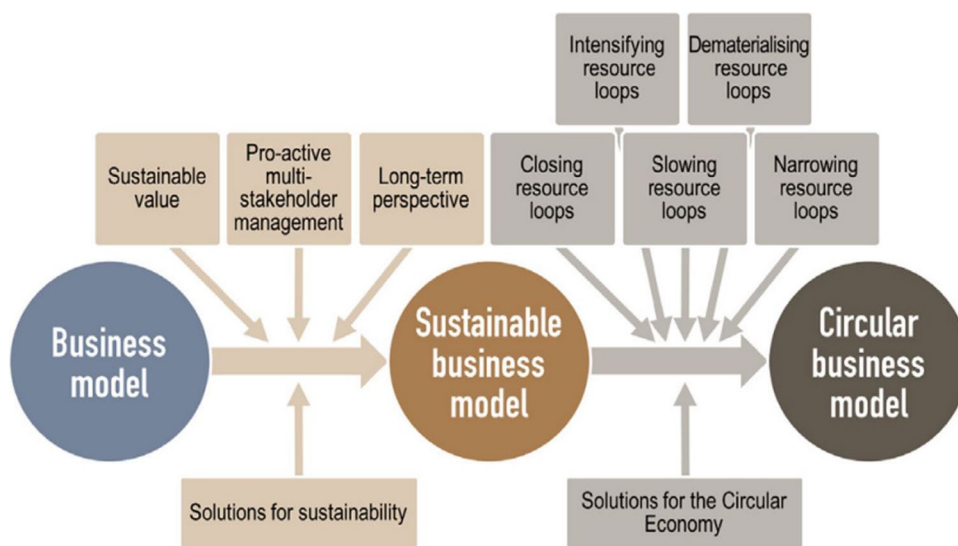
than just focusing on financial returns for consumers and investors, as unsustainable corporate models do (Suhandi and Chen 2023).

We believe that circular economy business models belong to sustainable business strategies. Their main aim is to improve sustainability performance by minimising contributions of resources and curtailing trash and emissions outflow from the administrative approach, achieved by closing loops (Khan et al. 2021), as shown in Fig. 1. Closing loops pertain to the natural and technological nutrition drives of the CE, which involve reprocessing, enhancing efficacy (Işık et al. 2023) and extending the application phase. While it was initially classified as part of the slowdown process, we want to underscore the importance of an intensified utilisation phase and introduce the notion of substituting product utility with software and service options (Khan et al. 2021).

Table 1 Deployment of sustainability dimensions into circular business models (CBM)

Sustainability dimensions	Circular business models (CBM)		
	Value proposition	Value creation and delivery system	Value capture
Economic	Offerings (products and services) with economic margin to ensure profit	Incentives for actors in the supply chain to extend product use and return disposal to the value system	Gain (or at least not negative result) to each stakeholder
Environmental	Products and services designed to minimise natural resources depletion	Eco-efficient production and logistic operations	Reduced environmental burden by extracting more value from less natural resource consumption
Social	Maximise product and service value for society's well-being	Pro-active approach towards stakeholders in the closed loops	Further environmental consciousness on the importance of products
Protection of future generations	Long-term capacity to address economic, environmental and social concerns	Incremental and radical changes at the system level to ensure long-term partnerships	Preparation of current production systems to make “perfect” circular economy viable in the future

Fig. 1 Comparison of circular business models



In terms of an organisation's value proposition, its main goals and vision must be translated into offerings that generate revenue, which can cover direct and indirect expenses (Afshan and Sharif 2016). These offerings should be developed using eco-design and design-for-disassembly techniques, which aim to promote the well-being of society and the ability to tackle long-term economic, environmental, and social issues (Zhu and Sarkis 2004) and create value for CBM. It is vital to establish a profit link involving investors driven by and providing financial viability, environmental benefits, social considerations, and long-term business sustainability (Khokhar et al. 2020b). Additionally, the value obtained by the CBM system comprises not only financial benefits but also the preservation of natural resources and the well-being of society in the quick and lengthy term (Luo et al. 2022).

Circularity in supply chain management

The origin of supply chain management (SCM) can be traced back to the work of Oliver and Webber, which generated considerable interest from various fields, including operations management and psychology. As a result, a vast collection of literature comprising more than 40 thousand books and articles has been produced on the subject (Khokhar et al. 2022). However, the concept has numerous definitions and interpretations due to the various disciplines and research methodologies involved in SCM. Upon reviewing the literature, we describe SCM as the coordination and management of diverse organisational purposes, such as promotion, IT, economics and customer facility, within and across businesses and administrations to optimise operational efficiency and effectiveness, leading to a competitive edge (Wan Ahmad et al. 2016).

The success of SCM relies on the organisation's networks, as no single entity possesses all the essential abilities and assets to produce its profit proposal (Hou et al. 2021a, 2021b). The configuration of these associations varies based on specific attributes, such as the features of each organisation being the system nodule and the type of product (Liu et al. 2019). Additionally, the extent of cooperation between governments depends on the level of dedication, duration and formality of the relationship, ranging from a minimal market shift to an integrated company (Khaskhelly et al. 2022). This debate is especially significant in community sustainability because robust alliance networks are vital in improving sustainability performance (Bag et al. 2022).

The literature contains more specific descriptions of SCM that often focus on procurement. These definitions prioritise tactical variety, cooperation with and management of contractors (Işık et al. 2019a), as shown in Table 2. Despite their practical usefulness and theoretical distinctiveness from other concepts, we employ a broader description to permit

Table 2 Literature overview circular value creation and its implications for business models and supply chain strategies from 2010 to 2022

Most cited textbooks	Review articles CBM	Review article of CSCM
Suki et al. (2020),	Ahmad et al. (2023)	Geissdoerfer et al. (2018)
G. Singh et al. (2022)	Yang et al. (2018)	Khokhar et al. (n.d.)
Ünal et al. (2019)	“Perceptions of Circular Business Models in SMEs,” 2018)	Gawusu et al. (2022)
Ongan et al. (2022)	Khan et al. (2019a)	Nandi et al. (2020)
Ünal et al. (2019)	“Perceptions of Circular Business Models in SMEs,” (2018)	Pollard et al. (2023)
Khan et al. (2019a)	HOU et al. (2021b)	Awudu and Zhang (2012)
Hou et al. (2023)	Khan et al. (2019b)	Khan et al. (2021)
Khan et al. (2019a)	Sharif et al. (2020a)	Afshan and Sharif (2016)

our debate's most comprehensive possible range of applications (Liang et al. 2022). Depending on its focus, SCM can be an essential portion of, or roughly indistinguishable from, the value chain and the creation and delivery of value (Kocaoğlu et al. 2013). Thus, it is a crucial component of an organisation's corporate models and has a significant role in converting them to CE. Managerial links must reconsider how and where value is generated, utilised and recovered (Işık et al. 2019a).

The discrepancies between traditional and circular business models in their supply chains are due to the necessity of closing, slowing and restricting the movement of materials and energy. We believe that for the most favourable sustainability act, all aspects of the company style must be consistent with these three objectives (Sreenu et al. 2022). Although some investigations have explored sustainable and ecologically responsible supply chains, such as the specialised issue of the research on SCs, for the CE, it is still in its emerging stages. The literature on the circular economy is limited, mainly concerning its implementation in China, with only a few evaluations focusing primarily on waste-to-energy supply chains (Hu et al. 2019).

Based on the available literature, we define CSCM as coordinating and organising various acts, including sales, advertising, IT, investment and customer assistance across organisations and industry groups, as shown in Table 3. The objective is to minimise material and energy flow, narrow it down, intensify, dematerialise, reduce reserve stored and avoid waste and discharge outflow from the method. This approach can enhance operational efficiency and effectiveness while creating competitive advantages (Fasan et al. 2021).

Table 3 Comparison of SCM, CSCM and CSCM for sustainable innovation (SI)

Empty cell	SCM	CSCM	CSCM for SI
Aim	Operative effectiveness and efficiency Competitive advantages	Operative effectiveness and efficiency Competitive advantages Minimising material and energy input Minimising waste and emission leakage	Operative effectiveness and efficiency Competitive advantages Minimising material and energy input Minimising waste and emission leakage
Means	Configuration organisational functions Coordination of organisational functions Closing resource loops	Configuration organisational functions Coordination of organisational functions Slowing resource loops Narrowing resource loops Closing resource loops	Configuration organisational functions Coordination of organisational functions Slowing resource loops Narrowing resource loops Long-term perspective

Considering the value chain’s significance to the corporate standard and the necessity of aligning all aspects of the corporate brand for optimum sustainability, it is plausible to argue that CSCM, which strives to foster sustainable development, should encompass SBM traits (Cetinkaya 2010). Hence, CSCM for organic growth ought to contain the generation of further economic and non-economic value, proactive management of multiple stakeholders and a prolonged-term outlook, as shown in Fig. 2.

Methodology

The research study utilised a literary analysis to establish a theoretical basis for the case studies that were carried out. This methodology was selected due to the study’s exploratory

nature, and case studies were deemed appropriate for examining current trends and obtaining a comprehensive understanding of unique scenarios applied to the present research.

After conducting a literature review and establishing the necessary background information, the researchers selected companies to participate in the study. Since the methodology involved case studies, the researchers opted for a theoretical sampling approach instead of a statistically representative one. The selection criteria required the companies’ business models to align with the circular economy framework’s closing, slowing, intensifying, narrowing and dematerialising loops, as shown in Fig. 3.

The study identified four companies that met these criteria: alpha, which manufactured remanufactured office furniture; beta, which focused on producing flat-rolled aluminium with a high percentage of recycled material; gamma, which made high-end

Value proposition <small>e.g. Product Design</small>	Value capture <small>e.g. Incentive for return/repair/...</small>	Value creation and delivery <small>e.g. Supply chain</small>	Example <small>Office furniture</small>	Economically sustainable <small>e.g. Profit</small>	Environmentally sustainable <small>e.g. CO₂ footprint</small>	Socially sustainable <small>e.g. Jobs created</small>
L	L	L	Traditional office furniture manufacturer	=	=	=
L	L	G	Recycling of returned furniture	-	+	=
L	G	L	Discount for returning old furniture, disposal by retailer	-	=	=
L	G	G	Discount for returning old furniture, recycling of conventionally designed furniture by manufacturer	-	+	+
G	L	L	Product design that uses recycled materials purchased from third parties	=	=	+
G	L	G	Recycling of returned furniture, product design that makes use of recycled materials	+	+	=
G	G	L	Discount for returning furniture, disposal by retailer, third party recycled materials in product design	=	=	=
G	G	G	Discount for returning furniture, in-house recycling, product design that uses recycled materials	+	+	+

+ Positive influence
 = Little influence
 - Negative influence

Fig. 2 A value-based view on sustainable circular business models

fashion accessories from fire hoses and delta, which offered a bike-sharing service (Bäckstrand and Fredriksson 2020). The first three companies were based in the UK, while the fourth was Brazilian. Beta was the only large corporation, while the others were medium- and small-sized businesses with fewer than fifty employees. Despite their industry and business model differences, each selected company provided valuable insights into the factors and functions contributing to the circular economy.

The researchers gathered data for their study by conducting semi-structured interviews with key individuals from the selected companies as their primary method. To address the potential for interviewee biases, the researchers used publicly available documents and information from the companies’ websites to supplement the interview data. The researchers asked for specific examples to support the interviewees’ general statements throughout the interviews. Key informants were selected based on their involvement and overall understanding of each company’s circular business model, including CEOs and founders from alpha, gamma and delta and the corporate sustainability manager from beta. The interviews focused on each company’s economic, environmental and social value proposition; creation and delivery systems and the value captured by various stakeholders in each case study. The data collected was analysed qualitatively, considering factors related to sustainable development and the circular economy.

To put it simply, CSCM for sustainable innovation builds on the goals and methods of traditional SCM and CSCM but with added focus on achieving social, environmental and economic goals, proactively managing multiple stakeholders, taking a long-term perspective and implementing measures to reduce, restrict and slow down the use of resources in supply chain activities.

Economical, environmental and social goals

To start analysing the case studies, we discussed the organisation’s economic, environmental and social objectives. We used a triangulated approach, combining information from the companies’ mission and vision statements posted

on their corporate websites with insights gained from interviews. To protect the confidentiality of the companies, we did not provide direct quotes from the websites. All four organisations are profit-driven and intend to cover costs and generate revenue by selling products or services. Three organisations have explicitly stated their objective of reducing landfill waste on their websites.

The case study analyses showed that the companies had varying levels of explicit connection to social goals. The study aimed to create local jobs through remanufacturing, while delta aimed to promote cycling as an alternative mode of transportation in urban areas. Beta declared its commitment to customers, co-workers and local communities but did not specify any goals for these stakeholders. However, the interviews and the company’s website showed that beta contributed to society through technological innovation and development related to the production process of sheets from recycled aluminium and the application and usage of aluminium sheets with high recycled content. Gamma’s statement was unclear and referred to the intangible value of preventing materials from going to landfills or incineration. All companies supported the market for recycled and remanufactured goods, and delta believed that promoting cycling could offset their emissions, although they had not yet quantified their environmental impact.

Taking a proactive approach to managing multiple stakeholders

Effective management of multiple stakeholders is critical to circular supply chain management (CSCM) and circular business models (CBM). It involves providing value to various internal and external stakeholders proactively. The companies examined had a proactive approach towards their shareholders and other stakeholders, as shown in Table 4. For example, alpha and gamma aimed to lead by example and encourage innovation and partnerships to make circular business practices feasible while contributing to the circular economy. Beta

Fig. 3 Components of a circular business model (CBM) template

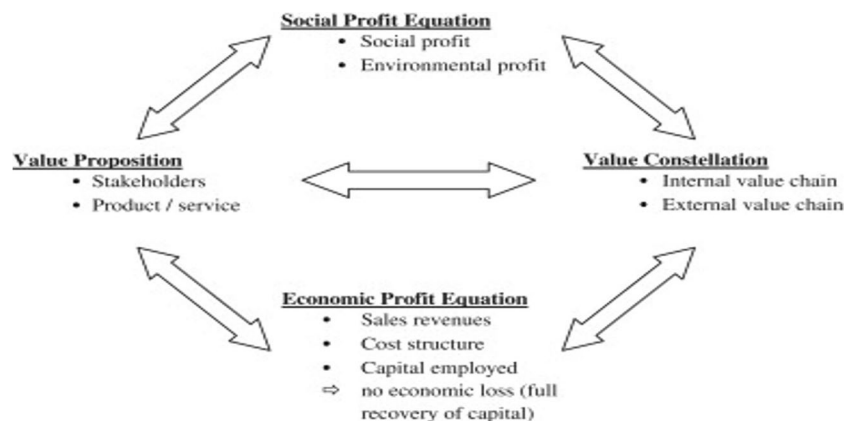


Table 4 Sustainable value captured by stakeholders

Stakeholder	Alpha	Beta	Gamma	Delta
Shareholders/investors	Structurally lower cost disruptive high growth and sustainable business	Supply risk reduction, longer-term return	Satisfaction of company with the purpose	Satisfaction and motivation
Employees	Opportunity to work for a company with the purpose	Motivation towards challenging targets for increasing the rate of recycled content in the product	Satisfaction of business with purpose Decent salary	Satisfaction of business with purpose
Clients	Quality and price combination for products and services, wellness and productivity (interior design)	Product quality (independent from the inputs for production) Partnership with clients for technology development applied to low-carbon aluminium components and applications	Purpose-driven products Long-term products (financial return)	Private sponsor for bike-sharing service: brand value, relation to local government
Suppliers	Chance to sell surplus waste stock (used as input for the remanufacturing process)	Development of equipment suppliers to address the technical challenges of high recycled content	Close relationship with suppliers of materials (such as the fire-fighters community)	Income Connection to the business purpose
Society	Local semi-skilled jobs, reduction of supply risk, demonstration of a working circular business	Higher environmental awareness Engagement of local organisations to collect recycled material Low carbon footprint products (packaging)	Transition to a circular economy	Environmental and health awareness Bike culture
Environment	Less burden on landfill	Reduction of carbon emission throughout the whole process	Less burden on landfill	Low carbon additional solution for urban transportation Image before society
Government	Local semi-skilled jobs, reduction of supply risk, demonstration of a working circular business	Retaining local production value (instead of buying from abroad)	Taxes	

Table 5 Towards circular business model and circular supply chain in the case studies

BM type	Elements	Case study			
		Alpha	Beta	Gamma	Delta
CBM	Closing loops	Development of partners to provide reverse logistics of used furniture and remanufacturing	High investment in R&D for product development	Low waste in the production stage	
	Slowing loops			Product design based on extended usage stage	Internal product development and bike assembly to ensure long usage stage and facilitated maintenance
	Intensifying loops				Bike sharing intensifies the use phase.
	Narrowing loops		Partnership with clients interested in low-carbon solutions		
	Dematerialising loops				Rent service instead of product ownership
SBM	Creation of sustainable value:	Interior design solution combining remanufactured and new office furniture	Flat-rolled aluminium with very high recycled content	Luxurious fashion accessories (such as purses and belts) from fire hoses	Service for individual urban transportation (bike sharing)
	Pro-active multiple stakeholder	Pushing the supply chain to develop towards the circular economy	Pushing technology boundaries for low-carbon aluminium goods and production process	Going the supply chain to establish the circular economy	Dissemination of the culture of bike sharing as transportation for short distances
	Long-term perspective	Promoting the culture of remanufactured goods	Need to develop alternative materials to reduce dependency on imports and commodity prices	Promotion of sustainable consumption	
		The urgency to action to change towards the circular economy		The speed to act to modify towards a circular economy	Need for more efficient ways for urban transportation

identified an opportunity to decrease dependence on imported, commodity-priced materials with high carbon emissions and invested significantly in new technology to manufacture high-quality aluminium sheets with a significant proportion of recycled materials. An overview of the stakeholders and the benefits they receive indicates that the companies were proactive in managing their stakeholders.

Long-term perspective within short-term action

The case study evaluated four companies: alpha, beta, gamma, and delta, each with their distinct approach to circular business. These companies adopt a long-term perspective, recognising the importance of considering future generations in their present decisions. The interviews conducted revealed the positive contributions each company is making in the long run. Alpha and gamma strive to create economically viable businesses that promote the principles of circular economy. Alpha focuses on remanufacturing office furniture, requiring infrastructure support from logistics and production organisations to enable other circular companies. Gamma emphasises materials with high potential for usage and aims to create products that can last virtually forever, including luxury accessories made from fire hoses, leather waste and parachute silk. Beta's primary goal is to lessen reliance on imported commodity-priced materials with high carbon emissions by investing in new technology to manufacture high-quality flat aluminium sheets with a high percentage of recycled materials. Delta's goal is to promote the integration of bike sharing into everyday life, going beyond leisure activities and encouraging adoption among various users, such as adults and children and private and public organisations, which can also see it as a potential business opportunity.

Circular resource loops and guidelines for sustainable business models

During the study, researchers gathered fascinating observations about the resource loops of companies. The circular business models that were presented by the case studies were

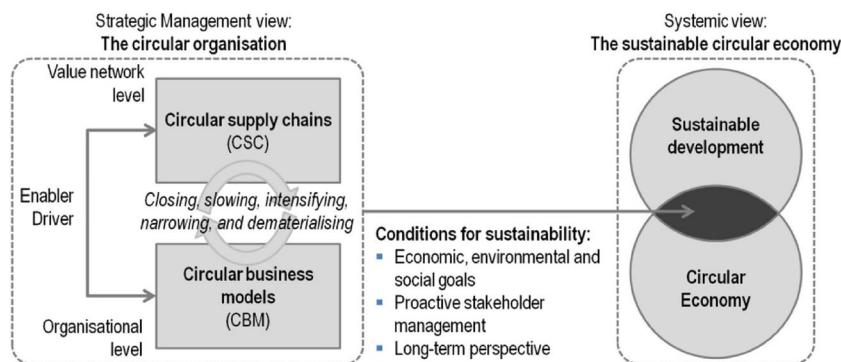
found to be consistent with the Butterfly diagram. Alpha is focused on the refurbish/remanufacture cycle, while beta and gamma employ recycling business models. On the other hand, delta emphasises the maintenance cycle by designing and manufacturing durable and easy-to-repair products, thereby extending the use of their bicycles. The study also evaluated the value proposition of the circular business models and the requirements of circular supply chain management (CSCM), as shown in Table 5.

Results and discussions

The study suggests a framework that combines the concepts of circular economy, sustainable development, circular supply chain management and circular business models as in Fig. 3. This framework is developed by analysing case studies and literature and aims to illustrate how these ideas are interconnected. The left side of the framework emphasises the relationship between a specific circular business model, an organisation and its value network functioning as a circular supply chain. The study reinforces previous claims about the significance of CSCM in closing, narrowing and slowing the loop and goes further by introducing strategies to intensify and dematerialise the loop also represented in Table 5.

Delta acknowledged the importance of using durable and easy-to-maintain bicycles, influencing their decision to build their bikes instead of purchasing them. The proposed framework highlights the significance of economic, environmental and social goals; proactive stakeholder management and a long-term perspective in achieving circularity and sustainability also discussed in literature. The case studies presented in “*Economic, environmental and social goals*,” “*Taking a proactive approach to managing multiple stakeholders*” and “*Long-term perspective within short-term action*” offer empirical evidence to support the relevance of these conditions. Although the triple bottom line approach, which focuses on economic, environmental and social pillars, is necessary, it is insufficient for CBMs and SBMs. Successful sustainable businesses require a proactive approach to stakeholders and a long-term perspective that complements short-term goals, as shown in Fig. 4.

Fig. 4 A framework represents the condition for sustainability



This paper contributes to prior research by presenting empirical evidence and arguing that the three conditions for CBMs address challenges for both circular economy and sustainable development. While the connection between these perspectives is debatable, this research demonstrates an overlap between them and recognises the need for further and more extensive discussions. The paper suggests that while circular economy is one way to achieve sustainable development, sustainable development is a broad and abstract concept that may lose meaning. At the same time, circular economy offers a more concrete way to organise society and the economy.

Conclusion

This study contributes to the literature by proposing a theory- and practice-based integrated framework of CBM and CSCM, discussing their interrelationships and contributions to the sustainability dimension. We present four case studies to address this question: alpha, an office furniture remanufacturer; beta, a producer of high recycled content aluminium panels; gamma, a manufacturer of recycled luxury accessories and delta, a bike-sharing company.

All four case studies incorporated circularity into their business models and supply chains. These findings corroborate previous research on SBM derived from value creation and found evidence for elements of CBM and CSCM. It includes products designed and manufactured from waste materials, reverse logistics partnerships, and efforts to inspire systemic change through communication and collaboration in the circular economy. It reinforces previous theoretical studies showing that technological innovations (e.g. in terms of material flows) and social innovations (e.g., changes in consumer behaviour) are required.

However, the studied cases still face the challenge of shifting the paradigm from linear to circular, especially concerning the required adjustments in the company's supply chain and customer procurement processes. Empirical data show alignment between CBM and CSCM to address sustainability challenges. As shown in the framework shown in Fig. 2, coalbed methane combined with circular supply chains can contribute to sustainable development by promoting economic, environmental and social objectives; proactively managing stakeholders, including a long-term perspective and closing, slowing, intensifying, shrinking and dematerialising resource loops. The literature has previously indicated circular resource cycling. Our framework complements this perspective by explicitly adding circular economy strengthening and dematerialising initiatives.

This paper sheds light on practice by introducing different CBMs and discussing the main challenges. The cases studied present similarities and contrasts. For example, alpha is a small company that acts locally, is inherently circular and

is committed to contributing to sustainable development. At the same time, beta is a large global organisation that increases the amount of recycled materials in its products, mainly to compensate for the uncertainty of resource procurement. Despite these differences, the business models of all case companies depend on changing consumer and supplier behaviour, as CBM and CSCM require a systemic paradigm shift. For example, product quality perceptions of remanufactured or recycled materials by corporate customers are often lower than conventional products, resulting in lower achievable prices. Although the product quality requirements are very high, the advantage in cost structure is relatively small.

Our study's main limitations include the limited number of case studies, and the data collection was mainly based on one interview per case study. However, discussions were triangulated from public documents to mitigate this. Complementing data collection with interviews with other stakeholders in the supply chain could be an interesting future follow-up study to complete the current study. The research is a first step in assessing whether "circularity" makes businesses and their supply chains more sustainable. A more systematic assessment of their contribution to the SDGs is needed to confirm and complement these initial steps.

Author contributions Md Sahabuddin and Md. Shariful Alam: visualisation, editing, review, and use of software. Maryam Khokhar: conceptualization, data curation, writing — original draft. Mohammad Anzad Hossain, Mohammad Faridul Alame and Wahiduzzaman Khan: methodology, writing — original draft, data curation, visualisation.

Data availability The data can be available on request.

Declarations

Ethical approval and consent to participate We advise that we have no human participants, data, or tissues.

Consent for publication N/A.

Competing interests The authors declare no competing interests.

References

- Afshan S, Sharif A (2016) Acceptance of mobile banking framework in Pakistan. *Telematics Inform* 33(2):370–387. <https://doi.org/10.1016/j.tele.2015.09.005>
- Ahi P, Searcy C (2015) An analysis of metrics used to measure performance in green and sustainable supply chains. *J Clean Prod* 86:360–377. <https://doi.org/10.1016/J.JCLEPRO.2014.08.005>
- Ahmad M, Alvarado R, Yan Q, İşık C, Jabeen G (2023) Is environmental sustainability transmissible? Transportation-based environmental taxation spillovers for sustainable development. *Environ Sci Pollut Res* 30(31):77420–77435. <https://doi.org/10.1007/S11356-023-27474-4/METRICS>
- Awudu I, Zhang J (2012) Uncertainties and sustainability concepts in biofuel supply chain management: a review. *Renew Sust Energ Rev* 16(2):1359–1368. <https://doi.org/10.1016/j.rser.2011.10.016>

- Bäckstrand J, Fredriksson A (2020) The role of supplier information availability for construction supply chain performance. *Prod Plan Control*. <https://doi.org/10.1080/09537287.2020.1837933>
- Bag S, Dhamija P, Bryde DJ, Singh RK (2022) Effect of eco-innovation on green supply chain management, circular economy capability, and performance of small and medium enterprises. *J Bus Res* 141:60–72. <https://doi.org/10.1016/j.jbusres.2021.12.011>
- Begum Siddiqui M, Khokhar M, Rafique Makhdoom T, Devi A, Akhtar Bhatti A, Hussain N, School of Business, B., Bhutto Shaheed University Lyari, B, Author C (2023) Exploring the rural development of China Pakistan Economic Corridor project impact on social responsibilities and South Region of Pakistan. *International Journal of Special Education* 38(1):135–150. <https://www.internationaljournalofspecialeducation.com/submission/index.php/ijse/article/view/2322>
- Camero C, Sowlati T (2014) Assessment and optimisation of forest biomass supply chains from economic, social and environmental perspectives - a review of literature. *Renew Sustain Energy Rev*. <https://doi.org/10.1016/j.rser.2014.04.041>
- Cetinkaya B (2010) Developing a sustainable supply chain strategy. *Sustain Supply Chain Manag : Pract Ideas for Moving Towards Best Pract* 17–55. https://doi.org/10.1007/978-3-642-12023-7_2
- Chen IJ, Paulraj A (2004) Towards a theory of supply chain management: the constructs and measurements. *J Oper Manag* 22(2):119–150. <https://doi.org/10.1016/j.jom.2003.12.007>
- Coenen J, van der Heijden RE, van Riel AC (2022) Expediting the implementation of closed-loop supply chain management: a facilitated case study on re-using timber in construction projects. *Circ Econ Sustain* 2022:1–32. <https://doi.org/10.1007/S43615-022-00186-6>
- Fasan M, Soerger Zaro E, Soerger Zaro C, Porco B, Tiscini R (2021) An empirical analysis: did green supply chain management alleviate the effects of COVID-19? *Bus Strateg Environ* 30(5):2702–2712. <https://doi.org/10.1002/BSE.2772>
- Gawusu S, Zhang X, Jamatutu SA, Ahmed A, Amadu AA, Djam Miensah E (2022) The dynamics of green supply chain management within the framework of renewable energy. *Int J Energy Res* 46(2):684–711. <https://doi.org/10.1002/ER.7278>
- Geissdoerfer M, Morioka SN, de Carvalho MM, Evans S (2018) Business models and supply chains for the circular economy. *J Clean Prod* 190:712–721. <https://doi.org/10.1016/j.jclepro.2018.04.159>
- Godil DI, Sharif A, Agha H, Jermisittiparsert K (2020) The dynamic nonlinear influence of ICT, financial development, and institutional quality on CO2 emission in Pakistan: new insights from QARDL approach. *Environ Sci Pollut Res* 27(19):24190–24200. <https://doi.org/10.1007/S11356-020-08619-1>
- Govindan K, Salehian F, Kian H, Hosseini ST, Mina H (2023) A location-inventory-routing problem to design a circular closed-loop supply chain network with carbon tax policy for achieving circular economy: an augmented epsilon-constraint approach. *Int J Prod Econ* 257:108771. <https://doi.org/10.1016/j.ijpe.2023.108771>
- Hailiang Z, Khokhar M, Islam T, Sharma A (2023) A model for green-resilient supplier selection: fuzzy best–worst multi-criteria decision-making method and its applications. *Environ Sci Pollut Res* 0123456789. <https://doi.org/10.1007/s11356-023-25749-4>
- Hossain B., Khokhar, M., Sharaf, M., & Ejaz, S. (2023). The effect of eco-preneurship and green technology management on greenhouse gas discharge : an analysis on East Asian economies.
- Hou Y, Khokhar M, Khan M, Islam T, Haider I (2021a) Put safety first: exploring the role of health and safety practices in improving the performance of SMEs. *SAGE Open* 11(3). <https://doi.org/10.1177/21582440211032173>
- Hou Y, Khokhar M, Sharma A, Bakul J, Mohammad S, Hossain A (2023) Converging concepts of sustainability and supply chain networks : a systematic literature review approach. *Environ Sci Pollut Res*. <https://doi.org/10.1007/s11356-023-25412-y>
- Hou Y, Khokhar M, Zia S, Sharma A (2021b) Assessing the best supplier selection criteria in supply chain management during the COVID-19 pandemic. *Front Psychol* 12:804954. <https://doi.org/10.3389/FPSYG.2021.804954>
- Hu J, Liu Y-L, Yuen TWW, Lim MK, Hu J (2019) Do green practices really attract customers? The sharing economy from the sustainable supply chain management perspective. *Resour Conserv Recycl* 149:177–187. <https://doi.org/10.1016/J.RESCONREC.2019.05.042>
- Irshad L, Arshad S, Murthy K, Uba. (2019) A novel localization technique using luminous flux. *Appl Sci* 9(23):5027. <https://doi.org/10.3390/app9235027>
- Işık C, Ongan S, Özdemir D (2019a) Testing the EKC hypothesis for ten US states: an application of heterogeneous panel estimation method. *Environ Sci Pollut Res* 26(11):10846–10853. <https://doi.org/10.1007/S11356-019-04514-6/TABLES/8>
- Işık C, Simionescu M, Ongan S, Radulescu M, Yousaf Z, Rehman A, Alvarado R, Ahmad M (2023) Renewable energy, economic freedom and economic policy uncertainty: new evidence from a dynamic panel threshold analysis for the G-7 and BRIC countries. *Stoch Env Res Risk A* 2023:1–16. <https://doi.org/10.1007/S00477-023-02452-X>
- Işık C, Sirakaya-Turk E, Ongan S (2019b) Testing the efficacy of the economic policy uncertainty index on tourism demand in USMCA: theory and evidence. *Tourism Econ* 26(8):1344–1357. <https://doi.org/10.1177/1354816619888346>
- Khan SAR, Jian C, Zhang Y, Golpîra H, Kumar A, Sharif A (2019a) Environmental, social and economic growth indicators spur logistics performance: from the perspective of South Asian Association for Regional Cooperation countries. *J Clean Prod* 214:1011–1023. <https://doi.org/10.1016/j.jclepro.2018.12.322>
- Khan SAR, Sharif A, Golpîra H, Kumar A (2019b) A green ideology in Asian emerging economies: from environmental policy and sustainable development. *Sustain Dev* 27(6):1063–1075. <https://doi.org/10.1002/SD.1958>
- Khan SAR, Yu Z, Golpîra H, Sharif A, Mardani A (2021) A state-of-the-art review and meta-analysis on sustainable supply chain management: future research directions. *J Clean Prod* 278. <https://doi.org/10.1016/j.jclepro.2020.123357>
- Khaskhelly FZ, Khokhar M, Zehra N, Azhar H (2022) Closed loop supply chain : evaluating ecological footprint. *Rev Manag Sci* 4(2):69–94
- Khokhar M, Hou Y, Rafique MA, Iqbal W (2020a) Evaluating the social sustainability criteria of supply chain management in manufacturing industries: a role of BWM in MCDM. *Problemy Ekorozwoju* 15
- Khokhar M, Iqbal W, Hou Y, Abbas M, Fatima A (2020b) Assessing supply chain performance from the perspective of Pakistan's manufacturing industry through social sustainability. *Processes* 8(9):1064. <https://doi.org/10.3390/pr8091064>
- Khokhar, M., Zia, S., Islam, T., ... A. S.-P., & 2022, undefined. (n.d.). Going green supply chain management during covid-19, assessing the best supplier selection criteria: a triple bottom line (tbl) approach. *Ekorozwoj.Pollub.Pl.*
- Khokhar M, Zia S, Islam T, Sharma A, Iqbal W, Irshad M (2022) Going green supply chain management during covid-19, assessing the best supplier selection criteria: a triple bottom line (tbl) approach. *Problemy Ekorozwoju* 17(1):36–51. <https://doi.org/10.35784/pe.2022.1.04>
- Kocaoglu B, Gülsün B, Tanyaş M (2013) A SCOR based approach for measuring a benchmarkable supply chain performance. *J Intell Manuf* 24(1):113–132. <https://doi.org/10.1007/s10845-011-0547-z>
- Liang J, Razzaq A, Sharif A, Irfan M (2022) Revisiting economic and non-economic indicators of natural resources: analysis of developed economies. *Res Policy* 77. <https://doi.org/10.1016/j.resourpol.2022.102748>
- Liu Y, Eckert C, Yannou-Le Bris G, Petit G (2019) A fuzzy decision tool to evaluate the sustainable performance of suppliers in an

- agrifood value chain. *Comput Ind Eng* 127:196–212. <https://doi.org/10.1016/j.cie.2018.12.022>
- Luo N, Olsen T, Liu Y, Zhang A (2022) Reducing food loss and waste in supply chain operations. *Trans Res Part E: Logist Trans Rev* 162:102730. <https://doi.org/10.1016/J.TRE.2022.102730>
- Nandi S, Hervani AA, Helms MM (2020) Circular economy business models - supply chain perspectives. *IEEE Eng Manag Rev* 48(2):193–201. <https://doi.org/10.1109/EMR.2020.2991388>
- Ongan S, Işık C, Bulut U, Karakaya S, Alvarado R, Irfan M, Ahmad M, Rehman A, Hussain I (2022) Retesting the EKC hypothesis through transmission of the ARMEY curve model: an alternative composite model approach with theory and policy implications for NAFTA countries. *Environ Sci Pollut Res* 29(31):46587–46599. <https://doi.org/10.1007/S11356-022-19106-0/METRICES>
- Perceptions of circular business models in SMEs (2018). *Amfiteatru economic*, 48(20), 310–324.
- Pollard J, Osmani M, Grubnic S, Díaz AI, Grobe K, Kaba A, Ünlüer Ö, Panchal R (2023) Implementing a circular economy business model canvas in the electrical and electronic manufacturing sector: a case study approach. *Sustain Prod Consump* 36:17–31. <https://doi.org/10.1016/J.SPC.2022.12.009>
- Sauer PC, Seuring S (2018) A three-dimensional framework for multi-tier sustainable supply chain management. *Supply Chain Manag* 23(6):560–572. <https://doi.org/10.1108/SCM-06-2018-0233/FULL/PDF>
- Sharif A, Afshan S, Chrea S, Amel A, Khan SAR (2020a) The role of tourism, transportation and globalisation in testing environmental Kuznets curve in Malaysia: new insights from quantile ARDL approach. *Environ Sci Pollut Res* 27(20):25494–25509. <https://doi.org/10.1007/s11356-020-08782-5>
- Sharif A, Aloui C, Yarovaya L (2020b) COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: fresh evidence from the wavelet-based approach. *Int Rev Financ Anal* 70. <https://doi.org/10.1016/j.irfa.2020.101496>
- Singh D, Verma A (2018) Inventory management in supply chain. *Mater Today: Proc* 5(2):3867–3872. <https://doi.org/10.1016/j.matpr.2017.11.641>
- Singh G, Daultani Y, Rajesh R, Sahu R (2022) Modeling the growth barriers of fresh produce supply chain in the Indian context. *Benchmarking* 30(2):653–677. <https://doi.org/10.1108/BIJ-09-2021-0517/FULL/PDF>
- Sreenu M, Gupta N, Jatoth C, Saad A, Alharbi A, Nkenyereye L (2022) Blockchain based secure and reliable cyber physical ecosystem for vaccine supply chain. *Comput Commun* 191:173–183. <https://doi.org/10.1016/J.COMCOM.2022.04.031>
- Suhandi V, Chen PS (2023) Closed-loop supply chain inventory model in the pharmaceutical industry toward a circular economy. *J Clean Prod* 383:135474. <https://doi.org/10.1016/J.JCLEPRO.2022.135474>
- Suki NM, Sharif A, Afshan S, Suki NM (2020) Revisiting the environmental Kuznets curve in Malaysia: the role of globalisation in sustainable environment. *J Clean Prod* 264. <https://doi.org/10.1016/j.jclepro.2020.121669>
- Ünal E, Urbinati A, Chiaroni D, Manzini R (2019) Value creation in circular business models: the case of a US small medium enterprise in the building sector. *Resour Conserv Recycl* 146:291–307. <https://doi.org/10.1016/J.RESCONREC.2018.12.034>
- Wan Ahmad WNK, Rezaei J, de Brito MP, Tavasszy LA (2016) The influence of external factors on supply chain sustainability goals of the oil and gas industry. *Res Policy* 49:302–314. <https://doi.org/10.1016/J.RESOURPOL.2016.06.006>
- Yang M, Smart P, Kumar M, Jolly M, Evans S (2018) Product-service systems business models for circular supply chains. *Prod Plan Control* 29(6):498–508. <https://doi.org/10.1080/09537287.2018.1449247>
- Zhu Q, Sarkis J (2004) Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *J Oper Manag* 22(3):265–289. <https://doi.org/10.1016/J.JOM.2004.01.005>

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