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Research paper

Circular Supply Chain Management: Bridging Business Innovation and Sustainability Through Best Practices

Kapil Khanna[1*], Swee Kuik[1], Joowon Ban[1]

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Abstract

The current linear economic system is unsustainable due to its dependence on the uncontrolled exploitation of diminishing natural resources. The integration of business innovation and supply chain management (SCM) has brought about the redesign of business processes through the implementation of a closed-loop approach. The Circular Economy (CE) offers a sustainable solution to improve business opportunities by *'closing the loop'* and following the principles of rejuvenation and reuse inspired by nature. Presently, numerous studies have attempted to establish the concept of SCM by integrating CE principles, which are commonly denoted as circular SCM. With this study, we try and provide a more definite approach, as to what truly makes a SC circular. While many scholars have recognized the challenges of transitioning to CE, there is still a lack of consensus on business best practices that can facilitate companies in embracing CE across the supply chain. Hence, this paper conducts a thorough literature review to scrutinize the SCM practices utilized for CE and how they differ from other SCM models. It then identifies the obstacles and recommends best practices that can enhance a company's ability to incorporate CE principles toward business innovation and supply chain performance. Further, the paper proposes future research in the field of using technologies such as the Internet of Things (IoT) and blockchain, as business innovation tools for supply chain management towards CE adoption.

Keywords: Business Innovation · Challenges · Circular Economy · Circular Supply Chain · Supply Chain Management · Technology · Best Practices · Blockchain

1. INTRODUCTION

The The COVID-19 pandemic has impacted businesses. The flow of commodities, people, resources, and services has been greatly hampered in the last 2-3 years as countries closed their borders to international trade. As a result, there has been a heightened interest in managing supply chains in a more sustainable manner, by a) bringing them closer to home and b) adopting some of the Circular Economy (CE) principles of recycling, reuse, and remanufacturing to reduce resource dependency. Several aspects of business revolve around Supply Chain (SC) and Supply Chain Management (SCM), from procurement, to manufacturing and to delivery. The emergence of e-commerce and the Internet of Things (IoT) has led to the adoption of reverse logistics and IT systems, which deals with returned products (Geissdoerfer et al., 2018). SCM has thus taken center stage in the research world in the past decade (Angelis et al., 2018). The integration of SCM with CE practices, however, remains a significant challenge for businesses. With CE promising a more sustainable alternative to the current linear approach, it is vital that the best practices in SCM must be identified to support a transition to CE.

Circular economy (CE) has been defined in different ways (Kirchherr et al., 2017). The main tenets of CE are classified into the economic, environmental, and social benefits that can help companies gain competitive

[1] School of Business and Law, Central Queensland University, Brisbane Branch, HQ- Rockhampton, Australia.
*Corresponding Author: kapil.khanna@cqumail.com

advantages. To further achieve a favorable return on investment, as well as constructive socio-economic and environmental outcomes, the CE principles must be embraced throughout the supply chain. The importance of integrating CE with SCM, thus, has been stressed by many scholars (Ripanti & Tjahjono, 2019). As for SCM practices, the industry literature distinguishes five key elements as best practices: 1) Inventory management that calls for a just in time and lean approach to handle demand variations, 2) maintaining long-term relationships with suppliers, 3) use of big data technology like blockchain, 4) process integration and 5) information sharing (Association for supply chain management, n.d). This can tie with some of the eight SCM 'processes' including supplier relationship management, demand management, order fulfilment, manufacturing flow and returns management, as identified by Lambert (2014).

To integrate the more sustainable approach of CE, it is required that SCM strategies, be extended both upstream and downstream (Braz et al., 2022). Managing supply chains to adopt CE principles, provides benefits in terms of achieving more sustainable outcomes (Genovese et al., 2017; Nasir et al., 2017). Indeed, managing the supply chains has been identified as one of the most crucial factors for adopting the CE principles (Angelis et al., 2018; Govindan & Hasanagic, 2018). As a result, there is renewed interest in SCM for CE. However, the field of SCM research is still in its early stages when it comes to formulating the most effective SCM practices that may facilitate the achievement of a CE's vision and potential. Further, the existing definitions of Sustainable SC (SSC) and Closed loop SC (CLSC), are misleading and hamper clear understanding of a true Circular SC (CSC) (Farooque et al., 2019).

This paper takes a holistic approach from (Hazen et al., 2020) who stressed the importance of understanding the correlation between SCM and CE implementations as a promising future research agenda. Their work identified some core SCM processes and their interaction with CE principles. We extend the existing works to identify the best SCM 'practices' that can help facilitate a smoother transition to CE. This study is further motivated by (Angelis et al., 2018), wherein they identified that not only is there a dearth of literature that connects CE and SCM, but also there is a scarcity of material on the practical side of adopting SCs towards CE. The extant literature identifies the challenges associated with adopting CE but does not identify best practices that can help overcome these challenges. To fill the gap in the existing literature, this study undertakes a three-step process:

- First, it analyses the existing literature to understand what makes a SC truly circular.
- Second, we look at what are the challenges associated with adopting CE within a business model including its' SC.
- Third, we identify the 'best practices' in SCM that can help overcome the challenges and smoothen the process of integrating CE and SCM.

In lieu of attaining the above objectives, the main Research Question (RQ) for this study is:

What are the SCM best practices to overcome challenges associated with adopting CE along the SC of an organization?

2. MAKING SUPPLY CHAINS CIRCULAR

Managing Supply Chains (SC) gained traction as early as the 1980s, due to fast growing international trade across borders (Angelis et al., 2018). The early 1980s saw a surge in globalisation, which led to growing exchange and flow of goods and services, which in turn lead to more research and concepts being developed around SC and SCM practices. The most prevalent approach amongst researchers at that time was a linear model of input of raw materials and output of products. For managing SC, a firm was considered the central point, from where upstream and downstream relationships were managed (Angelis et al., 2018). One of the earliest works by Christopher (1998) defined SCM as more of network management process amongst various interconnected organisations that are dependent on each other to facilitate the flow of materials and information from suppliers to end users. Ballou (2006) gave a more functional based definition of SCM, where functions like transportation, inventory control, knowledge sharing etc., are repeated often till the finished goods reach the end user. Many definitions of SCM focus on value addition activities that meet the demands of the customers (Lambert, 2014; Ballou, 2006). These early definitions of SCM, raw material extraction, value added manufacturing and logistics make products reach the end

user in a cost-effective way, depict a linear approach, focused mainly on raw inputs and finished outputs. The FMCG and textile industries are a typical example of such an approach.

As identified, the initial model of SCM was a linear set up which took a take-make-consume-dispose approach for goods and services (Geissdoerfer et al., 2018). When Elkington (1998) coined the Triple Bottom line theory, it reflected the changing trend of the times, where organisations needed to shift focus from not only economic benefits but also social and environmental wellbeing. The end consumers and other stakeholders have stared demanding more responsible behaviour from companies and their supply chain partners. Currently, there are growing demands to switch from the linear approach to SC that results in lot of waste generation, to more sustainable and green practices. When it comes to linking SCM with sustainable practices, earlier literature largely focused on sustainability in SCM and closing the loop (Farooque et al., 2019). The sustainable side of SCM practices owe its origins from closed loop and reverse logistics literature as early as Thierry et al. (1995) and Fleischmann (1997) respectively. With the advent and growth of e-commerce, a new dimension of handling returned goods via reverse logistics was added to SCM (Govindan & Hasanagic, 2018).

The first attempt to integrate the three pillars of sustainability, social, environment and economic, within the SCM context was done by Carter and Rogers (2008). These works led to development of concepts like Closed Loop Supply Chains (CLSC) and Sustainable Supply Chains (SSC). But, as pointed out by Genovese et al. (2017), these concepts grew in parallel to the CE thought process. CE and its underlying concepts found mention in some early works. For example, organizational sustainability, industrial ecology (Maranesi & Giovanni 2020), and eco-industrial parks (Kazancoglu et al., 2020) have some essence of CE principles embedded in them. By incorporating CE principles within the paradigms of CLSC and SSC, it offers a more streamlined approach for positive social, economic and environment outcomes.

Closed loop side of SCM (CLSC), calls for reverse logistics where goods are sent back to the producer to find more sustainable methods to reuse the components (Guide & Wassenhove, 2006). The concept of CLSCs comes closest to what a CSC would look like, but its inherent flaw is its concern with only reducing the amount of waste in the landfills. A CSC gets to work from the very design stage of the product and engages end consumers to adopt recycle and reuse practices (Farooque et al., 2019). 'Design for circularity' (Santos et al., 2017) shared and rental economic concepts sit at its core.

Recovering value from products and packaging materials and returning them to the producer is how a CLSC enhances environmental performance. The problem with CLSC is that value recovery is frequently not as extensive as it might be since all the efforts are focused on the original supply chain (Farooque et al., 2019). Consequently, CLSC continues to produce significant quantities of waste, because it is very unlikely that all activities pertaining to reuse, or recycling can be done within the same supply chain (Christopher, 1998). A CSC takes it a step further by partnering with other organisations in the industrial sector, or even outside of it, to recover value from waste.

The forward and reverse flows of a CLSC model could thus benefit from embedding CE values especially when managing returned goods (Ripanti & Tjahjono, 2019). The reverse logistics, earlier only focused on recovering goods from end consumers and setting up channels to bring them back to the manufacturers. CE based SC processes, however, require reversed goods to maintain their highest value, to ascertain highest utility when brought back for future re-consumption (Ripanti & Tjahjono, 2019).

Research into Sustainable Supply Chain Management (SSCM) found that proponents of the practice can address the three, social, economic, and environmental challenges (Govindan & Hasanagic, 2018). It requires businesses to consider environmental and social impacts when making economic choices and taking actions, both internally and across the supply chains that impact their bottom line. An SSC aims to integrate and accomplish an organization's social, environmental, and economic objectives by effectively coordinating critical business operations. This coordination is intended to enhance the long-term economic performance of the firm and its supplier chains (Santos et al., 2017).

SSCM aims to make the supply chain more sustainable by minimizing negative impacts. It promotes sustainable practices like green logistics and ethical sourcing but may still operate within a linear production model (Farooque et al., 2019). It is argued that for a successful CE implementation, the sustainability of the entire SC network plays a crucial role (Van Buren et al., 2016). Sustainable SC practices, however, still largely focus on collaborations that generate positive outcomes on the triple bottom line (Nasir et al., 2017). A CSC expands

the focus, by converging on intensifying, closing slowing, narrowing, and dematerializing the resource loops (Geissdoerfer et al., 2018; Hazen et al., 2020). CSC emphasizes circular economy principles, designing products and supply chains to facilitate continuous material loops. While SSCM focuses on minimizing negative impacts within current supply chains, CSCM rethinks the entire system to eliminate waste and regenerate resources (Farooque et al., 2019).

Although idealistic in approach, the two versions of SCM, CLSC and SSC, do not encapsulate the vision of a truly circular SC, that aims for an economic set up that generates zero-waste and is largely regenerative and restorative by design. The economic gains are made by integrating circular thinking as a strategic tool in the business model. In their seminal work (Farooque et al., 2019) tried to define SCs that have truly embodied CE concepts as 'circular supply chains' (CSC) and their subsequent management as CSCM. Accordingly, *'circular SCM…… systematically restores technical materials…regenerates biological materials towards a zero- waste vision, through a system wide innovation and SC functions…. involving all stakeholders'* (Farooque et al., 2019, p.884). Integrating CE principles within SSCM means that the supply chain must evolve from being "eco-efficient" to becoming fully regenerative. This circular transformation includes adopting strategies like reverse logistics, product life extension, recycling, and resource recovery (Zeng et al., 2017). CE requires collaboration, knowledge and information sharing amongst all the players in the supply chain. In that, the strategies, structure, material flow, scale, and scope of CSCs, is different from more traditional, linear structures and other SC models (Angelis et al., 2018).

A comparative analysis between sustainable, close loop and circular supply chain is done in (Table 1) below. It shows that an SSC, is customer centric, with a broader scope. A CLSC is partially closed with internal actors and one way flow of materials, while a CSC, while taking a broader stakeholder approach, maintains a more narrow, closed loop structure that creates cascading loops of material flows.

Table 1. A Comparative Study Between a Closed Loop, Sustainable and Circular Supply Chain

Criteria	CLSC	SSC	CSC
Strategy	Better environment outcome by reducing waste and recovering value	To look beyond cost and price- A positive Triple bottom line outcome	Leasing and service based. Less about ownership. Zero waste.
Structure	Partially closed with actors from within the chain.	Partially closed with participation from non-economic actors.	Closed, short and cascading movement within loops.
Flow	Product and service flow from customers to producers	Mixed- Reverse, closed.	Biological and Technical segregation.
Focus	Recover value by returning goods to producers.	Creating social values	Capture value with collaboration across multiple stakeholders.
Scope	Regional and global- Efforts limited within the original SC of producer.	Global& Regional	Regional and Local

Note: Adapted from (Farooque et al., 2019) and (Angelis et al., 2018)]

We sum up that, by adopting CE principles SCs can become truly circular. This is done by circulating inherent components of a product/service within a closed loop, to reduce the need to mine new raw materials for manufacturing (Genovese et al., 2017). For this to be highly effective though, it's needed that CE be embedded within a company's production network across all SC stakeholders. The primary practices to consider in preparation for shifting towards a CE are supply chain architecture, relationships, and human resource management (Zeng et al., 2107). The latest SCOR (Supply chains operations reference) framework (Association for supply chain management, n.d) also includes 'return' and 'enable' processes, as a reflection of SCM processes shifting towards CE business models.

Thus, growing interest in transitioning towards CSCs has resulted in research, to identify adoption of CE 'methods' in the SCM 'domain' (Hazen et al., 2020). What is missing from the extant literature is clear

identification of SCM best practices that can facilitate CE adoption. In subsequent section we explore the SCM practices (citing both academic and industry provided literature) that can help organizations transition and adopt CE principles. But first we identify what are the challenges that organizations face while trying to adopt CE practices. These challenges are associated with internal process limitations, consumer perceptions, policies, and technical uncertainties (Table 2). With the challenges identified, we research for SC best practices to overcome these issues.

3. SC CHALLENGES FOR CE

The previous analysis showed that when CE concepts are adopted in the SCM of an organization, it is said to transition to a CSC. A CSC truly incorporates the CE philosophies applicable to both goods and services. When a SC is circular, it achieves the goals of resource efficiency, sustainable productivity, and economic profitability, that does not harm the environment (Farooque et al., 2019). An idealistic outcome of a CSC is to generate zero waste (Burke et al., 2021), based on concepts like designing of Eco-Industrial parks to facilitate industrial ecology (Angelis et al., 2018). The waste produced from one industry becomes the raw material input for another. For example, Genovese et al. (2017) point out how biodiesel can be produced from the wasted cooking oil that the food industry generates in millions of tons annually. The construction industry could use waste from the textile sector to make insulation material for houses and buildings (Nasir et al., 2017). All these efforts though, need collaboration from different players all along the supply chain, which are hard to actualize.

For many organizations, large or small, a CSC transition poses many challenges. Lack of knowledge of profitable implementation approaches, access to funds and manpower, poor management commitment and apathetic government policies are some of the factors sighted in literature (Govindan & Hasanagic, 2018). The literature review efforts for this paper showed lot of convergence of ideas for SC and CE (Geissdoerfer et al., 2018; Angelis et al., 2018). But an attempt to integrate and link SCM practices for adopting CE principles did not produce significant results. This study fills the gap and identifies best practices in SCM that can help overcome some of the challenges linked to a circular transition.

3.1 CE Challenges

Adopting CE practices is difficult since it requires readaptation of current production mechanisms and factors of production need to be remodified to encompass such changes (Garcia-Quevedo et al., 2020). Most authors seem to acknowledge that incorporating the complex CE tactics into the strategic planning is hindered by high initial costs (Jaeger & Upadhyay, 2020). and apparent financial risks involved (Ethiranjan et al., 2021). As a result, the adoption of CE related activities can be perceived to be challenging, since their implementation necessitates more resources and incurs additional costs for firms. Modifying such a system requires innovation all along the SC, which can be time consuming and expensive (De Jesus & Mendonça, 2018). Just like any other innovative practices, CE as an innovative idea for sustainable alternatives faces cost, IT, market, and institutional barriers. A firm's ability to innovate and change the existing business models to greener alternatives like CE requires a change at infrastructure, human and financial resources levels. It is evident that access to finances via equity and investment has a direct impact on other resources. There is a link therefore to the scope of CE adoption and availability of investment (Aranda-Uson et al., 2020). Moreover, Rizos et al. (2016) identifies the lack of human resources with the right technical knowledge to implement complex CE related initiatives, as another crucial barrier. Inability to access and use technology, that can help keep track of a product across its lifecycle, from manufacturing, sale, use and disposal, prevents SCs to fully incorporate CE (Giudice et al., 2021).

The rigid and unfavorable regulatory environment in many countries adds to the existing challenges (De Jesus & Mendonça, 2018). Taxation models that incentivize purchase of cheaper raw materials as compared to recycled or reclaimed resources are a deterrent for companies to use these alternative resources (Rizos et al., 2016). Strict monitoring and reporting of CE related activities is an additional administrative burden that already stretched out companies cannot afford (Kirchherr et al., 2017).

Further analysis showed that adopting the three basic principles of CE, reuse, recycle and remanufacturing requires strong technical know-how, and effective product, and service offerings. These in turn call for a professionally trained human force, which is often scarce (Sharma et al., 2019). Organizations are unbale to

undertake waste management (a major underlying principle of CE), because of lack of knowledge and awareness amongst stakeholders, and monetary and regulatory ambiguities (Govindan et al., 2020). In their seminal work, Govindan and Hasanagic (2018), analysed the barriers to adopting CE 'practices' from a governmental, organizational/supplier, society, and consumer perspective. They found that lack of government support in forms of incentives or reduced taxes, corruption, and complex, non-enforceable policies hindered CE implementation. Lack of technical expertise, and a skilled workforce, along with unsuitable product designs, that prevent recycling and remanufacturing, were also a major cause of supply chain issues related to takeback procedures. From a consumer point of view, a general mistrust about the quality of second hand, refurbished products, and a lack of knowledge around CE practices and benefits prevented companies from taking up such initiatives (Govindan & Hasanagic, 2018).

CE integration requires closing the loop by encouraging customers to return products at the end of their life, which involves reverse logistics. These CSC models aim to divert used products from ending up in landfills, to be used instead as raw materials for manufacturing secondary products (Genovese et al., 2017). However, complex product design not suitable for recycling or remanufacturing is a major deterrent for CE related reverse supply of goods (Govindan & Hasanagic, 2018). Moreover, uncertainty around the quality and quantity of goods being returned is also a challenge to maintain managerial commitment and supply of funds for CSC (Werning & Spinler, 2020). Sustainability projects towards CE adoption, require a change from the 'business as usual' approach and sometimes may be disruptive in the way a company and its SC partners operate. The implementation of such a comprehensive transformation may lead to significant initial expenses (Werning & Spinler, 2020), and when coupled with structural inflexibility and cultural rigidity (Williams & Schaefer, 2013), it hinders the commitment of top management to transition towards a CE.

Overall, CE transition at both the firm and supply chain level faces many hurdles, and the extant literature has made efforts to enumerate and categorize them. However, if the management is committed to overcoming these challenges, using technological innovations there are opportunities to be realized in the long term. Some examples being, improved brand image (Rizos et al., 2016), cost reduction (Ritzén & Sandström, 2017). and social well-being (Dey et al., 2019). In Table 2, we enumerate the most commonly occurring challenges that find mention across prominent academic research papers. In the following section, we identify SCM best practices that can overcome these challenges for an effective CE transition.

Table 2. SC Challenges for CE

Challenges	References	Description
High start-up costs	PAN ET AL (2105)	Training of staff. Redesigning SC structures. High costs of green raw material. Initial costs of investing in new technologies.
Technological limitations	SU ET AL. (2013)	Complex product recovery and recycling activities. Lack of technical expertise to track quality of products during LCA and assure quality of remanufactured goods.
Consumer perception towards quality of recycled good	LIEDER AND RASHID (2016)	Lack of knowledge and branding/ warranty of products made using used materials. Consumers perceive new products to be of better quality than recycled goods.
Weak economic incentives	SU ET AL. (2013)	Unclear short term tangible benefits. Cheaper to make new products, with existing technology and know-how. Unclear pricing schemes for remanufactured products.
Non-favorable government policies and laws	SU ET AL. (2013)	Lack of clearly defined policies. Lack of subsidies and support to manage initial costs. Incompatible with existing environmental laws.
Lack of management support for Integration of CE Practices	SU ET AL. (2013	An unmotivated attitude of management towards CE. Lack of clearly defined priorities. Bureaucratic and top-down approach to decision making.

Note. Adapted from 'A *systematic review of drivers, barriers, and practices towards circular economy: A supply chain perspective' (Govindan & Hasanagic, 2018)*

4. SCM BEST PRACTICES FOR CE

With the growing exchange of goods and services across borders, there has been an ever-increasing interest amongst scholars to study the impact of SCM and its related practices on a firm's operational performance and overall competitive advantage (Truong et al., 2017). While most of the earlier work focused on production and manufacturing aspects of the SCM activities, Storey et al. (2006) suggested to move beyond success at operations level and adopt a supply strategy. This strategy includes logistics, purchasing, industrial relations and marketing. SCM practices, according to Kushwaha (2012), include information and communication sharing, maintaining good supplier relationship and sustainable manufacturing practices. It also involves an inventory, warehousing, transportation and distribution management system, and customer relationship management. Chong et al., (2012) included the company's efforts to internally train and gear strategic operations towards CE initiatives as additional practices. Weetman (2017) further emphasised on the level and quality of information sharing, both upstream and downstream as the basis for good SC performance.

As discussed above, the efforts to adopt SCM practices for sustainable outcomes like CE pose a lot of challenges. We did find independent studies about SCM practices in general, but not in particular for transitioning to CE. As such, very few efforts have been made to ascertain which SCM practices can help

achieve sustainable outcomes via CSCM. Govindan and Hasanagic (2018), developed a conceptual framework to link SCM practices and sustainability (Fig. 1)

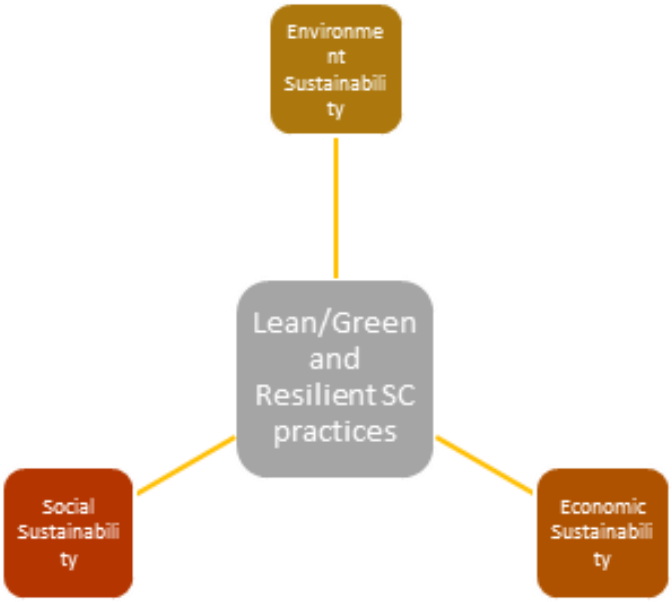

Figure1. SCM Practices and Sustainability

Note: Adapted from 'Impact of supply chain management practices on sustainability' by (Govindan & Hasanagic, 2018)

Broadly divided into three core SCM practices of lean, resilient, and green practices, they concluded that waste elimination, SC risk management and cleaner methods of production had the maximum impact on the triple bottom line, (the social, economic and environment) sustainability of the SC (Govindan & Hasanagic, 2018). Out of these three, waste elimination and cleaner production are also identified as core CE principles, that have been proposed by several authors (Angelis et al., 2018; Ripanti & Tjahjono, 2019). It would thus seem that adopting these practices in SCM could help manage risks and align businesses with CE based initiatives. A more structured and comprehensive approach is however required to address this complex issue. For this study, we highlight best practices in SCM that can help integrate CE practices, by overcoming some of the challenges identified earlier.

To overcome challenges related to product design that hinder recycling, Bressanelli et al. (2018) suggest a 'modular' redesign combined with service 'digitization' as the ideal 'process integration' approach of SCM. The integration of modular design with service digitization allows companies to create products that are easier to recycle or repurpose while using digital technologies to optimize the flow of materials and information across the SCs. "*Smart, connected products*" that use IoT and data analytics to enhance product design, improve recycling rates, and support circular SC strategies via recycling (Porter & Heppelmann, 2015). The use of technologies like blockchain can help enhance the 'information sharing' aspect of SCM to further smoothen the process of CE integration amongst all SC partners (Giudice et al., 2021). Further, when it comes to refurbishing and remanufacturing stages of a SC for CE, combined efforts of technology and manpower skills come in handy (Bressanelli et al., 2018).

Waste minimization is one of the most important CE principles. The 'inventory management' aspect of SCM can help reduce waste. Effective inventory management within SCM is crucial for minimizing waste. Improved inventory control is directly linked to reductions in both material waste and carbon emissions, supporting a more sustainable SC (Vlachos & Dyra, 2020). Further, inventory can be managed using lean manufacturing and Just in Time (JIT) 'procurement' methods. Research shows that while lean manufacturing is a desirable SCM approach, JIT leads to more pollution because of frequent supply runs (Govindan & Hasanagic, 2018).

The high startup costs and low investment challenges of CE can be overcome, by managing the operations side of a SC. The repair, reuse and remanufacturing principles of CE are quite labor intensive. The fact these operations create more jobs can be an economic outcome that incentivizes government investments (Moreau et al., 2017). Privately, crowd funding (Bressanelli et al., 2018) and ethical investment can also play an important role. By optimizing logistics and inventory management, companies can reduce the costs associated with storing and transporting goods meant for repair or remanufacturing. Effective operations management can reduce the costs of CE activities by enhancing coordination, minimizing waste, and improving overall SC efficiency (Nasir et al., 2017).

The returning of goods by consumers both via the e-commerce channels, and through take-back incentives, puts the reverse logistics aspect of SCM to the test. Practices of maintaining a 'manufacturing flow' and 'sharing of information' can help overcome the uncertainty around product quality and quantity being returned in Circular SCs (Werning & Spinler, 2020). Effective information sharing among SC partners, including manufacturers, distributors, and retailers, is key to managing the unpredictability of returns. By leveraging accurate, real-time data on returned goods, companies can build a responsive and adaptive reverse logistics network. The barriers created by negative consumer perceptions around recycled goods can be mitigated using technology, like blockchain, that tracks the whole process and passes the information to consumers via third party certification to give them confidence (Ballou, 2006). In this step the 'customer relationship management' part of the SC can also create marketing messages to educate the consumers (Hazen et al., 2020).

Legislative barriers, such as restrictive regulations, lack of standardized guidelines, and insufficient incentives, can hinder the widespread adoption of circular economy practices (Kirchherr et al., 2017). Maintaining long-term relationships with all stakeholders is a very important way of overcoming legislative barriers and changing consumer mindset to participle in CE initiatives (Govindan & Hasanagic, 2018; Bressanelli et al. 2018). Developing and maintaining long-term relationships with stakeholders in the SC—including suppliers, customers, regulators, and local communities, can help businesses navigate legislative barriers and secure government support (Rizos et al., 2016).

Overall, it can be concluded that SCM plays an important role in implementing CE. This is because it encompasses the coordination and management of the entire flow of materials, information, and finances from suppliers to consumers. There are SCM 'best practices' that need to be considered to ensure a smooth transition and encourage organizations to adopt CE by overcoming some of the challenges associated with it. These practices focus on improving collaboration among SC partners, enhancing transparency and traceability, reducing waste, optimizing resource use, and leveraging digital technologies for a circular transition. By implementing these best practices, organizations can address common barriers to CE adoption. These are enumerated below (Table 3).

Table 3. SCM Best Practices

SCM Best Practices	
Challenges	**Approaches to overcome**
Technological limitations - Inconsistent product design and waste management	'Process integration' in SCs via 'modular' redesign and service 'digitization'. 'Inventory management' practices in SC like Lean and JIT for managing waste.
Legislative barriers and Government interventions	Maintaining long-term relationships and engagement with stakeholders.
Lack of integration of CE practices	'Information sharing' via technology like Blockchain.
Uncertainty around product quality and quantity of returned goods	Maintaining 'manufacturing flow' and 'sharing of information' both upstream and downstream.
Negative consumer perception	'Customer relationship management' via marketing for educating and third-party certifications.
High Start-up costs/Low economic incentives	'Operations management' processes like job creation and attracting ethical investments.

5. CONTRIBUTIONS OF THE STUDY

This study highlights the importance of SCM best practices and their impact on the successful implementation of CE initiatives. However, before identifying such practices, it is essential to understand what makes a SC truly circular. Through the research efforts we were able to distinguish between a CLSC, SSC and CSC. Although earlier literature tends to use these terms interchangeably, we were able to establish that a CSC incorporates all the characteristics of the two SC models and improves them further. A CSC faces many challenges though and by implementing best practices identified in this study, organizations can ensure a smoother transition. More specifically, challenges like waste management, product design, concerns about the quality of returned goods and negative consumer perceptions, can all be addressed by using technology like the IoT and Blockchain in SCM practices.

Digitization of services within SCM refers to the use of digital tools and technologies such as IoT, and blockchain to enhance visibility and control over the supply chain processes. These technologies can be used to track product usage, monitor the condition of components, and predict the need for repairs or replacements, leading to better management of resources and waste reduction (Bressanelli et al., 2018). Effective inventory management within SCM is crucial for minimizing waste. Blockchain and IoT can support waste minimization by improving transparency, providing real-time visibility into inventory levels, and tracking of material flows across the SC (Park & Li, 2021).

Digital platforms that facilitate real-time information sharing among stakeholders in the SC are essential for managing reverse logistics effectively. Blockchain technology can be particularly useful in this context by providing a secure, transparent, and immutable ledger of transactions related to returned goods, thereby enhancing trust and collaboration among SC partners and the end consumer (Kumar & Shirisha, 2021). It is argued that the current literature provides insights into use of these technologies in SCM across various disciplines, but there is a lack of research efforts for leveraging them for CSC. A CSC that incorporates all the tenants of a closed loop and sustainable SC faces challenges trying to balance economic gains with sustainable outcomes. Use of Technologies like IoT and blockchain in CE operations have the potential to lower costs and enhance the scalability of circular business models. However, they have not garnered much attention and need further research efforts to be fully incorporated in a circular SCM system.

6. CONCLUSION AND FUTURE RSEARCH AGENDA

The current linear economic model of 'take, make and dispose' has been criticized for the negative impact on the environment and social structure in its areas of operation (Kazancoglu et al., 2020). Organizations today need to reconsider the unsustainable path of extracting limited natural resources. By adopting more sustainable alternatives like CE along the supply chain, they can achieve better social, environment and economic outcomes. However, a transition to CSC is challenging and requires an understanding of best practices in SCM (Ghisellini et al., 2016). Several best practices have been identified that are critical to overcoming the barriers. These practices focus on improving collaboration among supply chain partners, enhancing transparency and traceability, reducing waste, optimizing resource use, and leveraging digital technologies for better decision-making. By implementing these best practices, organizations can address common barriers to CE adoption, such as high costs, regulatory uncertainty, lack of stakeholder engagement, and resistance to change.

Further, the study also identified a gap in current academic literature with regards to the use of Innovative technologies like IoT and Blockchain for assisting organizations in adapting CE and making their CS truly circular. Information and knowledge sharing are powerful tools that can be used across various sections of the SC. Further, digital tools can improve inventory management, inform product quality, and provide real-time data for better resource utilization. However, these technologies have not been studied in detail for their impact on making SCs adopt CE initiatives and hence more circular. The future research efforts can further develop on this study by analyzing the use of specific technologies like, IoT and blockchain as business innovation tools for SCM for CE adoption.

AUTHOR CONTRIBUTIONS

Kapil Khanna: concept development, methodology, research, sourcing the literature, writing the manuscript with inputs from co-authors.
Swee Kuik: analysing the data, verifying sources, drafting and editing, designing tables and figures.
Joowon Ban: overall planning, supervision, proof reading and writing, interpreting the findings.

DECLARATIONS

Competing interests. The authors declare no competing interests.

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