Journal of Cleaner Production 256 (2020) 120375

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

# Organizational enablers for circular economy in the context of sustainable supply chain management

Matloub Hussain [a, *], Mohsin Malik [b]

[a] College of Business (COB), Abu Dhabi University, P.O Box 59911, Abu Dhabi, United Arab Emirates
[b] Swinburne Business School, Department of Business Technology and Entrepreneurship, BA1001, Hawthorn Campus, Australia

ARTICLE INFO

*Article history:*
Received 9 July 2019
Received in revised form
27 January 2020
Accepted 1 February 2020
Available online 5 February 2020

Handling editor: Mattias Lindahl

*Keywords:*
Circular economy
Sustainability
Circular supply chains
Sustainable supply chain management

ABSTRACT

The paradigms of sustainability and circular economy have represented separate streams of academic literature but there is a growing realization that these two paradigms may have a mutually-constitutive relationship. Particularly, the relationship among the two notions in the context of supply chains remains unexplored and this is the focus of this research. We draw on the organizational sense making literature to identify the organizational enablers of circular supply chains and their relationships with the environmental performance of supply chains. Data was collected from various supply chains within the United Arab Emirates (UAE). A structural equation modelling (SEM) approach was adopted to test the hypothesis derived from a systematic review of the literature.

Originality of this work stems from the conceptualisation and validation of a framework for circular supply chains and sustainable performance as a combination of process facilitators and a persuasive organizational narrative that enables organizations to embrace the circular economy practices. The validated framework has implications for both academia and the industry because of its emphasis on the joint effects of a) the discursive ability of organizational actors to articulate a paradigm shift towards circular supply chains b) the process facilitators comprising of actions and practices that enable circular supply chains.



## 1. Introduction

The paradigms of sustainable supply chain management (SSCM) and circular economy (CE) have represented separate streams of literature but there is a growing interest in understanding the overlap between the two which potentially could reveal positive synergies (Genovese et al., 2017). The environmental dimension of SSCM aims to minimize the negative consequences for the environment during the supply chain processes (Seuring and Müller, 2008). The CE paradigm pushes the boundaries of environmental sustainability by espousing a more holistic objective of a production system that is both restorative and regenerative by design (Moreau et al., 2017). The restorative and regenerative design entails minimization of resource usage, waste, emission, and energy leakages by narrowing, slowing and closing material and energy loops (Geissdoerfer et al., 2017). The SSCM has adopted some of the CE practices such as reverse logistics (Genovese et al., 2017) and the 'Reduce, Recycle and Reuse' (Reike et al., 2018) but the fundamental difference between the SSCM and CE lies in the intent. CE is an idealist philosophy that targets a 'regenerative' production system that continually sustains the circulation of resources and energy within a closed system, therefore, reducing the need for new raw materials and inputs into the production system' (Genovese et al., 2017). While a prefect circularity is practically impossible, nevertheless, the CE principles represent a more effective approach in balancing the interplay of environmental protection and economic growth (Ghisellini et al., 2016). Similarly, some SSCM practices implement the CE restorative principle partially and in a more reactive way. For example, the 'Reduce, Recycle and Reuse' objective is to recover the material with an emphasis on the reduction of supply chain's environmental footprint whereas the restorative principle of a CE production system also aims to repair previous damage by promoting the use of more environmentally friendly materials (Murray et al., 2017).

Despite some overlaps, CE is fundamentally different to SSCM and a transition from linear to circular supply chains (CSCs)

* Corresponding author.
*E-mail addresses:* Matloub.hussain@adu.ac.ae (M. Hussain), mmalik@swin.edu.au (M. Malik).

https://doi.org/10.1016/j.jclepro.2020.120375
0959-6526/

warrants a radical shift from the existing business models and practices (Batista et al., 2018). Hofmann (2019) conceptualized SSCM as an incremental and CE as a radical innovation targeted at sustainability. CE's radical innovation conceptualization brings the focus on the people and their ability to initiate the technical processes to facilitate the adoption of circularity in supply chains (Kiefer et al., 2018). The nascent literature on CSCs has also started to appreciate the importance of the organizational human resource towards the transition to circular supply chains (Chiappetta Jabbour et al., 2019) but it still does not address the issue of enabling a strategic shift in the attitude of organizational actors (management and employees) towards CSCs. We aim to bridge this gap by investigating if a normative narrative supporting CE can affect an organisational shift towards enabling CSCs.

We respond to the call by Batista et al. (2018), Korhonen et al. (2018) and Hofmann (2019) to characterize a transition towards CE as a major paradigm shift. This has provided the motivation for this study as we conceptualize adoption of CE principles as a major organizational change. We draw on the organizational sensemaking framework proposed by Maitlis and Lawrence (2007) that posits that an organizational change from state A to state B would necessitate effecting a) process facilitators and b) building a persuasive organizational narrative. The process facilitators are the organizational routines, practices and structures that can either hinder or enable the process of a strategic change. In the context of transition to CSCs, a systematic review of the literature enabled us to identify Collaboration within the Supply Chain Network (COL) and the Supply Chain Configurations (SCC) as the two process facilitators that must be initiated to enable the CSCs. COL measures the role of collaboration within the supply chain network and SCC measures the role of supply chain configurations in the adoption of circular economy practices. The organizational sensemaking literature argues that the presence of process facilitators is a necessary but not a sufficient condition for an organisational change (Brown et al., 2015). The process facilitators must be supported by a persuasive organizational narrative that depends on the organization's discursive ability to shape the cognitions and attitudes of people towards a cause (Sandberg and Tsoukas, 2015). We conceptualize Organizational Narrative (ORN) as the understanding and attitude of management and employees towards CE that, in conjunction with the process facilitators (COL and SCC), comprise the organizational enablers of a transition to CSCs. In this study, we aim to investigate the mutual relationships between the organizational narrative (ORN) and the process facilitators (COL & SCC) and if these CSC enablers affect the environmental performance of supply chains (ENV). ENV has been conceptualized in this paper as the performance measure representing the effect of adoption of circular economy practices on the environmental performance of supply chains. Specifically, we answer the following research question (RQ):

***RQ -*** *"How do the organizational enablers of Circular Supply Chains (CSC) affect the environmental performance of supply chains?"*

Originality of this work stems from the conceptualisation and validation of a framework of circular supply chains as a combination of process facilitators and a persuasive organizational narrative that enables organizations to embrace CE principles. The validated framework has implications for both the academia and the industry because it establishes a relationship between s superior environmental performance of supply chains with the joint effects of a) the discursive ability of organizational actors to articulate an organizational paradigm shift towards circular supply chains b) the process facilitators comprising of actions and practices that enable circular supply chains.

To achieve this, we present CSC organizational enablers framework in Section 2 by highlighting the overlaps between SSCM and CE that lead to the emerging concept of CSCs. Section 3 provides details of our two phase research design of systematic literature review to identify the CSC constructs and develop the research hypothesis. Section 4 reports statistical results from the structural equation modelling (SEM) analyses for the relationships between CSC process facilitators, organizational narrative and the environmental performance of supply chains. Section 5 explains the statistical findings with research and managerial implications. This paper concludes in Section 6 with directions for future research.

## 2. Organizational enablers of circular supply chains

### *2.1. Sustainable supply chain management, circular economy and circular supply chains*

There is a growing realization that an organization's sustainability impact must be considered along its supply chain which led to the emergence of the sustainable supply chain management (SSCM) paradigm. SSCM is defined as 'the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements' (Seuring and Müller, 2008). Despite its emphasis on the triple bottom line of economic, social and environmental sustainability, the SSCM literature has focussed more on minimizing the environmental foot print of the supply chain activities (Malik et al., 2019). Environmentally sustainable practices such as green sourcing (Appolloni et al., 2014), green product design (Linton et al., 2007), green manufacturing (Deif, 2011), and green logistics (Song et al., 2016) enable organizations to be more resource efficient by substituting environmentally harmful inputs with environmentally friendly materials and energy resources. The SSCM emphasis on cleaner production and resource efficiency in the supply chains is identified as 'narrowing down the resources loop' in the CE literature because of the reduction in the resources usage associated with the product and the production process (Bocken et al., 2016). However, the CE literature terms the cleaner production and resource efficiency as 'weak sustainability' (WS) because of the implicit assumption that resources are abundantly available, therefore, the WS emphasis is on reduction of resources' usage by narrowing the material flow in the system (Loiseau et al., 2016). On the contrary, the strong sustainability (SS) calls for fundamental changes to the way goods and services are produced and consumed to preserve the finite set of resources at the disposal of mankind (Dietz and Neumayer, 2007).

The CE tenets of 'slowing and closing resources loops' enable a shift from a WS to SS by prioritising reuse and recovery of resources. Slowing resources loop is enabled by product designs that allow repair and remanufacturing, therefore, slowing down the flow of resources (Bocken et al., 2016). However, the ultimate objective of achieving a restorative and regenerative CE system is facilitated by recycling of resources that closes the material and energy loops (De Angelis et al., 2018; Yang et al., 2018). The overlap between SSCM and CE mainly occurs at the recycling activities towards the downstream operations of a supply chain. Close Loop Supply Chains (CLSCs) have extended the traditional reverse logistics concept to include remanufacturing, reusing, repairing, refurbishing and recycling (5Rs) to restore product value within the same supply chain. The open loop supply chains (OLSCs) extend the closed loop for the 5Rs to production systems outside the supply chain (Batista et al., 2018). A cooperative and collaborative effort to recycle and recover resources in the industrial ecosystem is also a

central tenet of the CE philosophy and it is known as industrial symbioses in the CE literature. An effective industrial symbioses refers to the exchange of materials, water and energy streams between industrial partners to minimise the collective resource usage and environmental impact (Patricio et al., 2018).

Fig. 1 synthesizes information from Loiseau et al. (2016) and Geissdoerfer et al. (2018).to map SSCM and CE principles on a 'Sustainability Paradigm- Level of Change' framework. The Sustainability Paradigm is a spectrum between Weak Sustainability (WS) and Strong Sustainability (SS). WS signifies environmental management paradigms that focus on the minimization of the environmental footprint whereas the SS require more structural changes in the way society and organizations create value (Dietz and Neumayer, 2007). We also draw on the notion of sustainability orientation to relate the transition from WS to SS to the mindset and attitude of the organizational actors. Cheng (2018) defined sustainability orientation as the deeply rooted values, beliefs and behavioural norms that shape a firm's sustainability activities and showed that it affects a firm's performance. This is similar to our conceptualization of organizational narrative (ORN) which we define as the understanding and attitude of organizational actors towards CE.

The emergence of CLSCs and OLSCs bring SSCM closer to CE but it still does not capture the philosophical objectives of CE's production system to be both restorative and regenerative as a more proactive way to balance the economic development and ecological sustainability. A restorative CE system promotes recuperation to the original state whereas a regenerative CE system targets recuperation to a new and usually a higher value state (Batista et al., 2018). In others words, CLSCs and OLSCs target value recovery in supply chains whereas a CE production system aims at opportunities for additional value creation from the recovered material. The OLSCs and industrial symbioses have opened avenues for the use of supply chain wastes to be used by other industries to recover value. However, the CE literature advocates a radical change in how organizations and societies produce and consume goods and services. The reorganisation of current value creation architecture through business model innovation is seen as a key to identify opportunities that would enable a regenerative CE system (Hofmann, 2019). For example, an Australian company, Close the Loop, came up with an innovative idea of using old printer cartridges, soft plastics waste and recycled glass to produce a road surface that lasted 65% longer than the traditional asphalt (Thornton, 2019). The literature calls initiatives like this that identify value creation opportunities to slow, narrow, and close resource loops as the Circular Business Models (CBMs).

The ongoing viability and large-scale adoption of CBMs such as the use of recycled materials for high quality asphalt production are largely dependent upon the reconfiguration of printer, plastic and glass products supply chains to provide their industrial wastes to the construction supply chain as input materials. This expands the traditional supply chain perspective to a broader 'supply chain network' or 'industrial ecosystems' where supply chains collaborate and reconfigure the supply chain networks to share low entropy wastes for potential use as an input to the production processes of other supply chains (Herczeg et al., 2018). This led to the emergence of the Circular Supply Chain (CSC) concept in the literature that has been defined as 'the configuration and coordination of the supply chains to close, narrow, slow, intensify and dematerialise resource loops (Geissdoerfer et al., 2018). From Fig. 1, we identify the overlap of CE and SSCM as the domain of CSC which facilitates the ongoing viability and large scale adoption of CBMs (Geissdoerfer et al., 2018). We build on this stream of literature to posit that the CSCs are enabled by establishing a) collaboration within the supply chain network and reconfiguration of the supply chains for industrial symbioses b) a persuasive organizational narrative that encapsulates a stronger orientation towards sustainability. Next, we describe our theoretical framework that draws on the theory of organizational sensemaking to enable a strategic change in organizations.

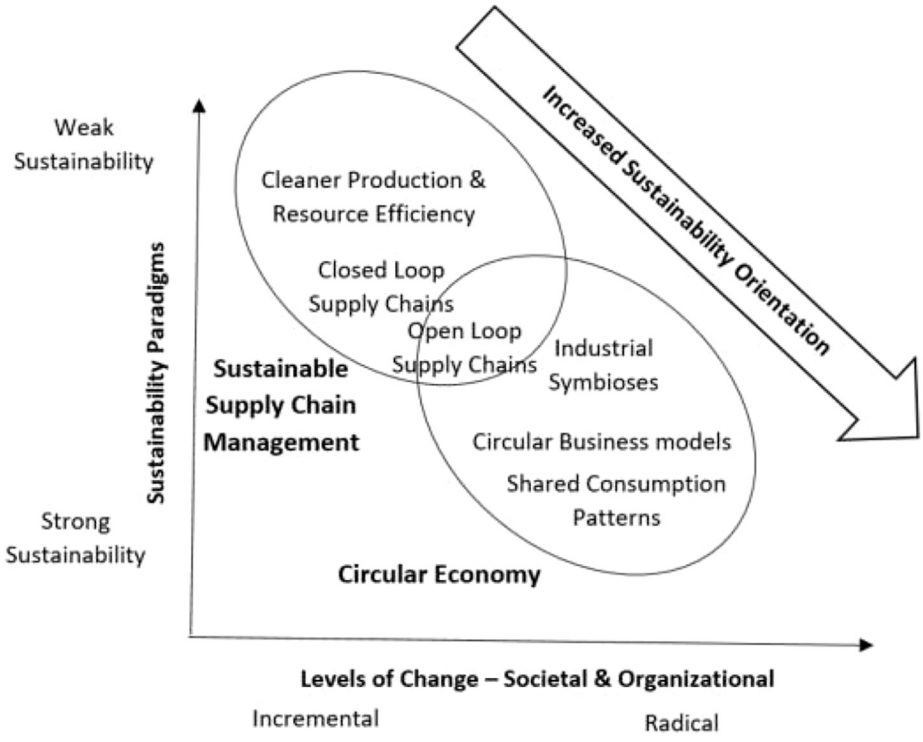


**Fig. 1.** Sustainable supply chain management and circular economy overlaps.

### 2.2. Theoretical framework: organizational enablers of circular supply chains (CSCs)

The organizational sensemaking literature addresses the issues that enable a strategic change from a current organizational state to a future high performing state (Maitlis and Christianson, 2014). In Section 2.1, we conceptualized CSCs as the future high performing state given the CE's established links with Strong Sustainability. Our theoretical framework draws on the sensemaking framework of Maitlis and Lawrence (2007) that identifies two sets of organizational enablers (process facilitators and a persuasive organizational narrative) for implementing a strategic change in how organizations operate. Process facilitators are those tangible actions and practices that facilitate a shift towards new organizational objectives. However, the success of the organizational change initiatives lies in the ability of an organization to construct a persuasive narrative in support of the organizational change (Maitlis and Christianson, 2014). The critical importance of the sustainability awareness and beliefs of organizational actors has also been highlighted in the literature on sustainability orientation. Sustainability orientation measures organizational values, beliefs and behavioural norms that shape its sustainability agenda which is similar to our conceptualization of organizational narrative. Sustainability orientation has been linked to firm performance (Adomako et al., 2019), financial performance (Danso et al., 2019), operational performance (Croom et al., 2018). and green innovation performance (Cheng, 2018). These relationships have been explained in terms of the resource based view by identifying the sustainability awareness within the organization as a unique resource that affects the environmental performance (Cheng, 2018). In a similar vein, our research framework posits that the mutual social constructions between the management and employees that are negotiated on normative grounds result in an organizational narrative that enable the transition to a new organizational state such as CSCs. However, both, process facilitators and a persuasive organizational narrative, need to coexist to build the capacity to change (Müller et al., 2015).

The formation of new supplier-buyer relationships in a collaborative supply chain network (COL) and the redesign of supply chain configurations (SCC) to enable physical flow of resources for industrial symbioses are the two essential process facilitators enabling CSCs. However, drawing on Maitlis and Lawrence (2007) framework, we posit that the process facilitators are more effective when supported by an organizational narrative that is able to garner the support from the management and employees on normative grounds. The nascent literature on the overlap of CE and SSCM can also be categorized on three broad categories of organisational enablers; collaboration in the supply chain network, the redesign of supply chain configurations to share the low entropy wastes with partner industries and CE as a strategic change that calls for alignment of all organizational actors attitudes and behaviours (Hofmann, 2019). In the next Section, we conduct a systematic literature review to identify the theoretical constructs of CSC organizational enablers and to develop research hypothesis for our statistical analyses.

## 3. Research design

Our research premise necessitated exploration of the overlaps of three streams of literature – circular economy, sustainability and supply chain management. Therefore, we employed a two phase research design for this study (Fig. 2). In phase 1, we conducted a systematic literature review of the extant literature on CE and SSCM to develop CSC constructs and research hypothesis. In phase 2 of our research design, we followed Gehlbach and Brinkworth (2011)'s recommended procedure for survey instrument development by seeking feedback from an expert panel to determine if the newly refined conceptualization of CSC organizational enablers matches the perspectives of our population of interest. This was followed by a pilot test to check the clarity of expression of our survey instrument. For further details on the Phase 2, please refer to Section 4. Next, we provide details of the Phase 1 – systematic literature review:

We followed Malik et al. (2018)'s guidelines in conducting systematic literature search by first identifying the relevant search keywords that would guide the search process. We identified 'circular economy', 'sustain*' and 'supply chain*' as the three keywords combination that was likely to provide a representative body of knowledge on CE and SSCM. Next, we accessed two databases Scopus and Business Source Complete (EBSCO) in February 2019 to search the title, abstract and authors provided keywords for the joint presence of the three keywords of "circular economy", "supply chain*" and "sustain*". Scopus is generally considered as the most comprehensive collection of peer reviewed scholarly literature (Ghezzi et al., 2018) and EBSCO database provides access to the literature on business, management and social sciences.

The initial search was constrained to return only peer reviewed journal articles written in English. Scopus returned 156 results and EBSCO returned 42 articles. All 42 EBSCO articles were also returned in the Scopus search, therefore, only 156 Scopus articles were retained for further analyses. Next, we applied relevance filter to keep the articles that were published in the Scopus business, management and accounting journals only. This reduced the available documents to 59. Then, we narrowed down to the journals that were ranked at the 90th percentile or above in the business, management and accounting category within Scopus to ensure access to high quality research. This provided us with the final list of 42 journal articles that was retained for further analyses. The yearly distribution of the search results shows that the overlap of CE and SSCM is a nascent area of research with more than 80% publication since 2018 (Fig. 3). Within the top business and management journals (journal rank $\geq$ 90th percentile), Journal of Cleaner Production has focussed more in this emerging research area as it has published more than two third of the papers appeared in our systematic search (Table 1). Next, we review the identified 42 papers to develop our theoretical constructs and research hypothesis in support of our CSC organizational enablers framework.

### 3.1. CSC process facilitators

#### 3.1.1. Collaboration within supply chain network (COL)

The collaboration construct is central to supply chain management in general. Blome et al. (2014) showed that supply chain collaboration comprising cooperation, mutual understanding and joint efforts affects both the market and sustainability performance of an organization. The collaboration construct within the realm of SSCM mainly constitutes the relationships between the upstream and downstream partners such as supplier engagement (Petljak et al., 2018), supplier training and development (Walker and Jones, 2012), supplier selection (Malik et al., 2016) and environmental collaboration with customers (Beske and Seuring, 2014). However, the OLSCs and CE's industrial symbioses collaborative emphasis takes a broader supply chain network perspective wherein supply chains from multiple industries share their low entropy wastes and by-products to be used as an input material. Industrial symbiosis is a central tenet of CE literature that relies on cooperative organisational behaviours to enable emergence of an industrial ecosystem that simultaneously minimizes the resource usage of virgin input materials and the output of waste products and emissions (Patricio et al., 2018). Govindan and Hasanagic (2018) introduced the notion of 'industrial chains' to stress the

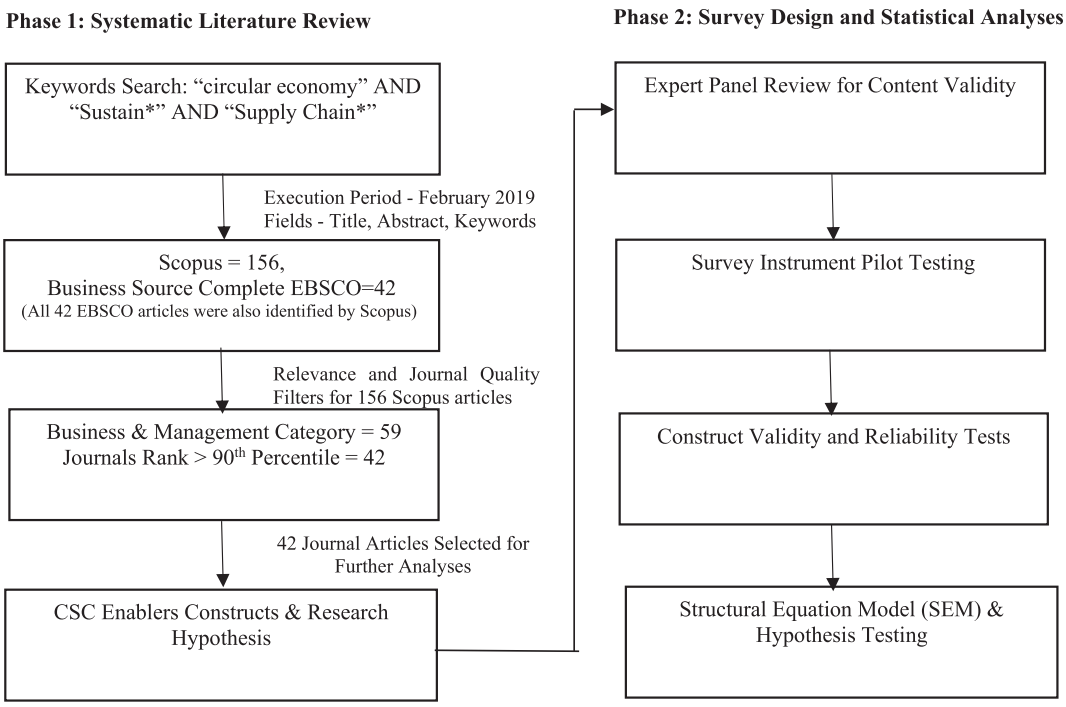


**Fig. 2.** The two phase research design.

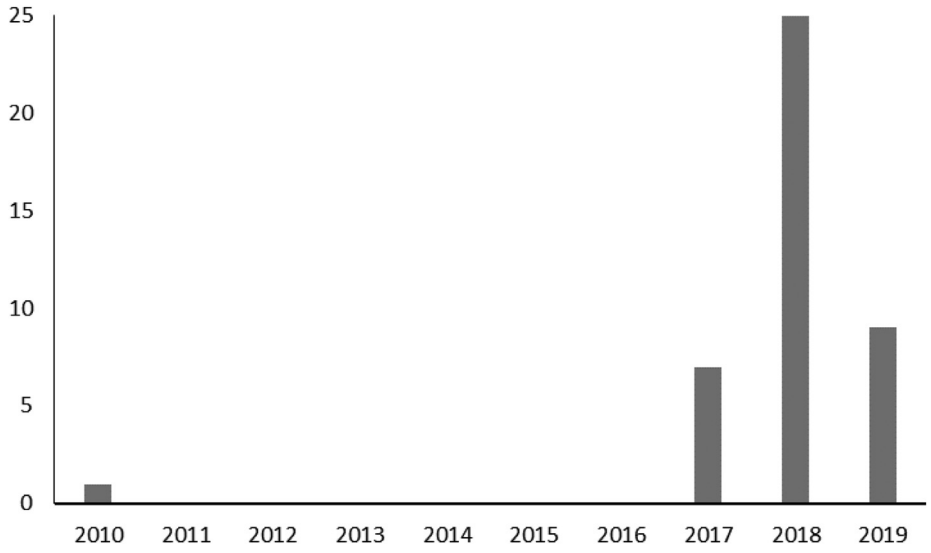


**Fig. 3.** The Time Distribution of 42 papers.

**Table 1**
The journal source distribution.

| Source | Documents |
|---|---|
| Journal Of Cleaner Production | 28 |
| International Journal Of Production Research | 5 |
| Production Planning And Control | 3 |
| Business Strategy And The Environment | 2 |
| Technological Forecasting And Social Change | 2 |
| International Journal Of Production Economics | 1 |
| Omega United Kingdom | 1 |
| Total | 42 |

importance of collaboration between multiple supply chains in a larger supply chain network that usually spans over multiple industrial sectors. This leads us to conclude that a transition to CSCs is enabled when the traditional upstream and downstream collaborative interactions are broadened to include organizations beyond the immediate industrial boundaries of a supply chain.

Typically, there are opportunities in multiple stages of a supply chain to collect and share the wastes and by-products in the broader supply chain network. For example, the paper supply chain has a number of transformation processes such as wood logging, pulping, paper manufacturing and paper cutting. The paper supply chain is part of a broader forest industry supply chain network with dyadic supplier-buyer relationships between pulp mills and fuel

supply chain's heating plants for bark chips (Carlsson et al., 2009). This shows that the responsibility to identify and establish industrial symbioses needs to be distributed at all stages of supply chain. Terming this as an important operational aspects of industrial symbioses in supply chains, Herczeg et al. (2018) suggested implementation of local waste and by-product collection and delivery systems. Ritzén and Sandström (2017) identified the centralized responsibility for pursuing industrial symbioses as a major barrier to CSCs and suggested that all departments and tiers of a supply chain must collaborate to take responsibility for exploring and implementing opportunities to share resources in the wider supply chain network.

The nascent literature on barriers and drivers to CSCs classifies enhanced technologies and information sharing across the value chain as a manifestation of effective industrial symbioses (Govindan and Hasanagic, 2018). The identification of industrial symbioses opportunities requires new process discoveries and input-output mapping of multiple stages of a supply chain within the industrial ecosystem (Patricio et al., 2018). This data intensive process is facilitated by the augmented information sharing and coordination within the broader supply chain network (Tura et al., 2019). Bressanelli et al. (2018) also identified information exchange within global configurations as a key enabler of collaboration within the supply chain network. The final step in establishing industrial symbioses partnerships is also heavily technology dependent. The use of low entropy wastes and by-products as a replacement to virgin resources usually requires new and innovative transformation processes that warrant substantial research and development efforts. The adoption of innovative technologies such as Internet of Things and big data analytics also helps in monitoring, tracing and automating the reverse flow of products (Bressanelli et al., 2018). Collaborative relationships within the value chain to develop the knowledge base and expertise on both the identification and implementation of industrial symbioses opportunities is a key process facilitator for the transition to CSCs (Herczeg et al., 2018; Patricio et al., 2018; Rizos et al., 2016). The multiple facets of the supply chain network collaboration discussed in this section leads us to our first hypothesis:

**H1.** "Collaboration within the Supply Chain Network (COL) positively affects environmental performance of supply chains (ENV)"

The description of CSC constructs and variables of Collaboration within the Supply Chain Network (COL) and the environmental performance of supply chains (ENV) is provided in Table 2. Table 2 also provides details of CSC Organizational narrative (ORN) and Supply Chain Configuration (SCC).

#### 3.1.2. Supply chain configuration (SCC)

The collaboration within the supply chain network (COL) is aimed at identifying opportunities for industrial symbioses but in most cases, the existing supply chain configurations need to be redesigned to implement sharing of industrial wastes and by-products. Therefore, not surprisingly, the emerging literature on CSCs has focussed more on reverse flow management in supply chains (Tura et al., 2019). The introduction of reverse logistics enables CLSCs to use recycling, repairing, refurbishing, remanufacturing and reusing for resource conservation with the same supply chain. However, the OLSCs entails cross sector waste management and utilization of the by-products which requires systemic change in the supply chain network to ensure sustained recovery and delivery of resources (Howard et al., 2018). Bressanelli et al. (2018) examined supply chain redesign for CE and concluded that the return flows uncertainty about the quantity, mix, timing and location of resources pick-ups and deliveries restricted the ability of reverse flows to reach an economic scale. Ritzén and Sandström (2017) suggested that the supply chains with similar supply and distribution structures are more likely to minimize the returns flow uncertainty, therefore, enabling CSCs. Mohamed Sultan and Mativenga (2019) used the notion of 'supply chain complexity for circular economy' to characterize the geospatial incompatibilities within the supply chain network. The study suggested joint decision making by stakeholders to position the recycling facilities for compatible supply and distribution channels within the supply chain network.

An important aspect of supply chain design enabling transition to CSCs is the inherent flexibility of the existing supply chain structures to introduce and extend the reverse product flow to the broader supply chain network. The global supply chains of large corporations with dispersed geographic locations find the reverse logistics particularly challenging (Govindan et al., 2015) but the OLSCs open up the possibility of sharing the low entropy wastes and by-products within the industrial ecosystem that may be in close physical proximity. However, this is largely dependent upon what De Angelis et al. (2018) referred to as the ability of an organizations to break the 'linear lock in'. The study postulated that CSCs are more likely to be developed from new start-ups that are still establishing their supply chains. For established global supply chains, emerging approaches such as redistributed manufacturing provide avenues to break the 'linear lock-in' by product manufacturing at multiple scales and locations, therefore, reducing the spatial complexities for the reverse product flow (Prendeville et al., 2016). Srai et al. (2016) investigated effect of redistributed manufacturing on the supply chain structures of multiple industries and noted blurring of industrial boundaries beyond the traditional supply chain boundaries. This leads us to hypothesize supply chain configuration as a process facilitator by designing/redesigning and restructuring supply chains to physically connect with partners in the industrial eco systems to share resources which then, reduces the environmental footprint of supply chains (H2).

**H2.** "Supply Chain Configuration (SCC) positively affects environmental performance of supply chains (ENV)"

### 3.2. CE organizational narrative

Even though the literature has highlighted the benefits of CSC, less is known regarding the organizational norms, values and narratives that support CE (Batista et al., 2018). This is surprising given the near consensus in the emerging literature on CE and SSCM that a transition to CSCs is a strategic change initiative that requires a paradigm shift (Gupta et al., 2018; Hofmann, 2019; Korhonen et al., 2018). An organizational paradigm shift necessitates a focus on people and the ability of an organization to influence the collective behaviour of all organisational actors towards the new organisational objective (Maitlis and Lawrence, 2007). The theory of organizational sensemaking calls this as the discursive ability of an organization that helps it to construct a persuasive and normative narrative in support of a paradigm shift (Müller et al., 2015). We draw on this stream of literature to conceptualize organizational narrative as a prevailing discourse that is a result of the shared understanding of the management and employees regarding the need to transition to CSCs. Sandberg and Tsoukas (2015) used the analogy of a 'springboard' for a persuasive organizational narrative because it sets up the organizational actors to embrace change. Therefore, we posit that the absence of a persuasive narrative that is grounded on normative principles adversely affects both the implementation of CSC process facilitators (COL and SCC) and the desired CE objective of improved environmental performance.

Maitlis and Lawrence (2007) calls for a social change in organization as an antecedent to the implementation of a strategic

**Table 2**
CSC organizational enablers and environmental performance of supply chains.

| # | Constructs and Variables | Description | Source |
|---|---|---|---|
| | Organizational Narrative (ORN) | ORN measures the understanding and attitude of organizational actors towards CE | |
| 1 | *Understanding of circular economy insights* | *A mutual understanding of CE principles and insights by management and employees enables transition to CSCs.* | Batista et al. (2018) |
| 2 | *Awareness of CE's potential for revenue gains* | *An awareness of CE's potential for revenue gains by management and employees enables transition to CSCs* | Bressanelli et al. (2018) |
| 3 | *Sustainability awareness* | *A general awareness of sustainability by management and employees enables transition to CSCs* | Tura et al. (2019), Moktadir et al. (2018) |
| 4 | *Awareness of CE's potential for costs savings* | *An awareness of CE's potential for cost savings by the management and employees enables transition to CSCs.* | Tura et al. (2019) |
| | **Collaboration within the Supply Chain Network (COL)** | COL measures the role of collaboration within the supply chain network in the adoption of circular economy practices | |
| 5 | *Collaborative interactions between tiers of supply chains from multiple industries* | *CSCs are enabled by collaboration with supply chain partners within and beyond the immediate industrial boundaries.* | De Angelis et al. (2018) Govindan and Hasanagic (2018) |
| 6 | *Distributed Responsibility for CE implementation across the supply chain* | *CSCs are enabled by a supply chain wide responsibility for implementing CE principles.* | Ritzén and Sandström (2017) Herczeg et al., (2018) |
| 7 | *Enhanced information and technologies sharing within the value chain* | *CSCs are enabled by enhanced information sharing and technological support within the value chain.* | Tura et al. (2019) Bressanelli et al. (2018) Patricio et al. (2018) |
| | **Supply Chain Configuration (SCC)** | SCC measures the role of supply chain configuration in the adoption of circular economy practices | |
| 8 | *Similarity in supply and distribution systems* | *CSCs are enabled by the application of similar operational and logistical practices across the supply chain network.* | Ritzén and Sandström (2017) Bressanelli et al. (2018) |
| 9 | *Restructuring supply chains to include end of life returns and managing byproducts and waste.* | *CSCs are enabled by supply chain restructuring to include processes for end of life returns, managing the byproducts and waste produced during the production process.* | Batista et al. (2018) Mohamed Sultan and Mativenga (2019) |
| 10 | *Structural flexibility* | *CSCs are enabled by a greater supply chain structural flexibility that breaks the 'linear lock-in' and geographical barriers.* | De Angelis et al. (2018) Prendeville et al. (2016) Srai et al. (2016) |
| | **Supply Chain Environmental Performance (ENV)** | The performance measure representing the effect of adoption of circular economy practices on the environmental performance of supply chains. | |
| 11 | *Compliance to environmental regulations* | *The performance of the supply chain in compliance to the applicable environmental laws and regulations by the adoption of circular economy practices.* | Sarkis et al. (2010), Hussain et al. (2019) |
| 12 | *Reduction in energy consumption* | *The performance of the supply chain in reducing the energy consumptions by the adoption of circular economy practices.* | Sarkis et al. (2010) Jadhav et al. (2019) |
| 13 | *Reduction in the usage of hazardous/toxic materials* | *The performance of the supply chain in reducing the usage of hazardous/toxic material by the adoption of circular economy practices.* | Zhu et al. (2007), Sarkis et al. (2010) |

change initiative such a transition to CSCs. Deciphering the link between the social interactions in organizations, Maitlis and Christianson (2014) identified the recursive relationship between organizational change and a persuasive organizational narrative. When leaders influence attitudes and behaviours of employees towards a cause, the employees make changes in their own roles and practices. This also helps others by explaining the vision and co-constructing ways that help shape the persuasive organizational narrative. The literature on sustainability orientation has now established the relationship between sustainability awareness and environmental performance (Cheng, 2018). The CE literature has also started to recognize the role of social constructions to enable the transition to CSCs. For example, Tura et al. (2019) observed that the organizational actors' cognitions such as sustainability awareness and a deeper understanding of CE's economic benefits contributes to transition to CSCs. Similarly, Rizos et al. (2016) identified the mindset and commitment of staff as the most dominant enabler for the adoption of CE practices in small and medium enterprises (SMEs). These findings propose a recursive relationship between the organizational narrative and the transition to CSCs i.e a compelling CE organizational narrative would affect the environmental performance of supply chain directly and it would also affect the process facilitators. Govindan and Hasanagic (2018) also stated that exploration of supply chain narratives and values of current practices of CE would help understand its present level of CE implementation. Zeng et al. (2017) characterized corporate management's sustainability advocacy as an element of institutional pressure that affects the adoption of CE practices. In light of the above discussion, we hypothesize a recursive relationship of CE organisational narrative with both the environmental performance of supply chains (H3) and the two process facilitators of collaboration within the supply chain network (H4) and supply chain configuration (H5).

**H3.** "A CE organizational narrative (ORN) positively affects supply chain environmental performance (ENV)"

**H4.** "A CE organizational narrative (ORN) positively affects the process facilitator of Collaboration in the Supply Chain Network (COL)"

**H5.** "A CE organizational narrative (ORN) positively affects the process facilitator of Supply Chain Configuration (SCC)"

## 4. Statistical analyses and results

### 4.1. Data collection and sample context

We used perceptual measures for our theoretical constructs. The

use of latent constructs to measure the facts and beliefs associated with organizational practices and performance is necessitated because of the absence of objective sources of information or when a common operational definition cannot be generalized to a multiple industry context (Helmuth et al., 2015). However, we followed Krause et al. (2018)'s best practices on key informants by identifying only the middle and top managers as the potential respondents. Krause et al. (2018) suggested that the self-reported evaluations of the senior managers of the relevant business areas are likely to be consistent with the objective observations.

The systematic literature review conducted in Section 3 identified four theoretical constructs of ORN, COL, SCC and ENV and the variables representing these four constructs. Since, these constructs are new and have not been tested in the literature as yet, we then followed Gehlbach and Brinkworth (2011)'s guidelines for new survey instrument development. These guidelines suggest active engagement with the domain experts to determine the content relevance and representativeness of the theoretical constructs identified and refined in the literature review. Ten senior industry managers with significant experience in sustainability strategy and supply chain management were approached for interviews and in person discussions to determine the face and content validity of the theoretical constructs. The discussions with the individual experts had two specific objectives. First, views of the experts were sought on the theoretical constructs and the constructs' variables to confirm the theoretical conceptualizations. The expert panel broadly agreed that the CSC domain has been adequately sampled by the four theoretical constructs identified in Section 3. Second, we used an adaptation of the Q-Sort technique (Gehlbach and Brinkworth, 2011) to determine if the industry experts categorize the variables in the four constructs in the same way as the literature in Table 3. Each expert was individually asked to group similar variables. All ten experts were able to match the variables to their theoretical constructs giving us an early and a qualitative indication of the convergent and divergent validity of the four constructs. After determining the face and content validity of the theoretical constructs, we developed survey questions representing all 13 variables. The expert panel was again approached for a pilot test of the survey questions. The focus in this step was on the wording and the clarity of expression so that the potential respondents are able to provide valid responses. Based on the feedback of the expert panel, several items were rephrased and explanations of key CE and CSC concepts were added in the survey.

The population of interest for this survey was the senior management in the United Arab Emirates (UAE) based firms that had experience in sustainability strategy and supply chain management. Member companies of Abu Dhabi Sustainability Group (ADSG) were approached for the recruitment of survey respondents. ADSG is a multi-industry cooperative body with voluntary memberships to promote sustainability in the region. Paper copies of the survey were provided to the ADSG member companies in March 2019 with follow up emails and phone calls to encourage participation. A total of 175 reusable responses were received. Table 3 describes the demographics and the industry sector composition of respondents.

The non-response bias was investigated by conducting a Mann-Whitney *U* test (Jadhav et al., 2019) to compare the first quarter (n = first 43) to the last quarter (n = last 43) of respondents. No statistically significant differences (p value > 0.05) were obtained between two subsets of the respondents. We also tested for differences in responses with respect to industry, size and revenue but did not find any statistically significant differences. To test for common method bias, a 'common latent factor' was introduced in the measurement model which allows the survey items to load on their theoretical constructs and also, on the common latent factor (Podsakoff et al., 2012). The measurement model was calculated with the unconstrained and constrained common latent factor to test for any statistically significant differences, The chi-square test for the difference was statistically significant ($\chi^2_{(df=12)} = 86.545$ at p-value<0.005) which shows that there was a risk of a measureable bias in our data. To control for the common method bias, we applied the statistical remedy suggested by Podsakoff et al. (2003) to keep the common latent factor in our subsequent causal analyses including the measurement model and the confirmatory factor analyses. This allows our model to calculate statistical results while adjusting for the common method bias. The data was then analysed using structural equation modelling (SEM) which statistically tests a hypothesized model and its predictive validity.

**Table 3**
Profile of the Respondents and their Organizations.

| | Frequency | Percentage |
|---|---|---|
| **Nature of Organization** | | |
| Manufacturing | 56 | 32% |
| Service | 73 | 42% |
| Oil & Gas | 46 | 26% |
| Total | 175 | 100% |
| **Management Level** | | |
| Middle Management | 102 | 59% |
| Top Management | 73 | 41% |
| Total | 175 | 100% |
| **Service in the organization** | | |
| Less than 2 years | 12 | 7% |
| Less than 5 years | 73 | 42% |
| More than 5 years | 90 | 51% |
| **Number of Employees** | | |
| Less than 500 | 38 | 22% |
| Between 500 & 1000 | 93 | 53% |
| Greater than 1000 | 44 | 25% |
| Total | 175 | 100% |
| **Total annual revenue in millions (AED)** | | |
| Less than 10 | 0 | 0% |
| Between 10 and 50 | 43 | 25% |
| More than 50 | 132 | 75% |
| Total | 175 | 100% |

### 4.2. Validity and reliability testing

After determining the adequacy of the data collection method, an overall measurement model was constructed in AMOS version 25 to examine the unidimensionality and construct validity for the collected data (Hair et al., 2018). The measurement model fitness measures were calculated using $\chi 2$/degree of freedom ratio (CMIN/DF), Comparative Fit Index (CFI), the Incremental Fit Index (IFI) and Standardized Root Mean Square Residual (SRMR). Our measurement model resulted in CMIN/DF = 4.755, CFI = 0.910, IFI = 0.911 and SRMR = 0.05 which meets the recommended thresholds of CMIN//DF < 5, CFI and IFI >0.90 and SRMR <0.08 (Hair et al., 2018). The measurement model offering a good fit allowed us to conduct multiple statistical tests to determine construct validity for our data (Table 4). The Average Variance Extracted (AVE) for the four constructs was recorded in excess of the recommended threshold of 0.50 (Alumran et al., 2014). The composite reliability test exceeded the benchmark of 0.7 for all four constructs (Archimi et al., 2018). The square root of AVE was greater than the factors correlation confirming the discriminate validity of the individual constructs (Archimi et al., 2018). Maximum Shared Variance (MSV) was less than their corresponding AVE which provided further support for the discriminate validity of the constructs for the collected data (Alumran et al., 2014).

**Table 4**
Reliability & discriminate validity tests.

| | No. of Items | ORN | COL | SCC | ENV | Composite Reliability | AVE | MSV |
|---|---|---|---|---|---|---|---|---|
| Organizational Narrative (ORN) | 4 | **0.802** | | | | 0.877 | 0.643 | 0.626 |
| Collaboration Within Supply Chain Network(COL) | 3 | 0.373 | **0.850** | | | 0.886 | 0.723 | 0.398 |
| Supply Chain Configuration (SCC) | 3 | 0.749 | 0.248 | **0.829** | | 0.866 | 0.687 | 0.561 |
| Supply Chain Environmental Performance(ENV) | 3 | 0.791 | 0.631 | 0.657 | **0.883** | 0.914 | 0.779 | 0.626 |

AVE = Average Variance Extracted (AVE) - Square root of AVE is shown as bold in diagonal.
MSV – Maximum Shared Variance.

### *4.3. The structural equation model (SEM) and the hypothesized findings*

After establishing construct validity, a structural equation model was constructed to assess the path coefficients for hypothesis testing. The fitness of the structural equation model was also evaluated which showed a good model fit (CMIN/DF = 4.252, CFI = 0.940, IFI = 0.941, SRMR = 0.043). The standard coefficients and the t-values for all construct variables are also shown in Table 5 whereas Fig. 4 shows the hypothesis test results for the structural model path diagram.

All 5 hypothesized relationships were supported ($p < .05$ or 0.005) which suggests that the respondents identified a strong relationship between the constructs of organizational narrative (ORN), the process facilitators (COL and SCC) and environmental performance of supply chains (Table 6). ORN seems to be the dominant organizational enabler because it had both direct and indirect relationship on ENV. The indirect effects of ORN on ENV are mediated by both the process facilitators (Table 7). The indirect effects of ORN on ENV through SCC and COL was examined by the Cohen's indirect effect measure (Jadhav et al., 2019) which showed partial mediation of a medium magnitude. No mediation was observed for the relationships between ORN→ SCC and COL→ ENV.

## 5. Discussion

### *5.1. CE process facilitators and environmental performance*

The positive significant relationships identified for hypothesis H1 and H2 establish the importance of visible CE practices for the improved environmental performance of supply chains. The collaborative interactions between various supply chain members have been linked to a superior supply chain performance (Blome et al., 2014) and our research contributes to the literature by establishing strong relationship between collaboration in the broader supply chain network with a superior environmental performance of supply chain. The literature has only presented research propositions suggesting a link between the collaborative interactions in the industrial ecosystems with a transition to CE such as De Angelis et al. (2018), Korhonen et al. (2018) and Tura et al. (2019). Similarly, Nascimento et al. (2018) suggested that digital transformations in data management and information systems enable material traceability and collaboration in material collection and recycling facilities Gupta et al. (2018) also inferred that a coordinated and holistic big data analyses in the supply chain network would result in economic, environmental and social benefits. Our study provides statistical support for these assertions because the COL construct measures both the intra/inter organizations collaborative interactions and enhanced information and technology sharing in the supply chain network. This is a significant contribution to the literature because the criticality of collaboration, both in terms of interactions and enhanced information and technology sharing within the supply chain network has not yet been empirically established. This new evidence has important implications for practice because it provides support for the adoption of Industry 4.0 technologies such as big data and IoT as a driver of industrial symbioses within the supply chain network.

The second process facilitator was Supply Chain Configuration (SCC) that was hypothesized to affect environmental performance of supply chains. This relationship was found to be statistically significant (H2) in our analyses confirming the research propositions of De Angelis et al. (2018) who termed the supply chain structural flexibility as a key element of constructing circular material loops around the linear supply chains. This finding also supports the qualitative inference of Srai et al. (2016) who observed that the supply chain redesign is the primary lever through which multiple supply chains can be made to implement industrial symbioses. The supply chain redesign was also described as an enabler for the inclusion of end of life product recovery and the effective use of the by-products (Batista et al., 2018). Our statistical findings have supported the emerging literature on the CE that identified the supply chain restructuring as a building block towards CSC but the literature lacked empirical results. The evidence that the SCC provides a more effective way of improving supply chain environmental performance also has important practical implications because the industry must now move away from the traditional linear supply chain perspective and instead, look for collaborative opportunities in the wider supply chain network to 'slow, narrow and close' the resources loop.

The CE literature is also proposing a mutually constitutive relationship between the COL and SCC. For example, Korhonen et al. (2018) linked the establishment of materials and energy loops for by-products to the cooperation of producers, consumers and other actors within the business ecosystem. This implies collaboration within the supply chain network should influence the redesign and

**Table 5**
CFA results for individual construct variables.

| Constructs and Variables | Standard Coefficients | t- Values *** |
|---|---|---|
| Organizational Narrative (ORN) | | |
| 1 | 0.793 | 10.164 |
| 2 | 0.860 | 12.006 |
| 3 | 0.799 | _a |
| 4 | 0.797 | 12.381 |
| Collaboration within the Supply Chain Network (COL) | | |
| 5 | 0.710 | 13.851 |
| 6 | 0.908 | 26.531 |
| 7 | 0.917 | _a |
| Supply Chain Configuration (SCC) | | |
| 8 | 0.796 | 14.586 |
| 9 | 0.964 | 12.416 |
| 10 | 0.706 | _a |
| Environmental Performance (ENV) | | |
| 11 | 0.871 | _a |
| 12 | 0.833 | 13.906 |
| 13 | 0.941 | 14.698 |

*** all significant to $p < 0.000$.
_a indicates a parameter that was fixed at 1.0.
n = 175, Estimation Method = Maximum Likelihood.
Model fit indices: CMIN/DF = 4.252, CFI = 0.940, IFI = 0.941 SRMR = 0.0431.

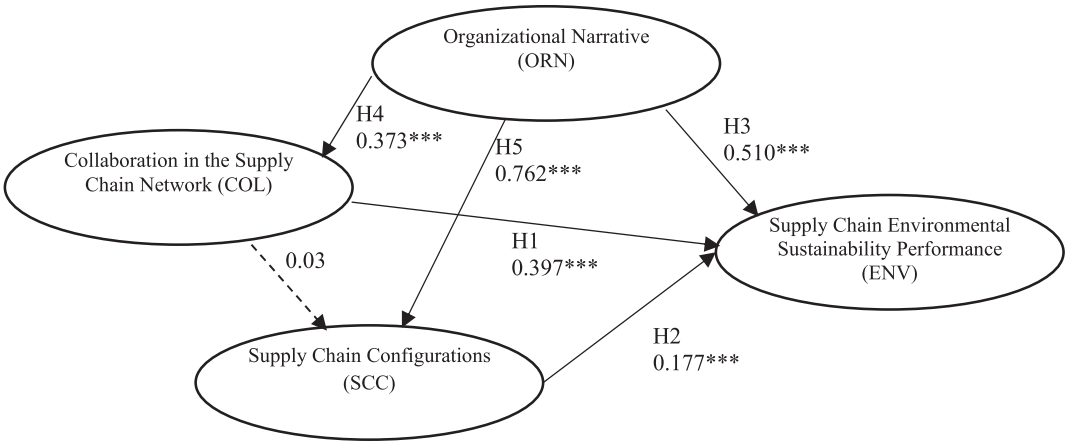


**Fig. 4.** Results from the structural equation model.

**Table 6**
Significance of the relationships identified for the hypotheses.

| Relationships | Hypothesis | Standard Coefficients | t-Values | Decision |
|---|---|---|---|---|
| COL→ ENV | H1 | 0.397 | 8.733*** | Accept |
| SCC → ENV | H2 | 0.177 | 2.827*** | Accept |
| ORN→ ENV | H3 | 0.510 | 7.048*** | Accept |
| ORN → COL | H4 | 0.373 | 4.193*** | Accept |
| ORN → SCC | H5 | 0.762 | 10.388*** | Accept |

**, *** indicates the significance of the p value at < 0.05, <0.005.
n = 175, Estimation Method = Maximum Likelihood.
Model fit indices: CMIN/DF = 4.252, CFI = 0.940, IFI = 0.941, SRMR = 0.0431.

restructuring of supply chain configurations but our analyses did not reveal a statistically significant relationship between COL and SCC. The lack of a mutual relationship between the two process facilitators (COL and SCC) is an interesting finding which can possibly be explained by the 'extent of collaboration' within the supply chain network. The literature identifies three dimensions of supply chain collaboration; information sharing, decision synchronization and incentive alignment (Rota et al., 2018). The collaboration construct within the supply chain network assumes a different connotation with a focus on knowledge and experience sharing, across a web of interconnected supply chains, to develop core capabilities for addressing common challenges (Herczeg et al., 2018). The COL construct within our research design extended the information sharing dimension of supply chain collaboration to the industry partners outside the boundaries of supply chains but it excluded joint decision making. This is supported by the literature on operationalizing industrial symbolises that usually involves complex interdependencies between network relationships (Bain et al., 2010). On the contrary, the supply chain configuration (SCC) entails decisions regarding the supply chain design which are generally made at the individual organization level. The differences in the nature of collaboration within a supply chain and a supply chain network were confirmed by our data analyses as no statistically valid relationship between COL and SCC was observed. Our results show that COL and SCC are two distinct constructs that independently affect the environmental performance of supply chains. Nevertheless, we identify the testing the relationship between COL and SCC in other contexts as a future research directions to fully understand their mutual relationship or lack of it.

The statistically significant relationships between the COL and ENV and SCC and ENV for our survey data corroborated with the findings of multiple real world CE implementations reported in the literature. For example, Ali et al. (2019) reported energy savings of 67% when the automotive supply chain was reconfigured to provide metal scrap to the construction industry as a raw material for metal building facades. Similarly, Wang et al. (2019) reported substantial improvements in the environmental performance as a result of collaboration and restructuring of manufacturing, electricity generation and chemicals processing supply chains to enable symbiotic exchange for energy, material and water. Gopinath et al. (2018) conducted a comprehensive review on the emissions reduction of cement and energy industries by using the sugar processing wastes. The implementation of these reported symbiotic exchanges was facilitated by the collaboration in the supply chain network (COL) and the supply chain configurations (SCC) which supports our statistical results of a valid relationship between the two process facilitators and the improved performance of supply chains (ENV).

### 5.2. The role of a persuasive organizational narrative for CE

The organizational sensemaking literature allowed us to characterize the transition to CSCs as a strategic change initiative. A key element of the organizational sensemaking process is the co-

**Table 7**
Significance of indirect relationships.

| Mediator | Relationship | Direct Effect (c') | Indirect Effect (a.b) | Total Effect (c) | Cohen's Indirect Effect Measure | Proportion of Total Effect Mediated (c-c')/c |
|---|---|---|---|---|---|---|
| SCC | ORN→ ENV | 0.510*** | 0.135*** | 0.645*** | Partial Mediation - Medium | 20.9% |
| COL | ORN→ ENV | 0.510*** | 0.148*** | 0.658*** | Partial Mediation - Medium | 22.50% |
| COL | ORN→ SCC | 0.762*** | - | 0.762*** | No Mediation | - |
| SCC | COL→ ENV | 0.397*** | - | 0.397*** | No Mediation | - |

We only report statistically significant relationships.
**, *** indicates the significance at p values of <0.05, <0.005.
Cohen's Indirect Effect Measure = 0.01–0.09 (Small), 0.10–0.25 (Medium) and >0.25 (Large).

construction of a collective narrative for change (Brown et al., 2015). An organizational narrative rooted in normative grounds is more likely to be broadly shared by all organizational actors (Maitlis and Christianson, 2014). We identified CE's organization-wide awareness of CE, sustainability insights and the economic potential of CE as providing the normative bases for the transition to CSCs. This brings a new and more proactive perspective to the CE literature because it focusses on the CE economic benefits whereas some of the earlier identified CE motives included supply chain risk minimization and decoupling economic and ecological development (Hofmann, 2019). The organizational sensemaking efforts rely on social constructions between organizational actors to generate an organizational narrative (ORN) that supports adoption of CE principles. Our statistically significant results have confirmed our research premise that a persuasive narrative (ORN) that is grounded in normative principles affects both, the implementation of CE process facilitators (COL and SCC) and the desired CE objective of improved environmental performance. This is in line with the theoretical underpinnings of organizational sensemaking literature which sees a persuasive normative narrative as a 'springboard' that can help organizational actors to achieve the new organizational objectives (Sandberg and Tsoukas, 2015) which in our case was the transition to CSC. These results have important managerial implications because of the evidence that if an organization is able to effectively communicate the rationale of adoption of CE, it affects both the adoption of CE practices (process facilitators) and the environmental performance (ENV). The double mediation effects through both the process facilitators (COL and SCC) had an accentuated effect on the ENV (Table 7). The direct and indirect significant relationships of ORN with superior environmental performance is a new finding in the context of SSCM and CE literature and it has the potential to be a watershed moment in the SSCM and CE discourse.

The literature in organization studies has established the recursive relationship of organizational sensemaking and achievement of strategic outcomes (Brown et al., 2015; Maitlis and Christianson, 2014). Conceptualizing a transition to CSC as a strategic initiative enabled us to identify the presence of process facilitators as a necessary condition for CE but these need to be supported by a persuasive organizational narrative to effect a transition to CSC. The empirical support for a double mediation effect (see Table 7) confirms the recursive nature of organizational narrative as a key enabler for CSC that has a double effect on the environmental performance of supply chains. This finding is critical for the successful implementation of CE initiatives. The sustainability and circular economy practices must have a compelling organizational narrative as an antecedent to transition to CSC because this convinces the organizational actors of CE benefits which then, enables them to take the ownership of the CE initiatives. This confirms Rizos et al. (2016) and Tura et al. (2019) propositions that the organizational actors' cognitions such as sustainability awareness and a deeper understanding of CE's economic benefits contributes to transition to CSCs.

The findings of this work has implications for both academia and the industry. The literature on the SSCM and CE synergies and distinctive features is still emerging. Consequently, both industry and academia, are interchangeably using/applying both concepts. Our work demarcates boundaries and identifies synergies between SSCM and CE further developing the nascent body of knowledge on circular supply chains. Most of the previous work on CE is rooted in industrial and engineering ecology and it has focused more on exploration and case studies. Our conceptualization of CSCs as a strategic change initiative allowed us to link the management literature with the CE discourse. Our statistical results have validated a framework developed with the theoretical lens of organizational sensemaking. This is a novel and significant contribution to the SSCM and CE literature that directly affects the ability of organizations to embed the CE elements into their supply chains.

## 6. Conclusions, limitations and future research

This study answered the research question: "How do the organizational enablers of Circular Supply Chains (CSC) affect the environmental performance of supply chains (ENV)?" We conceptualized a persuasive organizational narrative (ORN) and Collaboration within the Supply Chain Network (COL) and Supply Chain Configurations (SCC) as the set of organizational enablers that facilitate the transition to CSC. Our research found empirical support for the hypothesized relationships between the COL → ENV (H1), SCC → ENV (H2), ORN → ENV (H3), ORN → COL (H4) and ORN → SCC (H5). This is one of the first empirical validation of the relationships between the two process facilitators (COL and SCC) and the environmental footprint of supply chains (ENV). No relationship was found between the COL and SCC. A key finding of our research is the confirmation of a recursive relationship for ORN through the identification of a double mediation effect i.e ORN had both direct effect and indirect effect on ENV through the two process facilitators of COL and SCC. This reaffirms the criticality of social constructions within organizations for enabling strategic change initiatives. The extant literature on SSCM and the emerging body of knowledge on CE does not focus on taking measures to elicit cooperative behaviours from the organizational actors. We conclude that organizations must develop a persuasive narrative as an antecedent to the implementation of CE practices for a transition to CSCs.

The literature on CE and SSCM is in its early stages and we cannot rule out the effects of other variables on the identified relationships. We acknowledge this and identify it as a limitation of this research. Moreover, our data conformed to the convergent validity, discriminate validity and reliability testing criteria but we still would like to acknowledge the presence of common method bias in the data collection method. We followed the best post hoc practices (Podsakoff et al., 2003) to minimize the common method bias by including a common latent factor in our all data analyses which seemed effective. Future study may examine the proposed framework in different supply chains by expanding the organizational enablers framework which would help generalize our findings.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## CRediT authorship contribution statement

**Matloub Hussain:** Conceptualization, Data curation, Investigation, Project administration, Writing - original draft, Supervision, Writing - review & editing. **Mohsin Malik:** Formal analysis, Methodology, Writing - review & editing.

## Acknowledgements

All persons who have made substantial contributions to the work reported in the manuscript (e.g., technical help, writing and editing assistance, general support), but who do not meet the criteria for authorship, are named in the Acknowledgements and have given us their written permission to be named. If we have not included an Acknowledgements, then that indicates that we have

not received substantial contributions from non-authors.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2020.120375.

## References


Adomako, S., Amankwah-Amoah, J., Danso, A., Konadu, R., Owusu-Agyei, S., 2019. Environmental sustainability orientation and performance of family and nonfamily firms. Bus. Strat. Environ. 28 (6), 1250–1259.

Ali, A.K., Wang, Y., Alvarado, J.L., 2019. Facilitating industrial symbiosis to achieve circular economy using value-added by design: a case study in transforming the automobile industry sheet metal waste-flow into Voronoi facade systems. J. Clean. Prod. 234, 1033–1044.

Alumran, A., Hou, X.Y., Sun, J., Yousef, A.A., Hurst, C., 2014. Assessing the construct validity and reliability of the parental perception on antibiotics (PAPA) scales. BMC Publ. Health 14 (1).

Appolloni, A., Sun, H., Jia, F., Li, X., 2014. Green Procurement in the private sector: a state of the art review between 1996 and 2013. J. Clean. Prod. 85, 122–133.

Archimi, C.S., Reynaud, E., Yasin, H.M., Bhatti, Z.A., 2018. How perceived corporate social responsibility affects employee cynicism: the mediating role of organizational trust. J. Bus. Ethics 151 (4), 907–921.

Bain, A., Shenoy, M., Ashton, W., Chertow, M., 2010. Industrial symbiosis and waste recovery in an Indian industrial area. Resour. Conserv. Recycl. 54 (12), 1278–1287.

Batista, L., Bourlakis, M., Smart, P., Maull, R., 2018. In search of a circular supply chain archetype–a content-analysis-based literature review. Prod. Plann. Contr. 29 (6), 438–451.

Beske, P., Seuring, S., 2014. Putting sustainability into supply chain management. Supply Chain Manag.: Int. J. 19 (3), 322–331.

Blome, C., Paulraj, A., Schuetz, K., 2014. Supply chain collaboration and sustainability: a profile deviation analysis. Int. J. Oper. Prod. Manag. 34 (5), 639–663.

Bocken, N.M., De Pauw, I., Bakker, C., van der Grinten, B., 2016. Product design and business model strategies for a circular economy. J. Ind. Prod. Eng. 33 (5), 308–320.

Bressanelli, G., Perona, M., Saccani, N., 2018. Challenges in supply chain redesign for the Circular Economy: a literature review and a multiple case study. Int. J. Prod. Res.

Brown, A.D., Colville, I., Pye, A., 2015. Making sense of sensemaking in organization studies. Organ. Stud. 36 (2), 265–277.

Carlsson, D., D'Amours, S., Martel, A., Rönnqvist, M., 2009. Supply chain planning models in the pulp and paper industry. INFOR Inf. Syst. Oper. Res. 47 (3), 167–183.

Cheng, C.C.J., 2018. Sustainability orientation, green supplier involvement, and green innovation performance: evidence from diversifying green entrants. J. Bus. Ethics 1–22.

Chiappetta Jabbour, C.J., Sarkis, J., Lopes de Sousa Jabbour, A.B., Scott Renwick, D.W., Singh, S.K., Grebinevych, O., Kruglianskas, I., Filho, M.G., 2019. Who is in charge? A review and a research agenda on the 'human side' of the circular economy. J. Clean. Prod. 222, 793–801.

Croom, S., Vidal, N., Spetic, W., Marshall, D., McCarthy, L., 2018. Impact of social sustainability orientation and supply chain practices on operational performance. Int. J. Oper. Prod. Manag. 38 (12), 2344–2366.

Danso, A., Adomako, S., Amankwah-Amoah, J., Owusu-Agyei, S., Konadu, R., 2019. Environmental sustainability orientation, competitive strategy and financial performance. Bus. Strat. Environ. 28 (5), 885–895.

De Angelis, R., Howard, M., Miemczyk, J., 2018. Supply chain management and the circular economy: towards the circular supply chain. Prod. Plann. Contr. 29 (6), 425–437.

Deif, A.M., 2011. A system model for green manufacturing. J. Clean. Prod. 19 (14), 1553–1559.

Dietz, S., Neumayer, E., 2007. Weak and strong sustainability in the SEEA: concepts and measurement. Ecol. Econ. 61 (4), 617–626.

Gehlbach, H., Brinkworth, M.E., 2011. Measure twice, cut down error: a process for enhancing the validity of survey scales. Rev. Gen. Psychol. 15 (4), 380–387.

Geissdoerfer, M., Morioka, S.N., de Carvalho, M.M., Evans, S., 2018. Business models and supply chains for the circular economy. J. Clean. Prod. 190, 712–721.

Geissdoerfer, M., Savaget, P., Bocken, N.M.P., Hultink, E.J., 2017. The Circular Economy – a new sustainability paradigm? J. Clean. Prod. 143, 757–768.

Genovese, A., Acquaye, A.A., Figueroa, A., Koh, S.C.L., 2017. Sustainable supply chain management and the transition towards a circular economy: evidence and some applications. Omega 66, 344–357.

Ghezzi, A., Gabelloni, D., Martini, A., Natalicchio, A., 2018. Crowdsourcing: a review and suggestions for future research. Int. J. Manag. Rev. 20 (2), 343–363.

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32.

Gopinath, A., Bahurudeen, A., Appari, S., Nanthagopalan, P., 2018. A circular framework for the valorisation of sugar industry wastes: review on the industrial symbiosis between sugar, construction and energy industries. J. Clean. Prod. 203, 89–108.

Govindan, K., Hasanagic, M., 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. Int. J. Prod. Res. 56 (1–2), 278–311.

Govindan, K., Soleimani, H., Kannan, D., 2015. Reverse logistics and closed-loop supply chain: a comprehensive review to explore the future. Eur. J. Oper. Res. 240 (3), 603–626.

Gupta, S., Chen, H., Hazen, B.T., Kaur, S., Santibañez Gonzalez, E.D.R., 2018. Circular economy and big data analytics: a stakeholder perspective. Technol. Forecast. Soc. Change.

Hair, J., Black, W., Anderson, R., Babin, B., 2018. SEM: Confirmatory Factor Analyses, Multivariate Data Analysis. Cengage, United Kingdom, pp. 658–698.

Helmuth, C.A., Craighead, C.W., Connelly, B.L., Collier, D.Y., Hanna, J.B., 2015. Supply chain management research: key elements of study design and statistical testing. J. Oper. Manag. 36, 178–186.

Herczeg, G., Akkerman, R., Hauschild, M.Z., 2018. Supply chain collaboration in industrial symbiosis networks. J. Clean. Prod. 171, 1058–1067.

Hofmann, F., 2019. Circular business models: business approach as driver or obstructer of sustainability transitions? J. Clean. Prod. 224, 361–374.

Howard, M., Hopkinson, P., Miemczyk, J., 2018. The regenerative supply chain: a framework for developing circular economy indicators. Int. J. Prod. Res. 1–19.

Hussain, M., Al-Aomar, R., Melhem, H., 2019. Assessment of lean-green practices on the sustainable performance of hotel supply chains. Int. J. Contemp. Hospit. Manag.

Jadhav, A., Orr, S., Malik, M., 2019. The role of supply chain orientation in achieving supply chain sustainability. Int. J. Prod. Econ. 217, 112–125.

Kiefer, C.P., Del Río González, P., Carrillo-Hermosilla, J., 2018. Drivers and barriers of eco-innovation types for sustainable transitions: a quantitative perspective. Bus. Strat. Environ.

Korhonen, J., Nuur, C., Feldmann, A., Birkie, S.E., 2018. Circular economy as an essentially contested concept. J. Clean. Prod. 175, 544–552.

Krause, D., Luzzini, D., Lawson, B., 2018. Building the case for a single key informant in supply chain management survey research. J. Supply Chain Manag. 54 (1), 42–50.

Linton, J.D., Klassen, R., Jayaraman, V., 2007. Sustainable supply chains: an introduction. J. Oper. Manag. 25 (6), 1075–1082.

Loiseau, E., Saikku, L., Antikainen, R., Droste, N., Hansjürgens, B., Pitkänen, K., Leskinen, P., Kuikman, P., Thomsen, M., 2016. Green economy and related concepts: an overview. J. Clean. Prod. 139, 361–371.

Maitlis, S., Christianson, M., 2014. Sensemaking in organizations: taking stock and moving forward. Acad. Manag. Ann. 8 (1), 57–125.

Maitlis, S., Lawrence, T.B., 2007. Triggers and enablers of sensegiving in organizations. Acad. Manag. J. 50 (1), 57–84.

Malik, M., Abdallah, S., Ala'raj, M., 2018. Data mining and predictive analytics applications for the delivery of healthcare services: a systematic literature review. Ann. Oper. Res. 270 (1–2), 287–312.

Malik, M., Abdallah, S., Orr, S., Chaudhary, U., 2019. The differences in agent effects on sustainable supply chain management: an activity theory construction. Supply Chain Manag.: Int. J.

Malik, M.M., Abdallah, S., Hussain, M., 2016. Assessing supplier environmental performance: applying analytical hierarchical process in the United Arab Emirates healthcare chain. Renew. Sustain. Energy Rev. 55, 1313–1321.

Mohamed Sultan, A.A., Mativenga, P.T., 2019. Sustainable Location Identification Decision Protocol (SuLIDeP) for determining the location of recycling centres in a circular economy. J. Clean. Prod. 223, 508–521.

Moktadir, M.A., Rahman, T., Rahman, M.H., Ali, S.M., Paul, S.K., 2018. Drivers to sustainable manufacturing practices and circular economy: a perspective of leather industries in Bangladesh. J. Clean. Prod. 174, 1366–1380.

Moreau, V., Sahakian, M., Van Griethuysen, P., Vuille, F., 2017. Coming full circle: why social and institutional dimensions matter for the circular economy. J. Ind. Ecol. 21 (3), 497–506.

Müller, R., Pemsel, S., Shao, J., 2015. Organizational enablers for project governance and governmentality in project-based organizations. Int. J. Proj. Manag. 33 (4), 839–851.

Murray, A., Skene, K., Haynes, K., 2017. The circular economy: an interdisciplinary exploration of the concept and application in a global context. J. Bus. Ethics 140 (3), 369–380.

Nascimento, D.L.M., Alencastro, V., Quelhas, O.L.G., Caiado, R.G.G., Garza-Reyes, J.A., Lona, L.R., Tortorella, G., 2018. Exploring Industry 4.0 technologies to enable circular economy practices in a manufacturing context: a business model proposal. J. Manuf. Technol. Manag.

Patricio, J., Axelsson, L., Blomé, S., Rosado, L., 2018. Enabling industrial symbiosis collaborations between SMEs from a regional perspective. J. Clean. Prod. 202, 1120–1130.

Petljak, K., Zulauf, K., Štulec, I., Seuring, S., Wagner, R., 2018. Green supply chain management in food retailing: survey-based evidence in Croatia. Supply Chain Manag.: Int. J. 23 (1), 1–15.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol. 88 (5), 879.

Podsakoff, P.M., MacKenzie, S.B., Podsakoff, N.P., 2012. Sources of method bias in social science research and recommendations on how to control it. Annu. Rev. Psychol. 63, 539–569.

Prendeville, S., Hartung, G., Purvis, E., Brass, C., Hall, A., 2016. Makespaces: from redistributed manufacturing to a circular economy. In: International Conference

on Sustainable Design and Manufacturing. Springer, pp. 577–588.
Reike, D., Vermeulen, W.J.V., Witjes, S., 2018. The circular economy: new or refurbished as CE 3.0?—exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. Resour. Conserv. Recycl. 135, 246–264.
Ritzén, S., Sandström, G.Ö., 2017. Barriers to the Circular Economy–integration of perspectives and domains. Procedia CIRP 64, 7–12.
Rizos, V., Behrens, A., Van Der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., 2016. Implementation of circular economy business models by small and medium-sized enterprises (SMEs): barriers and enablers. Sustainability 8 (11), 1212.
Rota, C., Pugliese, P., Hashem, S., Zanasi, C., 2018. Assessing the level of collaboration in the Egyptian organic and fair trade cotton chain. J. Clean. Prod. 170, 1665–1676.
Sandberg, J., Tsoukas, H., 2015. Making sense of the sensemaking perspective: its constituents, limitations, and opportunities for further development. J. Organ. Behav. 36 (S1), S6–S32.
Sarkis, J., Shaw, S., Grant, D.B., Mangan, J., 2010. Developing environmental supply chain performance measures. Benchmark Int. J.
Seuring, S., Müller, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. J. Clean. Prod. 16 (15), 1699–1710.
Song, M., Zheng, W., Wang, Z., 2016. Environmental efficiency and energy consumption of highway transportation systems in China. Int. J. Prod. Econ. 181, 441–449.
Srai, J.S., Harrington, T.S., Tiwari, M.K., 2016. Characteristics of redistributed manufacturing systems: a comparative study of emerging industry supply networks. Int. J. Prod. Res. 54 (23), 6936–6955.
Thornton, A., 2019. These 11 Companies Are Leading the Way to a Circular Economy. World Economic Forum.
Tura, N., Hanski, J., Ahola, T., Ståhle, M., Piiparinen, S., Valkokari, P., 2019. Unlocking circular business: a framework of barriers and drivers. J. Clean. Prod. 212, 90–98.
Walker, H., Jones, N., 2012. Sustainable supply chain management across the UK private sector. Supply Chain Manag.: Int. J. 17 (1), 15–28.
Wang, S., Lu, C., Gao, Y., Wang, K., Zhang, R., 2019. Life cycle assessment of reduction of environmental impacts via industrial symbiosis in an energy-intensive industrial park in China. J. Clean. Prod. 241, 118358.
Yang, M., Smart, P., Kumar, M., Jolly, M., Evans, S., 2018. Product-service systems business models for circular supply chains. Prod. Plann. Contr. 29 (6), 498–508.
Zeng, H., Chen, X., Xiao, X., Zhou, Z., 2017. Institutional pressures, sustainable supply chain management, and circular economy capability: empirical evidence from Chinese eco-industrial park firms. J. Clean. Prod. 155, 54–65.
Zhu, Q., Sarkis, J., Lai, K.-h., 2007. Green supply chain management: pressures, practices and performance within the Chinese automobile industry. J. Clean. Prod. 15 (11), 1041–1052.