A Conceptual Framework for Adopting Ambidexterity in Circular Supply Chains

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Abstract

The incorporation of the circular economy principles into Supply Chain Management leads to a Circular Supply Chain (CSC), which fosters the perpetual flow of materials in a cyclical manner without damaging the environment, society or economy. This perpetual flow is essential for organizations to survive in an ever-increasingly dynamic environment and in a natural resource-constrained economy (NRCE). Therefore, organizations, which aim to implement CSC must seek to identify an intermediating factor, which should simultaneously foster reactive supply chain strategies to manage natural resources limitation and proactive supply chain strategies for uncertain environment. The concept of Ambidexterity enabling the simultaneous pursuit of exploration and exploitation aligns with the principles of CSC. However, this concept has not been investigated in the CSC literature to date. Within this context, the aim of this paper is to propose a conceptual framework to adopt Ambidexterity in CSC. The framework has a two-dimensional hierarchy that includes eco-efficiency aimed at reactive strategies, and eco-effectiveness aimed at proactive strategies: both regenerative and restorative from supply chain process perspective, closed-loop and open-loop/cascading from flow perspective. This paper provides a conceptual framework with four propositions that should enable the adoption of Ambidexterity in CSC.

Keywords
Circular Economy, Supply Chain, Ambidexterity, Exploration, Exploitation.

1. Introduction
It is evident that the growth of population with a consequent increase in consumerism and overuse of natural resources lead to a natural resource-constrained economy (NRCE) and to uncertain environment. Borland et al. (2016) posits this phenomenon as consequences of an Anthropocentric view, which postulates that the existence of whole nature is to satisfy the needs of human being, who are not constrained by nature like species. This view suggests unlimited growth and believes in science and technology that commits to a laissez-faire economy. According to Kilbourne (1998), this is the dominant social paradigm (DSP). However, continuing to rely only on Anthropocentric view can lead to destruction but not to regeneration. Borland et al. (2016) propose to change the view from an Anthropocentric to Ecocentric which, radically departing from the Anthropocentric view posits the liberation of ecosystem from repercussion of human mismanagement, exploitation and overuse. Ecocentric values therefore foster the reduction of excessiveness in human's population growth and overconsumption for the restoration of ecosystem to a healthy of equilibrium that is referred to Spilhaus (1972) as ecolibrium. More specifically, in relations to supply chains, efficiency-oriented supply chains tend to fall into a short term "competency trap" by focusing on existing solutions that may obstruct organizations from rapidly adapting to long term changes such as market changes and technology changes (Christopher and Holweg 2011). Supply chain managers therefore search for dynamic strategies to maintain their present competitive position and to adapt to future changes (Im et al. 2019) that lead to adapt Ambidexterity. Nevertheless, there are no articles published to date proposing a conceptual framework for adopting Ambidexterity in CSC.

The aim of this paper is therefore to develop a conceptual framework for adopting Ambidexterity in CSC which will be achieved by the following objectives:

- Gain deeper understanding in the domain of Ambidexterity, supply chain and circularity through existing literature
- Contribute to the knowledge in interdisciplinary discipline; strategic management, supply chain and business sustainability.

This paper is organised as follows: following the introduction, section 2 presents the literature review. The research methods are presented in Section 3; followed by the research results and discussion in Section 4. Section 5 concludes with contributions, and recommendations for future research.

2. Literature Review

2.1 Multi-facets of Supply Chain Management

The concept of Supply Chain Management (SCM) was initially employed in the 1980s to designate the flow of materials between firms. However, SCM was re-conceived towards the end of 1990s to accommodate all the business processes throughout an organization that constitute a supply chain (Cooper et al., 1997). Since the introduction of SCM and its initial definition, the concept has gained significant attention as demonstrated by the variety of its definitions. This current study however adopts the definition of SCM proposed by Stock and Boyer (2009) following their analysis of 173 definitions of SCM: *"The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction."* (Stock and Boyer 2009, p. 706). It is evident from the above definition the supply chain is composed of a long list of activities that consume vast amount of resources. However, the natural resources are rapidly depleting and future businesses will be rewarded not only based on economic performance but also on sustainability performance (Markley and Davis, 2007). Nevertheless, organizations are failing to take a proactive role towards conservation of depleting natural resources as evidenced by increasing amounts of waste generated through supply chain activities which are not only prime sources of serious environmental problems (Min and Galle, 1997) but also financial burden to organizations (Esty and Winston, 2009). Therefore, SCM has been taking divergent forms to mitigate NRCE and uncertain environments as outlined below:

Closed Loop SCM (CLSCM) or Reverse SCM promotes the 3 Rs (reduce, reuse and recycle) and extends further to 6 Rs with the addition of rethink, refuse and repair due to the growing concern of resource scarcity as propounded by Faisal (2010, p.510); "*In a world concerned more and more with the optimal use of the scarce resources, supply chains need to re-align themselves to adjust to this trend*." Despite the nature of CLSCM to reduce environmental impact intrinsically, ten years of research in reverse logistics, product recovery and CLSCM revealed that CLSCM models are cost oriented and driven by economic forces (Rubio et al., 2008). However, closing loop generates environmental benefits although the key driver is business economic (Guide Jr et al., 2003; Guide et al., 2003).

Sustainable SCM (SSCM) promotes the intersection of tripe bottom line coined by Elkington (1994); economic, environment and social. However, the term is widely employed to refer ecological and social SCM practices. Carter (2008) grades the intersection of economic, environment and social dimensions as "best" performance. Nevertheless, there is paucity of research on the intersection of these three dimensions (Ashby, 2012; Seuring and Muller, 2008; Seuring, 2013).

Green SCM (GSCM) or Environmental SCM (ESCM), which consists of SCM strategies aimed at combating climate change, at circumventing depletion of natural resources and at reducing the negative environmental impact of products and services. Organizations adopt these two concepts for reasons ranging from reactive regulatory strategies to proactive strategic and competitive advantage (Rao and Holt, 2005). Despite the shared purpose of these two concepts, GSCM is widely used within academic research (Ashby, 2012).

Ethical SCM or Corporate Social Responsibility (CSR) SCM or Social SCM, which ensures moral and legal compliance of all organizations involved in the supply chain and promotes social welfare. Organizations do include ecological practices in their CSR reports. However, this is the least researched field within academia (Ashby, 2012; Seuring, 2013). Similarly, supply chain practitioners have not been proactive towards adopting these concepts (Murphy and Poist, 2002).

Nevertheless, the divergent forms of supply chain discussed above are geared towards limitation of resources consumption, reduction of waste sent to landfill. They are however not geared towards the elimination of waste. Moreover, there is no clear indication about how the waste is managed outside the product supply chain; the focal company for instance may not receive loop flows within reverse flow (Batista et al., 2018).

2.2 Circular Supply Chain Management

Circular Supply Chain Management (CSCM) however embodying Circular economy principles (De Angelis et al., 2017), embraces both closed loop and open loop/cascading flows that are considered to be distinctive characteristics of CSCM (Batista et al., 2018; Farooque et al.,2019; Genovese et al., 2017). The principles of Circular economy (CE) by extending the boundary of green supply chain maintains the circulation of resources within a quasi-closed structure that decreases the consumption of raw materials (Genovese et al., 2015; Ripanti and Tjahjono, 2019) and basing on two types of cycle: biological and technical (Ellen MacArthur Foundation, 2015) in addition to adhering to restorative and regenerative processes (Batista et al., 2018). Therefore, the assimilation of CE into supply chain is known as Circular Supply Chain (Genovese et al., 2017; Nasir et al., 2017). The circular thinking is therefore well entrenched within Circular Supply Chain (Farooque et al., 2019) and used for different purposes such as design for remanufacturing (Ijomah et al., 2007), design for recycling (Gaustad et al., 2018) and sustainable packaging design (Bovea et al., 2018).

The supply chains adopting the principles of circular economy are also refereed as closed loop supply chain, open loop supply chain and CSC (Geissdoerfer et al., 2018) in addition to sustainable and green supply chain. CSCMs are defined as *"the coordinated forward and reverse supply chains via purposeful business ecosystem integration for value creation from product/services, by-products and useful waste flows through prolonged life cycles that improve the economic, social, and environmental sustainability of organisations"* (Batista et al., 2018, p. 446). It can be stated from a holistic perspective that CSC embraces both closed loop supply chain and open loop supply chain (Batista et al., 2018; Howard and Miemczyk, 2018; Thierry et al., 1995) in addition to open loop wholly (Kalverkamp, 2018) and cascading (Govindan and Hasanagic, 2018; Genovese et al., 2017). Despite its definitional variety, this study will adopt the following definition for its exhaustiveness; "*Circular supply chain management is the integration of circular thinking into the management of the supply chain and its surrounding industrial and natural ecosystems. It systematically restores technical materials and regenerates biological materials toward a zero-waste vision through system-wide innovation in business models and supply chain functions from product/service design to end-of-life and waste management, involving all stakeholders in a product/service lifecycle including parts/product manufacturers, service providers, consumers, and users.*" (Farooque et al., 2019 p. 884).

2.3 Ambidexterity in Supply Chain

Environmental dynamism propelled organizations to adapt mediating or moderating variables for mitigations such as Organisational ambidexterity (Hershcovis, 2011) which is an organisation's ability to pursue simultaneously exploration and exploitation for better performance. The concept of Ambidexterity coined by Duncan (1976) but widely known by the work of March (1991), who defined exploration and exploitation as *"exploration as "things captured by terms such as search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation" whereas exploitation as "refinement, choice, efficiency, selection, things such as implementation, execution"* (March, 1991, p.71). The exploration is about equipping for the future needs by fostering novelty whereas exploitation aims to stratify the current needs by focusing on efficiency (Jansen et al., 2006) that could be translated in time frame as exploration seeks long term benefits whereas exploitation aims to achieve short term gains March (1991). The exploration and exploitation activities could be approached in different ways as discussed below:

Structural approach promotes the simultaneous pursuit of exploration and exploitation (Duncan,1976; Lavie et al., 2010). Temporal separation approach that consists of alternating between exploration and exploitation over time (Puranam et al., 2006) that is also known as cyclical or sequential through which, organizations alternate between exploration and exploitation in accordance with environmental dynamism (Tushman and Romanelli, 1985). However, organizations are ambidextrous on a long term although the pursuit is sequential (Siggelkow and Levinthal, 2003).

Inter-organizational specialization approach (Lavie et al., 2010) which consists of partnerships, alliances, joint ventures and outsourcing for Ambidexterity. This paper will adopt interorganisational specialisation approach to apply into supply chain context as organizations can reap gains within their own boundaries and within supply chain through

Ambidexterity (Blome et al., 2013). The Supply Chain Ambidexterity is defined as "a firm's strategic choice to simultaneously pursue both supply chain exploitation (efficiency) and exploration (flexibility) practices (Kristal et al., 2010 p. 415).

The concept of Ambidexterity has been getting recognition within supply chain which has been studied for different purposes; impact of ambidextrous supply chain on competitive capabilities and on firm's performance (Kristal et al., 2010); positive impact of Ambidexterity governance upon innovation and cost performance (Blome et al., 2013); design and integration of supply chain teams (Fiset and Dostaler, 2013) and supply network innovation (Narasimhan and Narayanan, 2013). However, the studies are thus far limited to pecuniary gains. It has great potential to be applied to investigate circularity in supply chain as the both concepts characterised by the common goals; Circular Supply Chain aims to close the loop (exploitation) and to open loop/cascade (exploration). Ambidexterity in supply chain consists of using partners' resources for efficiency in short term through exploitation simultaneously pursuing exploration through new opportunities and through discontinuous innovation for effectiveness in long term (Güemes-Castorena and Ruiz-Monroy, 2020). More precisely, supply chain exploitation is about on traditional supply chain management by focusing on short term gains, risk reduction and measurable targets whereas supply chain exploration aims to respond to market dynamism and uncertainty by gearing towards learning and innovation in supply chain (Adler et al., 2009)

3. Methods

The secondary data consists of the existing literature in the subject area. Grey and white literatures were consulted but the paper mainly focused on peer reviewed journal articles. The selection of databases is as important as the selection of the keywords as supported by Liliani et al. (2020), who state that the likelihood of missing some pertinent articles is caused not only by rigid search strings, but also by the choice of databases or the screening process deployed. We therefore carried out a perusal of different databases prior to reaching the decision to select the four databases: SCOPUS, EBSCO (Business Source Premier), PROQUEST (ABI/INFORM Global), and SCIENCE DIRECT.

We utilised our prior knowledge to identify the synonyms for keywords, which were combined through the Boolean operator to generate search strings to obtain more specific results (Strozzi and Colicchia, 2012); i.e "*supply chain"* AND *"ambidexterity"* AND *"circular".* Although, keyword search is known to be an efficient search strategy, it does present with limitations as posited by Govindan and Hasanagic (2018) and Quarshie et al. (2016), who adopted a *"belt and braces approach"* by deploying both keyword search and manual search to ensure that all the relevant articles were covered. We therefore cross-checked the retrieved articles with the most recent publication, Vegter et al. (2020) that used the search string *"circular"* AND *"supply chain"* to unearth the broadest possible articles.

However, we identified that the key article, *"Supply chain management and the circular economy: towards the circular supply chain"* by De Angelis et al. (2018) and containing the term *"circular supply chains"* in the title and in the abstract, was missing in the article by Vegter et al. (2020). So, although Vegter et al. (2020) used the keyword search *"circular"* AND *"supply chain"* in the title, in the abstract and in the keywords on SCOPUS, they were unable to locate a key article. The search was carried out in May 2020 and we verified in June 2020 by performing a keyword search using the same search strings *"circular"* AND *"supply chain"* on SCOPUS but we were unable to retrieve the paper by De Angelis et al. (2018). Nevertheless, we were able to retrieve this article when a search was carried out in August 2020 using the keywords "circular economy" and "supply chain" which shows that regardless of the broadest or narrowest keyword searches, the searching process can be a conundrum at times. Yet, this limitation can be mitigated by a manual search (Govindan and Hasanagic, 2018; Quarshie et al., 2016). The relevant literatures were reviewed critically to identify the gaps and deficiencies in knowledge that enabled the development of a conceptual framework.

4. Results and Discussion

An uncertain business environment requires organizations to revamp in order to sustain the business by their strategy enhancement and profitability while maintaining their competitiveness in the market (Greenough and Tjahjono, 2006; Zailani, 2012;). Likewise, Mason-Jones and Towill (1998) defend the idea that the likelihood of generating a competitive bottom line performance is through organizations with the ability to manage uncertainty, which is not only created by the recent developments of the global economic climate (Rashid et al., 2018; Zailani, 2012) but also by complex environmental issues derived from multiple sources (Paulraj and Chen, 2007; Sutcliffe and Zaheer, 1998). Within supply chain management, environmental management capabilities necessitate the ability of firms to manage

the uncertainties in a supply chain from sourcing activities to forecasting that can impact upon financial and environmental situations (Carter and Rogers, 2008). Therefore, organizations should be able to powerfully pursue exploration and exploitation initiatives to circumvent environmental dynamism (Kristal et al., 2010; Nemanich et al., 2007; Tushman and O'Reilly, 1996). This pursuit of exploration and exploitation in the face of environmental changes can be facilitated by knowledge sharing ambidexterity, which requires ambidextrous goals to foster exploratory knowledge sharing and exploitative collaboration to address both existing and new problems (Im et al, 2019; Tjahjono, 2009). Hence, the following proposition is suggested:

Proposition 1: *Ambidexterity circumvents environmental dynamism by exploration and NRCE by exploitation for CSC.*

Reversing the flows to the focal company leads to a closed loop (Das and Posinasetti, 2015; Glover et al., 2014; Lai et al., 2013) and cascading through forward open flow lead to open loop (Genovese et al., 2017; Leigh and Li, 2015; Parks et al., 2010) that connect firms across other supply chains from other firms (EM Foundation, 2012). Furthermore, Genovese et al. (2017) and Govindan and Soleimani (2017) describe CSC as perpetual reuse and recycle of materials with limited waste in the entire supply chain (Batista et al., 2018; Bracquené et al., 2020; Govindan and Hasanagic, 2018; Meherishi et al., 2019; Schraven et al., 2019) whereas Ehrenfeld and Gertler (1997) and McDonough and Braungart (2002) describe CSC in a more broader perspective as a chain in addition to closing the loop guarantees zero waste (Farooque et al., 2019; Geissdoerfer et al., 2018). Hence, the following proposition is suggested:

Proposition 2: *Exploration enables open loop flow and Exploitation enables closed loop flow to adopt Ambidexterity in CSC.*

CE is restorative and regenerative by intention and design (EM Foundation, 2012; Webster, 2015). Within the circular economy system, the notion of being restorative fosters recuperation to the original state whereas the notion of being regenerative promotes recuperation to a new and a higher value state (Batista et al., 2018). The regenerative design is viewed as a facilitating tool to transit from Circular Economy to CSC (Franco, 2017). The regenerative supply chain is therefore congenital in circular economy (Howard et al., 2018). Borrowing from the latter, circular business models own the capacity to restore by fostering the recuperation of materials and to regenerate by bestowing a new life to materials (Esty and Simmons, 2011). Application of these approaches at industry level enables restoration by the cascading of used materials and renewable resources between organizations in addition to involvement and engagement in waste and industrial symbiosis processes across divergent organizations (Chertow, 2000) that lead to regenerative (Howard et al., 2018) and restorative (Leigh and Li, 2015) capabilities in addition to restorative and regenerative opportunities and practices (Batista et al., 2018). Hence, the following proposition is suggested:

Proposition 3: *Exploration enables regenerative processes and Exploitation enables restorative processes to adopt Ambidexterity in CSC.*

The present availability of natural resources is becoming increasingly scarce and the future availability of these resources is uncertain. This phenomenon necessitates organizations to manage the existing resources efficiently and conserving resources effectively for the future use. Borland et al (2016) describe this management of resources as eco-efficiency aimed at reactive and transitional strategies for incremental change and eco-effectiveness aimed at proactive and transformational strategies for fundamental change (Borland et al., 2016). Hence, the following proposition is suggested:

Proposition 4: *Exploration enables eco-effectiveness and Exploitation enables eco-efficiency that lead to Ambidexterity in CSC*

Built on the perspective of Ambidexterity, the Conceptual Framework in Figure 1 clearly posits the need to adopt Ambidexterity to circumvent Dynamic environment. A number of articles have been published within academia to manage the uncertainty by supply chain flexibility through reactive (buffering) and proactive (redesigning) strategies (Angkiriwang, 2014) and reactive and proactive pathways for a sustainable apparel supply chain (Roy, 2020). However, the relationship between Ambidexterity and environmental dynamics has been insufficiently explored (Junni et al., 2013). This framework therefore clearly depicts the two different descendants of Dynamic Environment and shows the relationship between Ambidexterity and Dynamic Environment: by exploration initiatives to circumvent uncertainty and by exploitation initiatives to circumvent NRCE. Moreover, the framework clearly

demonstrates that Ambidexterity is coupled with CSCM through its two dimensions: First, exploration, which enables open loop flow and regenerative processes in Supply chain for eco-effectiveness. Second, exploitation, which enables closed loop flow and restorative processes in Supply chain for eco-efficiency. Therefore, Ambidexterity is logically coupled up with CSCM. However, no publication to date adopted Ambidexterity in CSCM.

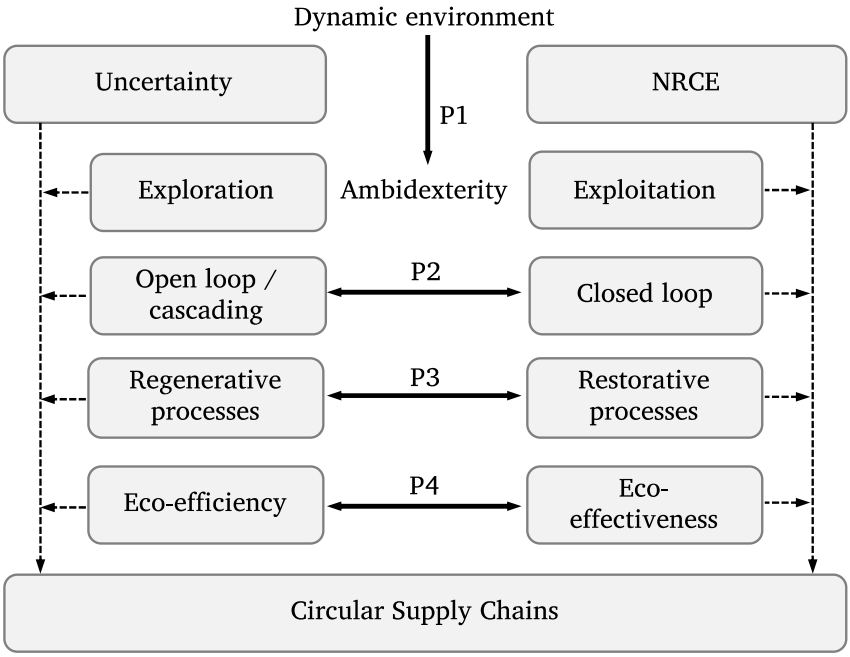

Figure 1: Conceptual Framework

5. Conclusion

The review of literature enabled to gain a deeper understanding of the subject area that led to developing the four propositions and a conceptual framework, respectively. It is apparent that there is no research to date published on adopting Ambidexterity for CSCM and very importantly, no article published to date on the intersection of circularity and supply chain and on the intersection of circularity, supply chain and Ambidexterity.

The literature review clearly reveals that CSCM and Ambidexterity are still at the embryonic phase, and conceptual frameworks and theories are yet to be developed within this context. Therefore, this conceptual framework contributes to the knowledge by integrating the principles of CSCM with Ambidexterity which informs the practitioners and academics.

More research needs to be conducted on the intersection of CSCM and Ambidexterity. Further research could focus on Ambidexterity not only for Circularity in supply chain, but also for the pursuit of triple bottom line in the supply chain.

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