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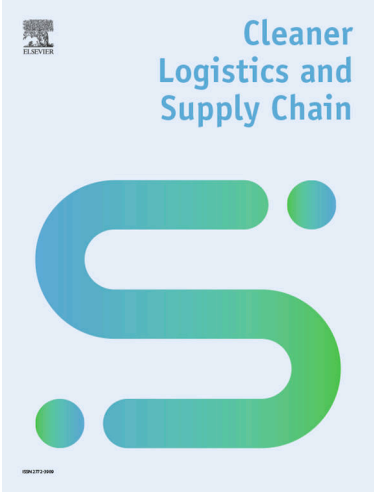

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Expanding conceptual boundaries of the sustainable supply chain management and circular economy nexus

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Abstract

Sustainable supply chain management (SSCM) has been developed for decades as a solution for multi-level social and environmental improvement. Circular economy (CE) also has many perspectives and generally has been introduced for investigating sustainability at multiple levels. Organizations are informed and encouraged by management theories to build their supply chain strategies at SSCM-CE nexus, including stakeholder theory, institutional theory, nature resource-based view, amongst others. As the scholarly and practical interests in SSCM and CE increases, there is a need to expand the current conceptual understanding and theoretical boundaries. Theory development for broader issues at SSCM-CE nexus is limited, leaving managers, policy makers, civil society activists, and other stakeholders with insufficient grounding for important decisions and direction. In this paper, we explore some promising theories which may provide additional conceptual lenses for SSCM and CE. These theories, including organizational learning, social innovation, and social learning—are constructed to develop a *dynamic sustainable supply chain-circular economy management* framework as a conceptual map over which theoretical boundaries from the existing and emergent organizational theories are overlaid. Future research directions are also provided and discussed to conclude this paper.

Keywords: Sustainable supply chain management; circular economy; systems thinking; theory development.

1. Introduction

Globally, manufacturers face high costs in treating, preventing, and controlling environmental issues (Mubarik et al., 2021). For example, US manufacturers spend tens of billions of dollars annually addressing environmental concerns (U.S. Census Bureau, 2008). The Carbon Disclosure Project reports that managers in these upper-tier companies have expressed a dilemma: they perceive more physical risk from climate change and higher pollution abatement costs, but less opportunity for building a reputation with customers based on their environmental practices (CDP, 2011). Downstream in the supply chain, customer-facing companies and households have ample incentive and opportunity to influence sustainability but rarely face consequences for failure (Gunarathne & Lee, 2021).

This situation leaves managers asking—first, how well has the supply chain learned to minimize the impact of operations and products on society and nature, while sustaining its ability to respond to demand, both now and over the long term? Second, what challenges will the supply chain face in transitioning to closed-loop supply chains and the circular economy? Third, what roles will traditional institutions such as government, industry, consumers, and civil society play in this transformation? Fourth, what roles might new institutions play?

Scholars are increasingly directing attention toward questions such as these for supply chain sustainability and circular economy development—since many important knowledge gaps remain.

The literature at the sustainable supply chain management (SSCM) and the circular economy (CE) nexus has observed that many opportunities exist for research to expand conceptual boundaries. For example, in SSCM, by considering more stakeholders, impacts, tiers, and time scales and thereby better reflecting the nature and complexity of today's business environment (Brandenburg, Govindan, Sarkis, & Seuring, 2014; Carter & Easton, 2011; Seuring & Müller, 2008) and in CE, by considering social and institutional issues (Merli, Preziosi, & Acampora, 2018)

Theory development at the SSCM-CE nexus is limited (Brandenburg et al., 2014; Carter & Easton, 2011; Lahti, Wincent, & Parida, 2018; Seuring & Müller, 2008), leaving managers, policy makers, civil society activists, and other stakeholders with insufficient grounding for important decisions and direction. Management research can use theory development to aid practitioners in situations like these, allowing them to understand complex problems, to craft organizational responses, eventually honing them into routine processes. Recently, scholars have suggested systems thinking as a promising tool for analysis and decision making in such cases (Rebs, Brandenburg, & Seuring, 2019).

Scholars can also gain from building and integrating theories and developments at the SSCM-CE nexus. Previous theory development work in related fields has not considered the SSCM-CE nexus (c.f., (Lahti et al., 2018; Rebs, Thiel, Brandenburg, & Seuring, 2019)). It has been suggested that theory development work in general is rare because graduate training in related fields neglects conceptual theory development (Carter, 2011; Suddaby, 2010). Neglecting theory development and focusing on a narrow range of methodologies (Touboulic & Walker, 2016) means that too many SSCM studies make it seem as if each one is the first to discover that SSCM is a real phenomenon.

In this paper we aim to expand the conceptual boundaries of the SSCM-CE nexus. We do so by reviewing popular and emerging management theories that can be applied at multiple levels (the micro (organizational), meso (supply chain) and macro (institutional) level) and by building on prior theory development efforts in SSCM and CE (Carter & Rogers, 2008; Hall, 2000; Pearce & Turner, 1990; Rebs, Brandenburg, et al., 2019; Rebs, Thiel, et al., 2019; Sarkis, 2012; Seuring & Müller, 2008). We use a systems thinking theory development approach to propose *dynamic sustainable supply chain-circular economy management* (D-SSCEM) as an integrative, multi-level theoretical framework over which the conceptual boundaries of the management theories identified above are overlaid.

The remainder of this paper is structured as follows. Section 2 sets the research scope and context of this perspective work by briefly reviewing two growing and substantial literature streams—SSCM and CE. Section 3 provides an overview of applied theoretical lenses at the SSCM-CE nexus, by naming and defining popular theories, and with exemplary theoretical insights. Section 4 details additional theoretical perspectives at the SSCM-CE nexus which show some promise. A theoretical framework is synthesized constructively in Section 5. Specific future research directions and managerial implications of this work appear in Section 6. Section 7 briefly concludes the paper.

2. Background

Two major literature streams—SSCM and CE—set the frame of reference for the theory synthesis. We begin with an overview of popularly applied theories in the SSCM field. We also introduce the CE context and the widely applied theories in CE.

2.1 Sustainable Supply Chain Management

Diverse SSCM definitions exist in the literature (Panigrahi, Bahinipati, & Jain, 2018). SSCM generally refers to inter-organizational business management which adds social and environmental considerations to the traditional focus on economic factors. SSCM definitions typically seek a contrast with traditional supply chain management (SCM) and draw attention to a variety of conceptual differences between SSCM and SCM. An additional set of definitions includes long-term thinking, often by linking SSCM to the product lifecycle. Such definitions often mention inter-organizational coordination.

Extant review articles show how organizations encounter pressures to be more sustainable from stakeholders. These pressures motivate SSCM practice adoption. Table 1 provides a list of common, but not necessarily exhaustive, conceptual differences between SCM and SSCM. These differences appear across multiple reviews of SSCM literature (Albino, Carbonara, & Giannoccaro, 2007; Brandenburg et al., 2014; Busse, Schleper, Weilenmann, & Wagner, 2017; Butt, Shah, & Ahmad, 2021; Carter & Easton, 2011; Davé, Dotson, & Stoddard, 2018; Kumar & Rahman, 2015; Sarkar, Sarkar, Ganguly, & Cárdenas-Barrón, 2021; Seuring & Müller, 2008; Wuttke, Blome, & Henke, 2013; Zimon, Tyan, & Sroufe, 2019).

--- Insert Table 1 about here ---

SSCM research reviews often find scholars do not adequately address the conceptual differences between SCM and SSCM. For example, many studies do not consider the additional stakeholders, responsibility for multiple tiers of the supply chain, longer product lifecycle time scales, or rigorous treatment of trade-offs between economic, social, and environmental dimensions of SSCM situations (Brandenburg et al., 2014; Carter & Easton, 2011; Dai, Xie, & Chu, 2021; Seuring & Müller, 2008). What this means is that those most familiar with the body of SSCM research are concerned that it has kept conceptually closer to SCM than has the actual practice of SSCM.

SSCM works still require theoretical developments that can fully inform practice (Brandenburg et al., 2014; Carter & Easton, 2011; Seuring & Müller, 2008), and use only a limited range of possible research paradigms to carry out their studies (Touboulic & Walker, 2016). This lack of attention to new perspectives in theory and focusing on a narrow and traditional methodological focus means that too many SSCM studies make it seem as if each one is the first to discover that SSCM is a real phenomenon. Important aspects of SSCM situations may be systematically missed through a reductionist perspective, instead of building a comprehensive accumulation of learning (Wieland, 2020).

2.2 Circular Economy

CE has had many perspectives and, in some cases, has been introduced for investigating sustainability firms and supply chains (Geissdoerfer, Savaget, Bocken, & Hultink, 2017; Ghisellini, Cialani, & Ulgiati, 2016). Scholars have argued that CE is an essentially-contested concept (Korhonen, Nuur, Feldmann, & Birkie, 2018)—implying that no CE definitional consensus exists. A consensus definition does not exist because of the complex and diverse agendas in its conceptualization, operationalization, and development (Kirchherr, Reike, & Hekkert, 2017).

In general, CE is used to provide an antipode viewpoint that the economy is a “materially open” or “linear” system—where natural resources are converted into production and consumption without considering waste along the product life cycle.

CE literature stream has often focused on defining *linear economy* problems rather than the managing *circular economy* processes. These processes are studied under different names depending on if they occur at the regional or industry-level (i.e., industrial ecology, symbiosis, or metabolism), supply-chain level (i.e., reverse logistics or closed-loop supply chains) or even at the organizational or product level (e.g., the material circularity index) (Korhonen et al., 2018). Macro global levels of CE have also been proposed (Geng, Sarkis, & Bleischwitz, 2019). The use of system-type descriptors, including biological metaphors, or more technical phrases like “circular”, “closed loop” and “circularity—is the distinguishing aspect of CE. Scholars evaluating the state of CE research are concerned about its general atheoretical stance (Bansal, Gualandris, & Kim, 2020) and for investigating the extent of complementarity across potentially-relevant theories (Joerg S. Hofstetter et al., 2021).

The SSCM-CE nexus describes the specific set of SSCM activities and processes that integrate CE principles– see Figure 1. Traditionally, supply chain management was considered a linear model.

SSCM expanded the concept of a linear model to a closed-loop model, supporting the CE principles. The major difference between linear and circular production and consumption systems is the inclusion of the 3 Rs: reuse, remanufacture, and recycle (Sarkis, 1995).

Research in SSCM and CE may begin exploring additional—interpretive and emancipatory—theoretical frames emerging from the current explanatory theory literature (Cornelissen, Höllerer, & Seidl, 2021). That is, instead of testing for explanatory theories—many of which we introduce here—we provide a more meta-theoretical interpretive theory. Eventually, we believe that SSCM-CE nexus needs to expand further to arrive at new paradigmatic shifts to emancipatory theory. Emancipatory theory is meant to unveil new and radical insights that can greatly rather than incrementally advance fields.

Just as real SSCM situations have conceptually broader structure than has been widely considered by researchers (see Table 1), they also appear to operate in a more complex system than is often considered. A critical aspect of CE is to use systems thinking in business environments. Circular business models, closed loop supply chains, and reverse logistics are all examples of applying systems thinking at the SSCM-CE nexus—these topics are not necessarily radical but are exceptional methods for synthesis and interpretation.

Moving from traditional supply chain management to sustainable supply chain management and moving from a linear economy to a circular economy provides ample opportunities to expand theoretical boundaries of existing management theories with additional layers of social and environmental conceptual dimensions. The extended—and potentially emancipatory—theoretical lenses will also facilitate practical managerial and organizational applications.

We will now provide an overview of the widely applied organizational explanatory theories at the SSCM-CE nexus and will introduce the potential interpretive or emancipatory theories that are emergent and have not been applied in the SSCM-CE nexus domain.

3. An Overview of Popular Explanatory Organizational Theories

SSCM extends the field of operations and supply chain management with a theoretical focus and practical implications considering economic, environmental, and social impacts—sometimes over longer inter-generational periods. Despite trends toward theorizing, most work at the SSCM-CE nexus has been atheoretical—focusing on technological, descriptive, and prescriptive solutions—rather than theory development and advancement (Liu, Feng, Zhu, & Sarkis, 2018). The most applied organizational theories crossing over SSCM and CE studies include stakeholder theory, institutional theory, the (natural) resource-based view (Liu et al., 2018; Touboulic & Walker, 2015).

Stakeholder theory (ST) describes how and why managers and organizations respond in certain ways to pressures depending on which stakeholders—government, industry, consumers, non-governmental organizations (NGOs)—they find critical to their strategies and operations (Delmas & Toffel, 2004; Guay, Doh, & Sinclair, 2004). Institutional theory (IT) describes the roles that institutions—social rules and norms—play in strategic organizational decision-making (Butler,

2011; Qi, Jia, & Zou, 2021). The natural resource-based view (NRBV)—an extension of the resource-based view but focusing on more sustainability-oriented resources—describes how a firm's competitive advantage evolves over time depending on the role of environmental concerns in organizational relationships (e.g., supply chain strategy) (Mishra & Yadav, 2021).

The following subsections will provide brief explanations of how each theory has been applied in the SSCM and CE domains.

3.1 Stakeholder Theory

ST sees managers as operating firms in an endogenous dynamic social system where they seek feedback from a changing set of stakeholders in their firm's environment to manage the consequences of the externalities resulting from the firm's operations. ST has two main components—identification and salience (Mitchell, Agle, & Wood, 1997).

Identification defines *who really counts.* This is a normative typology which describes why managers in a firm *should* pay attention to a certain type of individual or group. Stakeholders possess legitimacy or they do not. Legitimate claims can be made on an organization, for example, by any stakeholder which is impacted by externalities. While legitimacy says who managers *should* pay attention to, it typically downplays the decision rules managers employ in deciding how and when a latent stakeholder's legitimate claims receive attention.

Salience defines *what makes them count*. Stakeholders with legitimate claims move from being potential to actual stakeholders when they gain either power or urgency. If a stakeholder's claim on manager attention is either *time sensitive* or *critical*, it possesses urgency. Salience relates to the concept of *pressure*, a core aspect of IT—which is often linked to ST. A legitimate claim from a powerful stakeholder has salience. Similarly, even if they have no power, a stakeholder's legitimate and urgent claim has salience.

By adding power and urgency to the normative assessment of legitimacy, ST explains why managers pay attention to the stakeholders that they do. Economic, and social individuals and groups and even the natural environment itself can act as stakeholders and influence organizational decision making (Mitchell et al., 1997). According to reviews on the use of theory in SSCM or CE, ST is typically used to consider the extent of active procedures for stakeholder inclusion in decisions, particularly which stakeholders were relevant (Busse et al., 2017; Park-Poaps & Rees, 2010), and how stakeholders' expectations are considered against internal firm expectations (Touboulic & Walker, 2015).

Future research could improve ST by improving understanding of how national boundaries and different kinds of pressures and stakeholders relate to sustainability efforts across supply chain and CE members. While ST has been appropriated in SSCM, the CE linkage to ST has yet to be fully realized (Jabbour et al., 2019)—joint SSCM and CE-level analysis can show how ST can further SSCM-CE nexus investigation. For example, CE does not always explicitly incorporate social and environmental dimensions—stakeholders who wish to have CE go beyond technological and policy concerns may cause CE to be more focused on 'strong sustainability' developments (Joerg S Hofstetter et al., 2021).

3.2 **Institutional** Theory

IT theory is used in organizational studies to consider how external societal forces influence organizational processes (Barley & Tolbert, 1997; DiMaggio & Powell, 1983; Scott, 1995, 2005). The main premise of IT is that "organizations, and the individuals who populate them, are suspended in a web of values, norms, rules, beliefs, and taken-for-granted assumptions, that are partially of their own making" (Barley & Tolbert, 1997).

The definition of *institution* is flexible, it generally includes societal factors and cultural elements with important economic consequences like employment and private property (Barley & Tolbert, 1997; DiMaggio & Powell, 1983; Hedoin, 2009; Weber & Glynn, 2006). IT draws attention to long-term social processes of transferring cultural elements between individuals and social collectives.

The sources of institutional pressures are nuanced and complex. Three types of institutional pressures exist: (1) Coercive pressures—from the power of centralized government, large corporations and foundations; (2) Mimetic pressures—the need to copy, or mime, others' strategies due to the uncertainty of competition; and (3) Normative pressures—from social expectations through the process of professionalization to create "a pool of almost interchangeable individuals" (DiMaggio & Powell, 1983).

According to SSCM theory reviews, IT is typically used to consider how isomorphic pressures contribute to firm adoption of SSCM activities (Sarkis, Zhu, & Lai, 2011; Touboulic & Walker, 2015). Future research could improve IT by improving understanding of the influence of internal pressures, of ways governments might identify and target "core companies" to promote further adoption of SSCM; and of why there is so much heterogeneity in SSCM practices (Sarkis et al., 2011).

SSCM research has seen significant earlier linkage of IT. CE is only starting to take an IT perspective (e.g., Ranta, 2018; Hofstetter et al., 2021). Part of this lack of IT investigation with CE has to do with the levels of analysis and the atheoretical nature of research in CE. It is expected to grow as broader societal issues such as inclusiveness and equity beginning to make headway into CE research. The SSCM-CE nexus provides significant potential to diffuse IT across these disciplines, where SSCM investigations using the IT explanatory theory can be transferred to SSCM supported CE activities, business models, and strategies. The emergent IT CE literature seems to be already following this SSCM to CE evolution—for example see (Bag, Pretorius, Gupta, & Dwivedi, 2021).

3.3 Natural **Resource**-Based View

NRBV builds on and extends the traditional resource-based view (RBV). RBV states that firms derive most of its competitive advantage from the policies it employs to manage internal resources and capabilities (Barney, 1991; Penrose, 2009/1959). Whereas RBV considers societal welfare

(Barney, 1991), NRBV considers the competitive advantage that comes from explicit consideration of resources in the natural environment and stakeholders in firm environments in management policy (Hart & Dowell, 2011).

NRBV views stakeholder and institutional considerations as related to the external aspect of the strategies. NRBV also requires internal capability development of a shared vision (Hart, 1994). NRBV and its application in SSCM and CE posit three ideal organizational strategies as follows.

First, *Product stewardship* strategy considers the environmental performance across the entire product life cycle from design to use to disposal. This strategy involves significant changes to the way supply chains are configured with the long-term objective of "closing-the-loop in operations" (Hart, 1994)(p.9).

Second, *Clean technology* describes changing a firm's relationship to the physical environment through changes in technology rather than "incremental improvements to today's products and processes" (Hart & Dowell, 2011)(p.1471). This strategy is future-oriented and involves innovation and long-term investment and requires a capability for dealing with knowledge in dynamically complex situations (Hart & Dowell, 2011).

Third, *Base of pyramid* describes altering a firm's relationship to social inequality, particularly in low-income countries, by developing ways to supply the unmet demands of the poor and involves the development of novel capabilities (Hart & Dowell, 2011).

Extant studies of NRBV in SSCM and CE literature have confirmed some of Hart's hypotheses about the capabilities that facilitate success under different environmental strategies (e.g., Rodrigues et al., 2021 which consider SSCM and CE within a food supply chain context (Rodrigues, Demir, Wang, & Sarkis, 2021)). Also, Hart posited that success in pollution prevention is linked to management of material flows (i.e., operations management) and empirical studies found that process improvement and project management capabilities (i.e., operations management) increase the impact of pollution prevention strategies on financial performance (Hart & Dowell, 2011). Also, empirical studies found that managers invested in pollution control but underinvested in cost-effective pollution prevention (Hart & Dowell, 2011).

According to reviews on the use of theory in SSCM, NRBV is typically used to consider how inter-organizational and intra-organizational resources (identified using RBV) influence SSCM adoption by suppliers (Touboulic & Walker, 2015). Future research could improve RBV by improving understanding of how inter-organizational learning occurs, and by developing measures for the resources and capabilities for quantitative analysis. These complementary elements, learning and innovative capabilities, are considered here as under-used theories with new insights and interpretation are introduced next.

4. Potential Theoretical Perspectives to Expand SSCM-Nexus Understanding

As the scholarly and practical interests in SSCM and CE increases, there is a need to expand the current conceptual understanding and theoretical boundaries to include promising social science

theories which may provide additional theoretic lenses for SSCM and CE. These under-used theories can be used to reflect on the role of information feedback across multiple levels of analysis, and what such a framework means for broader issues.

In this section, we summarize three theories—organizational learning (OL), social innovation (SI) and social learning (SL)—from a systems thinking perspective with a focus on organizational, social, and environmental strategic planning. These theories describe processes of individual, organizational, and organizational network attempts to improve society through social and environmental institutions.

4.1 Organizational Learning

OL involves interactions between individuals and collectives. This position raises challenging conceptual (D. H. Kim, 1998) and methodological (Suddaby, 2010) issues for its broader application. Individual learning occurs only when the learner changes their decisions or goals in response to information stimulus and feedback from the environment which indicated to the learner that an original decision or goal needs adjustment (Powers, 1973). Across authors, organizational learning, exists in two types of information-feedback cycles (Argyris & Schön, 1978; Gioia, 2006; Maitlis & Christianson, 2014; March, 1991; Senge, 1990; Sitkin, Sutcliffe, & Weick, 1998): *Action Cycles* –where automatic decisions are applied, and actions are adjusted based on goals and perceived outcomes of decisions and *Learning Cycles* – where goals or decisions are changed in the face of perceived problems (Powers, 1973).

The *learning* cycle has three feedback loops: (1) a *double-loop learning* loop showing changes in goals and decisions, (2) a *cultivating alternatives* loop whereby an individual entertains several competing diagnoses of a problem in their mind, which are then tested in a group process of acting and interpreting until the individual makes sense of the problem with a correct and timely solution (or not), and (3) an *interpretation* loop whereby individuals' openness to new information is shaped by the plausibility of their current diagnosis which in turn influences their ability to perceive errors in that diagnosis (Forrester, 1961; D. Kim, 1990; Rudolph, Morrison, & Carroll, 2009) (Richardson, Andersen, Maxwell, & Stewart, 1994).

OL is rarely used for research in SSCM (Touboulic & Walker, 2015) or CE. We did a review and found that, since 2015, this is still relatively valid, with very limited studies that have used the OL lens (e.g., (Roy, 2020) and Bratt (2021)). Future research could improve OL by standardizing the constructs across theories in a single conceptual model. This would enable SSCM-CE researchers to use this theory more easily. Researchers could examine how social and environmental pressures—for example regulatory pressures (IT), and stakeholder feedback (ST)–can influence organizational and individual decision-making within organizational units and operational systems.

4.2 Social Innovation

SI is a practical and important phenomenon in modern society. It involves innovators (e.g., individuals, organizations, or networks) implementing innovations (e.g., novel organizational forms, strategies, or technologies) with the aim of resolving pressing social (or environmental)

problems. As argued by Rogers' *Diffusion of Innovation* and Schumpeter's *Creative Destruction*, innovation plays an essential role in the development of modern society (Ruzzeddu, 2018).

Despite its importance, SI is still an *essentially contested concept* with specific and direct theoretical constructs remaining elusive (Pel et al., 2020; Van der Have & Rubalcaba, 2016). It represents an emerging theoretical and practical phenomena with roots across social science disciplines (Haxeltine et al., 2017)(p.1).

This situation leaves practitioners, policy-makers in government, and the marketplace to their own devices, without a firm basis for action to promote social innovations (Ruzzeddu & Ferone, 2018). One important step is to frame socially-innovative actions *in* the social innovation *context*: as part of "the process of challenging, altering, or replacing the dominance of existing institutions in a specific social and material context … [where, due to] risks of capture, co-option and dilution … [social innovation actors are] the main protagonists but not the exclusive 'drivers'" (Haxeltine et al., 2017)(p.3).

An important application of SI theoretical lenses would be to integrate them with OL theory in the SSCM and CE domain. For example, studies can investigate how social innovation actors develop and implement innovations along with other important organizational issues such as leadership, interactions between individuals' motivations and organizational and network structure, which have been neglected so far (Pel et al., 2017).

We view SI as a potentially-emancipatory theoretical perspective as it enables considering the actions the broad set of SSCM-CE actors (i.e., adding individuals and SI networks to the typical study of organizations and supply networks) in the SI context noted above. Doing so will explore how SSCM-CE situations interact with existing or new social norms, beliefs, and perspectives—which can also be linked to our next broad-based potential interpretative theory of social learning.

4.3 Social Learning

Similar to SI, SL may also be considered an essentially contested concept with possibilities to extend the understanding and view of the SSCM-CE nexus. SL theory *proposes* processes of cultural change, especially changes in norms, in response to changing conditions of the natural environment. These processes are guided by an open-ended, consensus-driven process which is informed by long-term thinking and the expectation that macro-societal systems can be designed to be capable of more quickly adapting to changing circumstances (Bagheri & Hjorth, 2007; González-Ricoy & Gosseries, 2016; Hjorth & Bagheri, 2006).

SL relies on processes of social cooperation and proposes mechanisms which cultures would use to learn from failures (Hudson, Hunter, & Peckham, 2019)—or potentially from major socially disruptive events such as pandemics. As such, SL offers affordances (Boyd et al., 2018) that address failings in narrow views of evidence-based policy (Hudson et al., 2019; Saltelli & Giampietro, 2017). These views lead to command-and-control policy-making rather than learning policy systems (Bagheri & Hjorth, 2007). SL proposes redesign of linkages across institutions (González-Ricoy & Gosseries, 2016) and of policy cycles (Ilott, Norris, Randall, & Bleasdale, 2016) as part of a more holistic view of evidence for evidence-based policy.

Like OL, SL views learning processes as involving simultaneous cycles of action and learning(Bagheri & Hjorth, 2007) and similar challenges to those encountered in group-based organizational learning processes (Jones, Seville, & Meadows, 2002). SL also conceives of society as having a structure made up of feedback loops with its behavior being driven in large part by unintended consequences of past actions —a systems thinking perspective (Bagheri & Hjorth, 2007).

SL has most potential for SSCM-CE as an interpretive theoretical perspective to consider the inter-organizational processes that bring about significant changes in policy over time. With the increasing adoption in business of a digital infrastructure, novel opportunities are created for redesigning material flow and information feedback systems across supply chains. SL has significant potential to help managers make sense of the kinds of the resulting distributed, institutional processes.

Learning and innovation are crucial for achieving sustainability. Research on these theoretical perspectives at the SSCM-CE nexus is virtually non-existent or at best appears to be in its infancy. An improved holistic understanding of these theories—one considering how these theories are interrelated with each other and the SSCM-CE nexus —can inform both scholars and practitioners. The following section will map the three explanatory theories and these three emergent theories using a systems thinking perspective to formulate an integrative—interpretive and potentially emancipatory—theoretical framework for organizational strategic planning at the SSCM-CE nexus.

5. Mapping existing and potential theories through systems thinking

The SSCM-CE nexus can utilize a holistic framework that identifies key variables and relationships which have theoretical and practical significance in advancing both fields simultaneously. Systems thinking can be deployed to build understanding of the drivers of dynamics in complex situations such as business units and operational systems. *System Dynamics* provides guidelines for explicitly organizing holistic system structures in qualitative diagrams, and relating them to behavior patterns over time through mental and quantitative simulation (Lyneis, 1999). The *dynamic sustainable supply chain-circular economy management* (D-SSCEM) framework is proposed here as a conceptual map over which theoretical boundaries from the existing and emergent organizational theories are overlaid.

Developing a theory of the SSCM-CE nexus, dynamic or otherwise, involves considering best practice in theory development. Among other things, this involves the recognition that theory incorporates causality, and that box and arrow diagrams can show causality transparently and explicitly (Whetten, 1989).

We begin our perspective and interpretive theory-development by creating Figure 2 which combines the three box and arrow diagrams which Seuring & Muller developed in their 2008 literature review (Seuring & Müller, 2008) and which have been widely cited in the SSCM

literature. The resulting diagram includes the key variables and relationships used by researchers working in this domain.

Before combining, the various types of arrows were replaced with one type, because the authors did not describe the different arrow types. Otherwise, the boxes and arrows in their figures are unchanged, other than including them all in one combined diagram.

--- Insert Figure 2 about here ---

Looking at Figure 2, it becomes apparent that the arrows form several closed causal loops. As such, SSCM appears to be occurring in an information-feedback system. Such systems can often have a mind of their own, generating counter-intuitive behavior and unintended consequences.

We propose visualizing SSCM's major feedback loops using causal loop diagrams, as informed by the system dynamics approach to systems thinking (See Table 2). Blue arrows represent links with positive polarity: an increase in the cause variable will lead to an increase in the effect and a decrease to a decrease, all else equal. The pink arrow represents a link with negative polarity: an increase in the cause variable will lead to a decrease in the effect, and a decrease to an increase, all else equal. Significant time delays are marked with a double-hash. In these diagrams, no assumptions are made about time delays. Balancing feedback loops (B) bring a system back toward a goal after a change in one of their variables. Reinforcing feedback loops (R) reinforce the direction of change in one of their variables.

---Insert Table 2 about here ---

The theoretical framework (Table 2 or a systems perspective to the SSCM model), describes how supply chains change their behavior to become more sustainable over time. It is built up in three diagrams. These three diagrams are detailed in Table 2; with the last figure being the most comprehensive one. This latter figure in Table 2 is used to visualize popular and emergent theory for SSCM-CE later. First we will describe the dynamic view of SSCM before eventually integrating CE.

The first diagram in Table 2 is "Business as usual". In the narrow "theory of the firm" we have managers making decisions about materials, practices, and products. Over time, there are actual social and environmental impacts stemming from production, product use, and disposal (i.e., the product life cycle). Manager decisions are assumed here to be made without regard to such "externalities".

The second diagram in Table 2 is "Supply chains and stakeholders bring actual and perceived impacts under control". In a broad SSCM theory of the firm, stakeholders view externalities in an imperfect way as perceived impacts. As these perceived impacts grow, stakeholders bring pressure to bear on the responsible parties, namely the supply chain, to change its ways. In response to this pressure, supply chains use alternative decisions (about materials practices and products) to bring "actual impacts" and "perceived impacts" under control, along the product life cycle (Loop B1-Controlling Impacts). This general loop is critical to integrating CE with SSCM, more fully realizing the SSCM-CE linkage—although CE principles can be applied in other relationships, this is a clear and explicit link.

The third diagram in Table 2 is "Ways of controlling impacts and perceptions differ depending on the relationships among system actors". As we approach a real situation, the variables become more disaggregated to show the dynamic complexity of a SSCM-CE nexus. Stakeholders include actual and potential customers in the public, NGOs representing various stakeholder interests and governments. Each of these perceives "actual impacts" and brings pressures in its own way. Our supply chain includes a company and the other companies in its supply chain, including suppliers and customers (business or household). This disaggregation uncovers two more loops. Companies can respond to pressure in two different ways. They can change their ways (closing Loop B1 Controlling Company Impacts). Disaggregating stakeholders does not change the essential nature of loop B1. Companies can pass the pressure onto others in the supply chain to change their ways (e.g., with supplier evaluation, by increasing communication, sharing more product criteria and through supplier development to become more lean and greener). When this pressure results in supply chain companies changing, this brings an extended version of Loop B1 (Loop B2 – Coordinating Sustainability of Supply). Over time, companies changing their ways redefines supply relationships to involve mutually-reinforcing pressure to sustain or abandon sustainability, closing our third loop (Loop R1 – Supply Relationships for Sustainability—which will include CE practices).

We now provide figure 2a and 2b that integrate the theoretical perspectives into two synthetic interpretative theoretical frameworks. In Figure 2a we show the overlap and location of popular, explanatory theories (ST, NRBV, and IT). These are general locations in the SSCM model that the theories can help study and advance. ST considers stakeholders changing urgency with respect to perceived impacts and managers changing the attention they pay to various stakeholders, including to other companies in their supply chain. IT considers the pressures companies face from supply chain members and other stakeholders. The NRBV considers how evolving company strategies consider the natural environment with consideration of the stakeholder and supplier relationships in these strategies, with less emphasis on the transition between strategies. Broader emergent theories are further overlaid in Figure 2b. OL considers why and how a company makes changes to its policies, in response to outside pressure. SL describes how stakeholders interact to bring about changes in policy across organizations and individuals to respond to situations in the environment, without specific consideration of the nuances of supply relationships. SI considers stakeholder-company interactions and innovative changes, with less emphasis on supply relationships and learning.

There are more nuances in these relationships. The purpose of Figures 2a and 2b is to visualize how the theories might relate to SSCM-CE nexus. There is significantly more work and effort to further refine these initial perspectives which is core to many of the future research directions in the next section.

6. Future Research Directions and Managerial Implications

In this section, we briefly provide some potentially useful and impactful research directions using the general framework. Admittedly, these future research recommendations are not exhaustive and

are prejudiced by our perspectives and interests. Additionally, we outline some managerial implications in this section.

6.1 Research and Theoretical Implications

Several research and theoretical implications exist. First, multi-theoretical and multi-level analyses are difficult to simply evaluate with minimal polysemy. Using systems analysis tools such as system dynamics (SD) may be able to address the complexity of constructs by focusing on a practical case or class of cases. Because of its capabilities in modeling causal-loop and material closed-loop systems, scholars are increasingly developing SD models which cross the conceptual boundaries of the SSCM-CE nexus. SD theory development often involves integrating multiple theories (de Gooyert, 2018), and ideally results in a *canonical model*[1] (Lane & Smart, 1996).

SD studies must determine a specific situation for investigation—with the adage to *model the problem not the system*. To do this, researchers often rely on stakeholders to determine important variables and policies to analyze. However, they often struggle to identify the stakeholder who is willing to take direct responsibility for the instability, un-sustainability and inequity of complex resource supply situations (Jones et al., 2002). Without such canonical models available for SSCM-CE, SD studies that accept a previously-published model as canonical to save time on conceptualization may instead be introducing serious bias. SD research has the potential to make sense of complex nexus issues like SSCM-CE and to discover the causal loops which are the major source of uncertainty in such situations (Lewandowsky, Ballard, & Pancost, 2015; Skaggs et al., 2012). Nevertheless, novel approaches to setting the boundaries in SD studies may be needed to make inroads. Future SD research can link better to relevant theory and to the SSCM-CE nexus by using the frameworks presented here. A research question is—Can a canonical model be developed and accepted by the broader SSCM-CE community?

Future reviews of SD work in SSCM-CE could consider questions such as: Which theories are being used to understand SSCM-CE? Which theory development approaches are used to advance SSCM-CE? Are there common material flow and information feedback structures in SD models of SSCM-CE, including this framework? Which system archetypes are motivating SD models? What stakeholders are targeted by SD models of SSCM-CE?

Second, considering newer theoretical perspectives allows for emancipatory theoretical thinking. Whereas previously SSCM-CE situations have been technologically supported and focused, the newer social theoretical perspective advances these relationships, but also cause difficulties in scientifically designed studies. The social theory dimensions can extend SSCM-CE in the underdeveloped social dimension of sustainability. This situation may overshadow the environmental concerns—and for those of us who do research on the environmental dimensions—may be concerned with this overshadowing based on experiences with economics playing a larger role than environmental concerns. That is, human-focused concerns may dominate over environmental concerns.

[1] A canonical model in SD is a model generalized from practical case studies (Lane & Smart, 1996).

Future research from an emancipatory theory perspective would ask questions such as—How does the social dimension of research (e.g., a stakeholder's learning or financial viability) influence treatment of the environmental dimension? What non-traditional theories from other fields can help inform and advance SSCM-CE theory and practice?

Third, much of the previous literature on SSCM and much of CE has been targeted at organizational or higher levels of analysis. The social innovation and organizational learning theories presented here may expand the scope of the SSCM-CE nexus to include individual mindsets and behaviors as part of the analysis. Thus, not only would there be an expansion into social dimensions, but also group and individual level decision making, response, behavior, and action. So, how do individuals overcome common challenges to individual-level learning and innovation in SSCM and CE situations? How effective are widely-used tools in overcoming these challenges? What is the relationship of SSCM-CE theories between different levels of analysis?

Fourth, one of the most salient aspects of current SSCM and CE situations is emergent regulatory policy. Much of the research—at least at the SSCM level and significant portions of the CE literature—has been technologically, organizationally, inter-organizationally managed. The issue here is that policy level analyses and linkages to these and lower levels, such as individualistic behavior, has been limited. Understanding causal and material interrelationships amongst and between levels of analysis and systems is needed. It can manage a more effective implementation and support of these policies by governments, communities and very importantly, businesses and managers. What influence do discrepancies between system interrelationships assumed in regulatory policy and those existing in practice have on policy implementation? Can policy-based methods, such as SD, be utilized to effectively integrate regulatory stakeholders?

Lastly, tradeoffs exist, and conflicts may occur in the theories. For example, the learning in organizational learning and social learning theories occurs at different levels of analysis raising possible conflicts in their perspectives on learning. The multitude of theories presented in these models may help address this conflict. For example, institutional theory considers multiple institutional fields—social fields and organizational fields—and may help explain the different perspectives and when they are appropriate from social and organizational learning theoretical perspectives. In this case, not only may there be testing of alternative theories, but consideration, including, and testing bridging theories in broader models. These are not easy to complete but the general framework provided here is a suitable starting archetype. Can this general framework provide insights to synthesize these theories?

Further refinements of the D-SSCEM framework will be needed. Studies to further refine the relationships and apply them in cases are needed. We feel that the D-SSCEM research will keep scholars busy for decades.

6.2 Managerial Implications

Our framework and discussion have several managerial implications. We highlight some benefits and issues from the framework—especially the more mature model in Table 2—has for management, organizations, and their supply chains.

Managers are provided a relatively parsimonious framework from which to work. Organizations now have a variety of relationships between some of the more important factors faced relating to sustainable supply chain management and circular economy and innovations. They can prioritize strategies and re-allocate resources based on these relations. Unintended consequences that managers often experience can be lessened given the relationships are essentially presented. The current framework provides a very general systems mental map of the factors and relationships.

Modeling these relationships—for example through a system dynamics methodology—can support predictive organizational and supply chain analyses. If causal relationships can be tested, then managers can anticipate some risks and plan ahead accordingly. The general framework is flexible, and managers can add, or decompose the major elements further, or remove some relationships they feel are not appropriate for their environment. It provides management teams the opportunity to guide their sustainable supply chain strategies.

Even within the theoretical relationships—as described in figure 2—managers can begin to more generally understand that there are multiple types of forces playing a role. Stakeholder relationships, they need to realize, relate to organizational learning, especially when it arises from sustainability concerns and pressures faced. That is, organizations can learn from their stakeholder inputs which derive from a large set of stakeholders and in different ways. Learning can occur from broader societal forces and managers should be aware of broader forces—even if they are internally focused—whether these forces are from institutional changes or social innovations.

Managers involved in inter-organizational efforts that support SSCM, carbon reduction, waste management, or general emissions control, can observe the variety of resources and pressures they face. For example, organizational reports are now including materiality indices (Torelli, 2020). These materiality indices try to put various sustainability pressures and concerns—which may include various innovations—along managerial importance and stakeholder important axes. These materiality matrices can be used for prioritizing internal initiatives or seek to implement innovations depending on joint importance considerations. These types of relationships may be informed from theory and the frameworks presented in our perspective.

7. Conclusion

In this perspective paper we argue for the linkage of SSCM and CE—or the SSCM-CE nexus. We have provided general overviews of SSCM and CE, which are both still in development and refinement, although SSCM is closer to a more mature scholarly discipline. CE is still growing and its linkage to SSCM theory and understanding can help CE advance academically in the organizational and business literature. CE is well established in the broader policy literature and may inform SSCM theory from that perspective.

Together at the SSCM-CE nexus various existing theoretical perspectives exist. Major existing explanatory theories include stakeholder, institutional and natural resource-based theories. Each of these theoretical perspectives alone could use more study. We also provide additional emergent theoretical perspectives—organizational learning, social innovation, and social learning—that may further expand the understanding. Although these theories have existed and are still developing, their application to the SSCM-CE nexus may be valuable in contributing more

effectively to broader sustainability advancement and understanding—i.e., helping SSCM-CE achieve strong sustainability.

The major contribution of this work was the interpretive synthesis of these theories around a general SSCM-CE nexus framework, which we have described as a dynamic sustainable supply chain-circular economy management (D-SSCEM) framework. We then provided general research directions—at the highest levels—to further evaluate this framework and potentially arrive at paradigm shifting emancipatory theories. Although it remains to be seen how much new knowledge emanates from this relationship, a basic and important research question.

Clearly, our perspective and development is based on systems thinking. The model is relatively complex which goes against the rules of a simple theoretical framework. But, given that sustainability and circular economy topics are inherently complex, too much simplification may provide incremental advancement and understanding at best.

Another limitation is that we only considered major theoretical perspectives that have been studied. Hundreds of theories at multiple levels exist. For example, hundreds of motivational theories and consumer marketing theories exist at the individual and organizational levels. How these additional theories play a role in this model and interactions at the SSCM-CE nexus are open for debate and investigation. We believe the models we present here have substantial potential, but we are not excluding the potential of other theory.

What we do know is that CE and even much of the prescriptive normative SSCM literature has been relatively atheoretical. Additional theory can only help understand and advance these fields from a research and practice perspective. We look forward to seeing additional investigation and development of this framework and other SSCM-CE nexus investigations.

Table 1: Conceptual Differences of Traditional and Sustainable Supply Chain-Circular Economy Management

	Traditional Supply Chain Management	**Sustainable** Supply Chain Management
System Boundaries	Organizational proximal (spatial), economic (Wuttke et al., 2013).	Political, informational, legal, cultural, technological boundaries (Sarkis, 2012).
Relevant Flows	Materials, service, financial, information, and waste flows (Davé et al., 2018).	Adds water and energy flows (Sarkis, 2012).
Relevant Stakeholders	Managers, customers, stockholder (i.e., the pure stockholder as stakeholder view (Seuring & Müller, 2008).	Governments and non-governmental organizations (Busse et al., 2017).
Impacts of Decisions	The traditional "pure economic" performance metrics (Seuring & Müller, 2008).	The interrelated social and environmental impacts, and trade-offs (Seuring & Müller, 2008).
Supply Chain Tiers	Consideration of supply chain staff at one firm, or the buyer-supplier relationship (Butt et al., 2021).	A wider range of issues and, therefore, considering multiple tiers of the supply chain explicitly (Kumar & Rahman, 2015).
Degree of Cooperation	Cooperation is important (Albino et al., 2007).	SSCM involves a much greater need for cooperation (Zimon et al., 2019).
Time Scales of Problems	1-5 years	1-20+ years (generations)

Table 2: Theoretical Framework: Dynamic Sustainable Supply Chain and Circular Economy Management

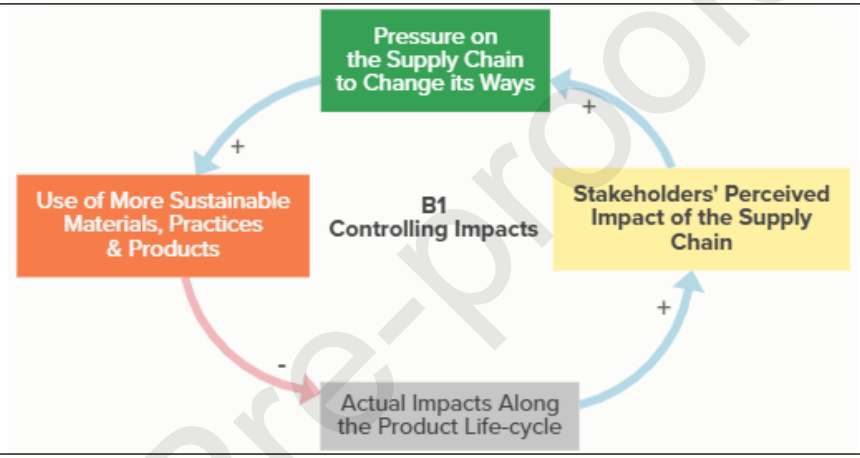
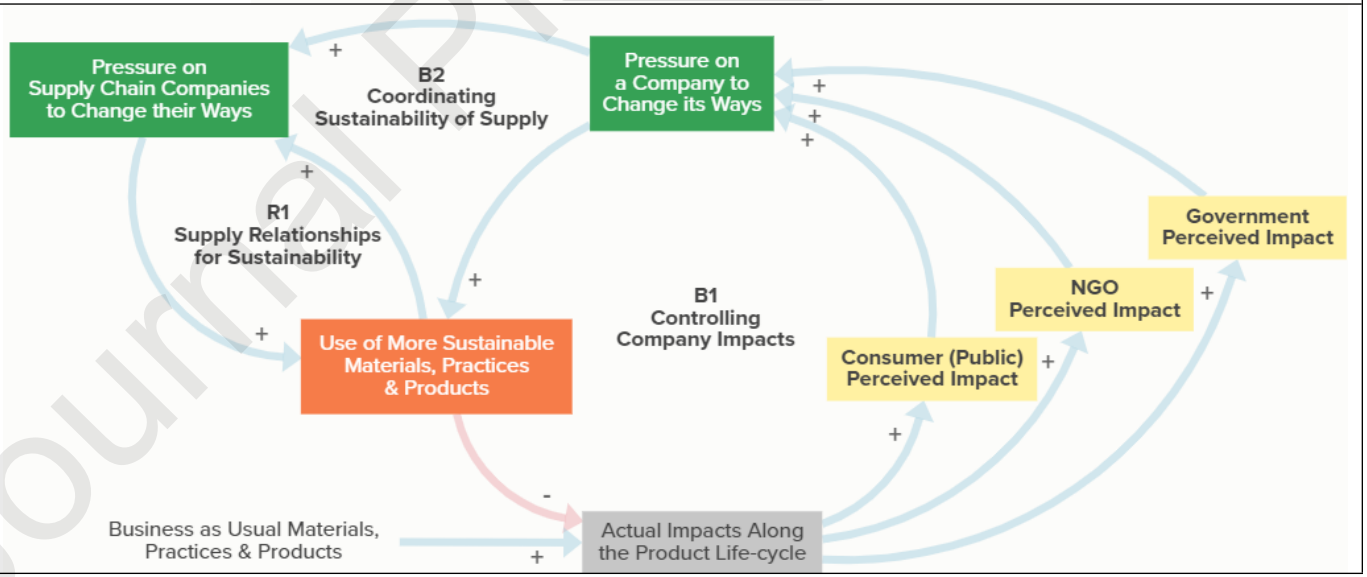
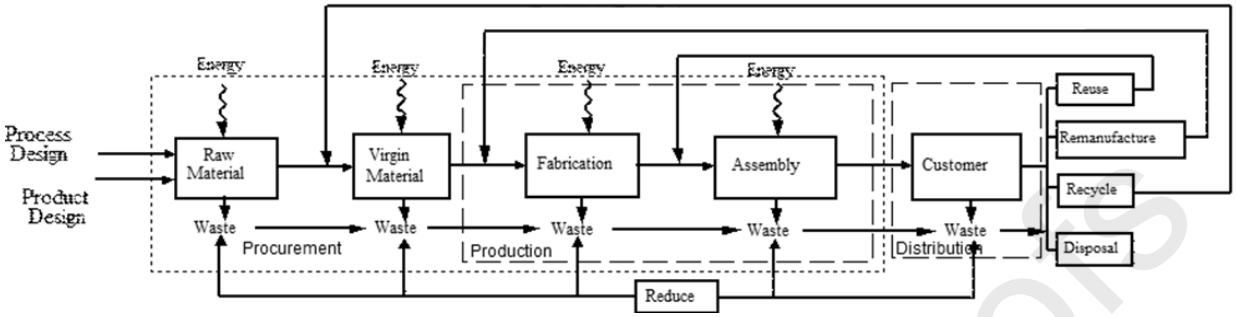
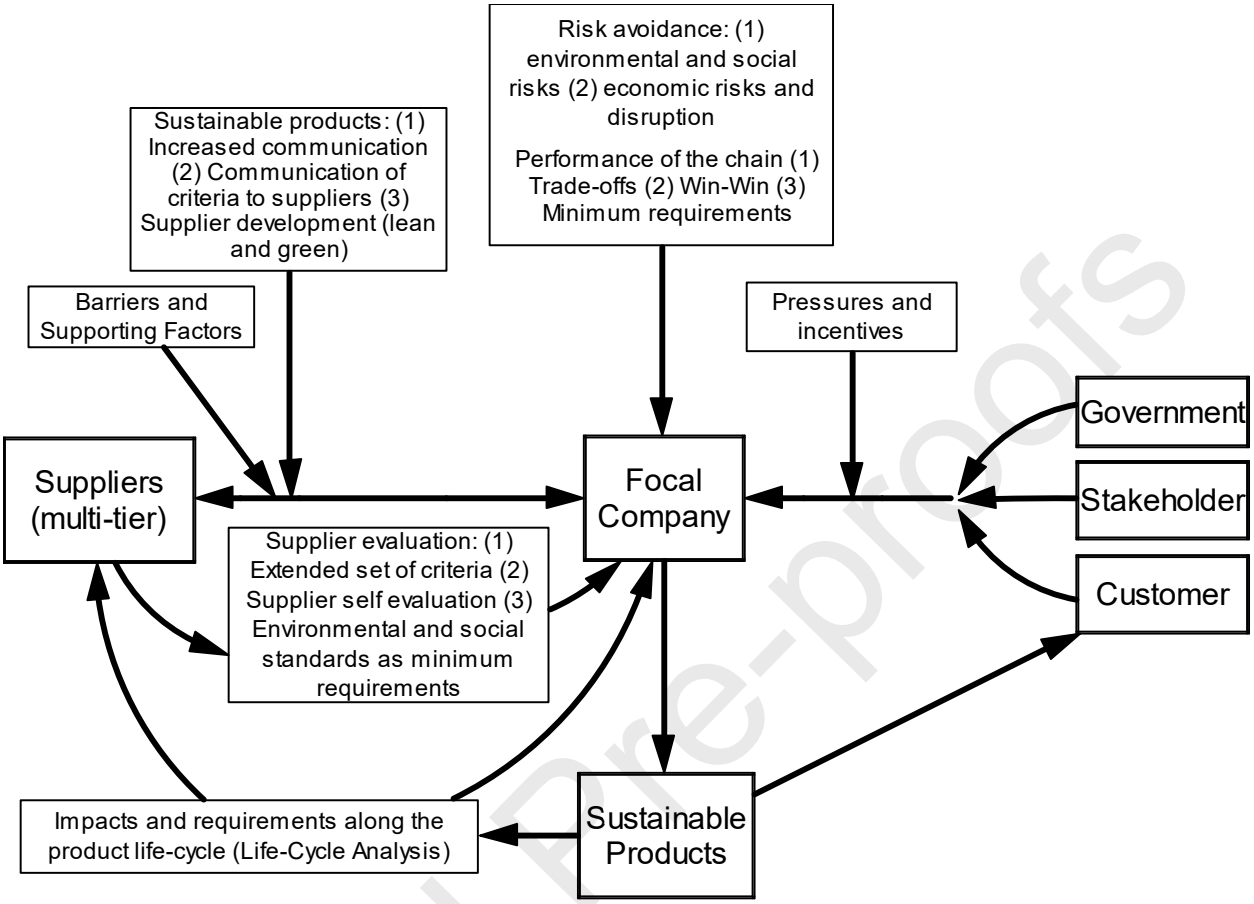
Business as usual	
Supply chains and stakeholders bring actual and perceived impacts under control—Integrating Product Life Cycle and Circular Economy principles	
Ways of controlling impacts and perceptions differ depending on the relationships among system actors	

Figure 1: High-Level View of the Sustainable Supply Chain Management – Circular Economy Nexus



Adapted from (Sarkis, 1995).

Figure 2: Conceptual Model of Sustainable Supply Chain Management



Note: This figure is adapted from Figures 4-6 of Seuring & Muller (2008) (Seuring & Müller, 2008).

Figure 2: Theoretical Framework: Dynamic Sustainable Supply Chain-Circular Economy Management (D-SSCEM)

Figure 2a: Explanatory Theories & D-SSCEM

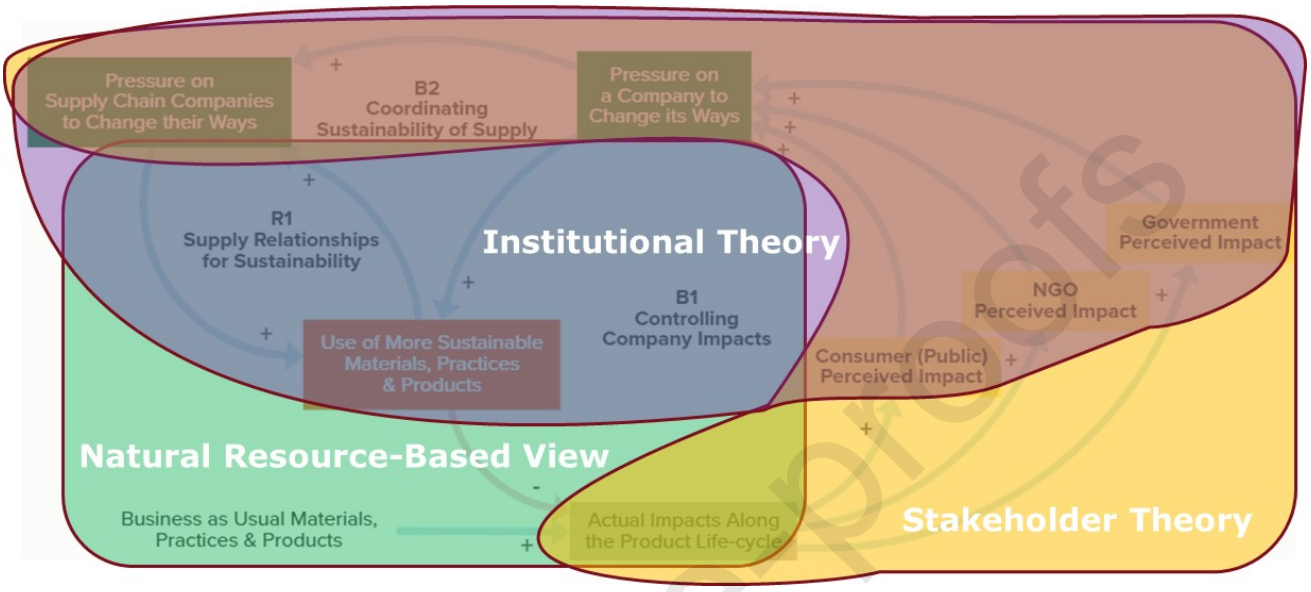
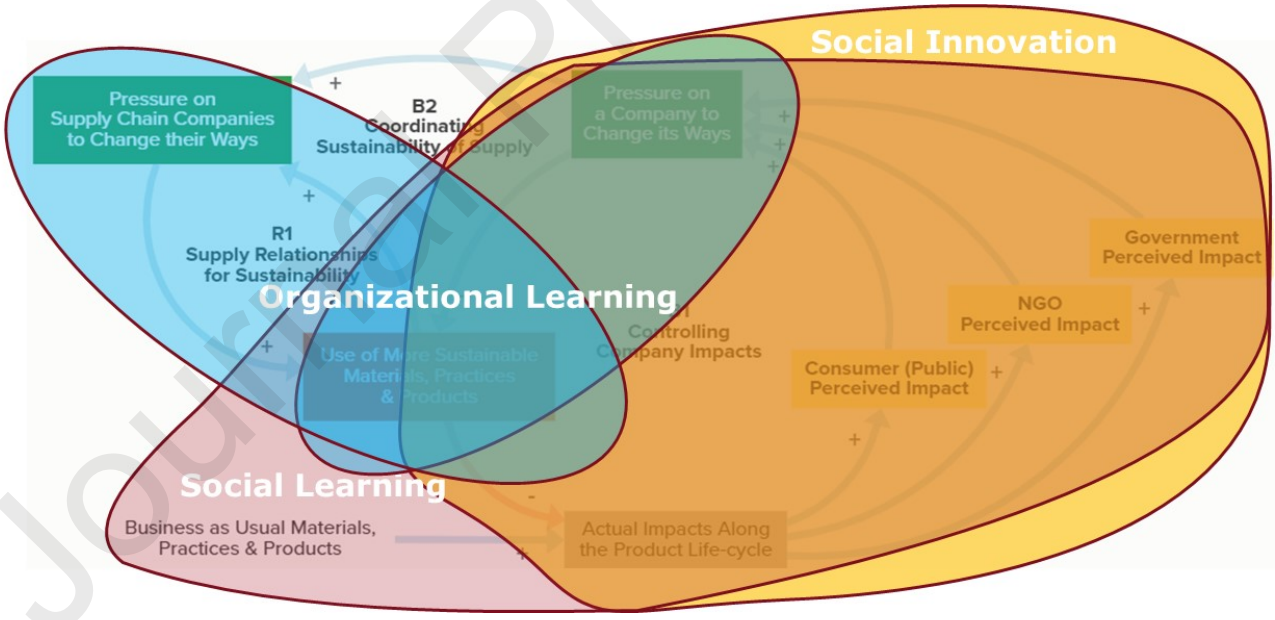


Figure 2b: Emergent Theories & D-SSCEM



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