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A Novel Approach to Supply Chain Management Theory Development

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Actor-Network Theory – A Novel Approach to Supply Chain Management Theory Development

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ABSTRACT
Supply chain management (SCM) researchers often conduct research using theoretical approaches and ontological assumptions adopted from other areas of management. These approaches and assumptions are valid for some aspects of SCM, but may also neglect or be unsuited to other questions and concerns that are distinctive to the SCM domain. Actor-network theory (ANT) provides an alternative perspective that addresses some of the blind-spots of established approaches. We begin by describing the main theoretical assumptions and the dominant ontological position of ANT, in terms of three principles: relationality, heterogeneity, and performativity. We then show how adopting these principles allows an alternative conceptualization of the supply chain and of SCM itself, and discuss the methodological implications of adopting these principles for research in SCM. ANT-inspired research can make four major contributions to the development of new SCM theory. First, ANT can provide new theoretical insights into the dynamic and fragile character of supply chains, specifically regarding how SCM systems and devices are implemented, constructed, and transformed in practice. Second, ANT can enable the development of SCM theory that leads to a better understanding of how people in SCM roles really act when managing in the supply chain space. Third, the question of what and who manages the supply chain can be explored in radically new ways. Finally, ANT can provide a complementary perspective on power in the supply chain, serving as a good lens for researchers interested in exploring the politics of representing, interpreting, and stabilizing SCM practices and systems.

Keywords: *Actor-Network Theory, Theory Development, Supply Chain Management, Relationality, Heterogeneity, Performativity*

INTRODUCTION

Qualitative research methods have been used in supply chain management (SCM) to generate new theories and elaborate on existing ones, leading to a range of new insights. However, such research has often been constrained by adopting ontological assumptions inherited from existing research in logistics, SCM, and the wider management discipline and by working with theories from management and other fields, such as transaction cost economics and institutional theory, which are not always suited to the SCM context (Flynn, Pagell, & Fugate 2020) or at least only to certain types of questions. According to Flynn, Pagell, and Fugate (2020), supply chains are characterized by the conflicting goals of supply chain members, units of analysis that are often different from those used in management research, and great structural and geographic dispersion and complexity. Combined, these characteristics suggest that alternative research approaches are needed that overcome the limitations of existing conceptualizations and associated methodologies, use new forms of data, and provide the basis for the development of new theory to complement the great strides already made in this discipline.

Therefore, the purpose of the current paper is to consider the potential of actor-network theory (ANT) as an alternative perspective for SCM. First of all, in the context of this Emerging Discourse Incubator (EDI), ANT is proposed as an alternative ontological and methodological approach that can provide the basis for theorizing particular SCM phenomena in a way that broadly parallels the use of discourse analysis (Hardy et al., 2020) and critical engaged research (Touboulic et al., 2020) proposed elsewhere in the current EDI. Within those subjects related to management, ANT has been applied extensively in organization studies, accounting, marketing, and information systems research (e.g., Callon, 1998; Mouritsen, Hansen, & Hansen, 2001; Czarniawska & Hernes, 2005; Andrade & Urquhart, 2010; Mason, Kjellberg, & Hagberg, 2018; Romestant, 2020; Abboubi et al., 2022). The position of the present paper is that ANT also has significant potential for use in SCM.

Using an ANT approach necessitates the abandonment of fundamental assumptions that are normally used by SCM scholars. By way of an illustration, consider the central SCM concept of "integration." As discussed in Frohlich and Westbrook (2001), integration is a measurable characteristic of an existing supply chain. The degree of integration is a function of the extent to which certain activities are carried out by the managers and businesses involved. For example, some of the items Frohlich and Westbrook use to operationalize integration are: sharing production plans, using customized packaging, and sharing logistical equipment (2001, p. 198). These are all activities in which human agents, such as purchasing and logistics managers, use tools such as planning systems, the design of packaging, and information about inventory to bring about certain effects. According to Frohlich and Westbrook (2001), the greater use of these practices by managers and firms constitutes greater integration, leading to better performance on a range of dimensions. Based on this view, an important task of SCM is to increase integration in existing supply chains so as to improve performance.

ANT researchers would question most of the fundamental assumptions of this analysis, based on three key principles: relationality, heterogeneity, and performativity. Here, the application of these ideas to the supply chain integration example is briefly outlined. In this initial sketch, it is convenient to begin with heterogeneity, which is perhaps the most radical of these principles. ANT, rather than seeing objects such as product components or information systems as subservient "tools" in the hands of human agents, adopts what some have called a "flat ontology" (Elder-Vass, 2008), whereby heterogeneous objects, as well as humans, can be considered to equally have potential agency. This can include "epistemic objects" such as management concepts, information systems such as warehouse management systems (WMSs), and physical objects such as tote-bins. According to Latour, one of the main ANT scholars, *"any thing* that does modify a state of affairs by making a difference is an actor*"* (2005, p. 71, emphasis in original): hence the "actor" in "Actor-Network Theory." Objects become actors

and "make a difference"—they have meaning and significance—only by being connected to other objects. This is relationality. For example, a container such as a tote-bin is related to other objects that are owned by an organization, moved by a warehouse operative, identified and tracked by a warehouse management system, conform to a standard (or nonstandard) specification, and so on. This set of interconnections constitutes the "actor-network" in "ANT."[1] The final concept is performativity. This refers to the principle that "society"—and, by extension, any social construct (such as a supply chain)—only exists while it is being performed, that is, while the relevant actor-network is maintaining or changing the state of affairs. In this view, therefore, the supply chain is not a given, pre-existing entity that simply exists, but rather, it is an accomplishment that exists only as episodes are performed between actors (bearing in mind that this includes nonhuman actors).

Thus, rather than assuming the existence of supply chain objects such as WMSs that have a certain set of properties or effects (e.g., integration), ANT argues that these objects (i.e., actors) take their form, significance, and effect when performed and related to one another in a particular practice. In ANT, the process of relating previously unrelated actors is known as translation. When translated, the meaning and significance of the involved actors are assumed to be potentially changed. An ANT study on the meaning and significance of supply chain integration would, rather than assuming that integration takes place as a consequence of a particular set of predefined practices (e.g., sharing production plans, common use of logistical equipment, etc.) and tools (e.g., planning systems), analytically explore and follow how supply chain integration is referred to, performed, and related to human and nonhuman actions and elements in a particular empirical practice. In this way, the empirical practice defines and translates supply chain integration through the episodes of practice. This approach exemplifies

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[1] Note that the term "network" here means something different than its meaning in SCM, where a network is a set of interconnected firms or facilities, which might be termed the "nodes" of the network (Carter, Rogers & Choi, 2015). Also, for supply chain scholars influenced by the international marketing and purchasing (IMP) tradition, an "actor" is usually an organization such as a firm: this is also different to the notion of "actor" in ANT.

a central methodological principle of ANT, that is, that the researcher should "follow the actors" (Latour, 1987), relentlessly tracking actors and actor-networks "in the making." In this instance, the researcher will follow supply chain integration in the making in the specific episodes of supply chain practice rather than deciding in advance what integration consists of before then going to identify and quantify it.

We suggest that ANT is specifically well equipped to enable the development of SCM theory in four main areas. First, because it assumes that actors and objects are performative, ANT is suited to developing theories on the dynamic and fragile processes of supply chain emergence, change, and reconfiguration. Specifically, ANT approaches are well equipped to provide new theoretical insights into the question of how SCM systems and devices are implemented, constructed, and transformed in practice. Second, because it follows and maps the efforts of supply chain actors in trying to associate with other (human and nonhuman) actors, ANT can enable the development of SCM theory on how people working in SCM roles really act when managing in the supply chain space. These insights will complement much of the existing knowledge on how firms as aggregate actors are understood as supply chain managers. Third, and because it assumes a distributed agency, we also suggest that ANT mirrors the dynamics of SCM because multiple actors are trying to manage and influence the supply chain from different perspectives at the same time. Thus, we argue that the question of what and who manages the supply chain can be explored in radically new ways. Finally, we suggest that ANT approaches may enable SCM theory that can better enable us to explore and model the politics involved in representing, interpreting, and stabilizing SCM practices and systems.

To develop this argument, the present paper is organized as follows. Next, we present the background and principles of ANT. This is followed by a presentation of the existing applications of ANT research that are relevant to the study of SCM. Section 3, which is the

core of the paper, presents the discussion, in which a complementary ANT conceptualization of SCM is developed and an agenda for ANT-oriented research in SCM is presented. Finally, ANT is shown to be a good complement to existing theoretical perspectives of SCM, not because it is claimed to be superior to existing conceptualizations but because it opens the potential for radical new insights into the practice of SCM that cannot be obtained by current theoretical conceptualizations.

ACTOR-NETWORK THEORY – BACKGROUND AND PRINCIPLES

This section begins by outlining the development of ANT and its basic ontological position. Then, the three principles from ANT already introduced in the previous section—relationality, heterogeneity, and performativity—are described in greater detail.

ANT: some background and a basic ontology

The main concepts of ANT were developed in a period of about 20 years from 1980 to 2000, principally by Bruno Latour, Michel Callon, and John Law. Since then, the ANT approach has been adopted in various fields. Callon later focused on economic sociology (Callon, 1998; Çalişkan & Callon, 2009) and, within the subjects related to management, ANT has been applied extensively in organization studies, accounting, marketing, and information systems research (Mouritsen, Hansen, & Hansen, 2001; Czarniawska & Hernes, 2005; Andrade & Urquhart, 2010; Mason, Kjellberg, & Hagberg, 2018; Romestant, 2020; Abboubi et al., 2022). During this period of application of ANT, the main concepts have remained relatively unchanged. Therefore, in what follows, we mainly draw on the early seminal sources, as well as Latour's (2005) summary and reassessment.

As a branch of sociology, ANT emerged from ethnographic studies during the 1970s as a way to study the process of producing scientific knowledge (Law, 2009). Importantly, ANT scholars consider both technical and social determinism to be flawed. On the one hand,

technological determinism assumes that technology and its impact are given and defined; on the other hand, social constructivism tends to assume that technology does not matter because it is always and inescapably socially constructed. ANT instead proposes a sociotechnical account (Callon & Latour, 1981; Law & Callon, 1988) in which neither the social nor technical positions are privileged and nothing is either purely social or purely technical (Law, 2009).

In contrast with social constructivism, ANT does not reject the idea that there are objects, actors, activity, and processes that exist independently of social cognition. However, ANT is constructivist in the sense that meaning and significance are only given to objects/actors when they are performed and constructed relative to other objects, actors, activities, and processes. Thus, ANT focuses on the processes through which sociotechnical networks are created, recreated, and fall apart. It assumes that the complex and fragile social and technical networks of relationships between actors are what hold society in place and what give rise to different types of the often taken-for-granted elements of society, such as management control systems, organizations, and even knowledge and markets (Callon, 1999). In this way, ANT differs from other constructivist approaches, such as phenomenology, which assumes that society is constructed by human interpretation (Towers et al., 2020) or some forms of critical engaged research, in which individuals construct objects of society based on their perceptions (Touboulic, McCarthy, & Matthews, 2020).

Given this perspective, ANT research focuses on studying the specific actions as they appear in specific episodes of practices. Thus, ANT research is highly empirically driven and seeks to follow both social and technical actors and their actions and interactions as they unfold in the empirical setting (Latour, 1987). Thus, ANT prioritizes a focus on dynamics and change, rather than on stability, providing a conceptual and methodological basis for developing theories of becoming, emergence, and change. In combining the words "actor" and "network," the term "actor-network theory" conveys the idea that agency occurs as structure, rather than

being its antithesis: it is both-and, not either-or. Similarly, ANT rejects any *ex ante* categorization of phenomena or analyses as either micro or macro (Callon, 2001).

Three ontological principles of actor-network theory

Ontology investigates the fundamental structures of the world and fundamental kinds of things that exist in the world (Smith, 2012). Ontology also includes an interest in the origins of "objects," "facts," "properties," and "categories," which are used to make sense of and describe reality. The distinctive ontology of ANT can be further understood in terms of the three principles already briefly introduced: relationality, heterogeneity, and performativity. Table 1 summarizes the main ontological assumptions of ANT.

-----------------Insert Table 1 Approximately Here---------------

The principle of relationality. The principle of relationality assumes that reality consists of a set of relationships between actors (e.g., physical objects, systems, practices, and humans) that do not have inherent essences but only take on their properties when they are related to other actors in so-called "actor-networks." The actor-network is the concept that, in ANT, captures the relational assumption. The actor-network "is a way of suggesting that society, organizations, agents, and machines are all effects generated in patterned networks" (Law, 1992, p. 380). Because of its relational assumption, ANT is often referred to as a "sociology of associations." Thus, actors are performed in, by, and through the relations in which they are associated with one another: "It [ANT] tells that entities take their form and acquire their attributes as a result of their relations with other entities" (Law, 1999, p. 3). A consequence of this is that no object can be built or understood completely in advance. The form of an object and its contents can only be conceptualized when knowing the network within which it is mobilized as an actor.

Therefore, an ANT analysis of a supply chain is concerned with the specific empirical setting in which this supply chain unfolds. How the supply chain in practice is referred to and related to other objects makes the supply chain infused with meaning and contents that can be used in the analysis. The principle of relationality means that an ANT analysis of a supply chain will be undertaken without any reference to the general principles of supply chains, their structure, form, or other characteristics. The only thing to which meaning is attributed in the analysis is the question of how the supply chain is mobilized or referred to in individual episodes of practice relative to other objects such as, for example, performance measurement systems, strategies, process representations, and written and verbal narratives.

Other approaches, such as functionalism, are also concerned with the connections between different objects. However, a functionalist interpretation of relationality is quite different from the ANT interpretation. In functionalism, the connection between different objects often becomes metaphorically described as a system or organism. This includes the various objects in a series of reciprocal relationships, where each performs different functions, and together, the parts create a whole. The performance of functions becomes crucial for the existence of the whole (organization, supply chain, or society), and the relationships become what places the individual part into the system. Importantly, in this view, the function of each part—and the relationships between them—are defined in advance: this is not so in ANT.

The principle of heterogeneity. The principle of heterogeneity assumes that not only humans, but also nonhuman objects, such as budgets, systems, plans, machines, technology, text, and process charts can be considered actors. The human cannot be designated in advance as more important than the nonhuman; conversely, it is also not possible to point to the nonhuman as the determinant. ANT argues that the form of agency does not, in an ontological sense, matter as long as it makes a difference in the surrounding world (Latour, 1987): applying this principle helps us understand who or what can be influential in the empirical setting we explore. Both

human and nonhuman objects have explanatory power through the relationality appearing in the individual episode, and their roles become the effects of the actualized actor-networks. The idea is merely to take nonhuman objects as seriously as human objects.

Taken together, the heterogeneity and relationality principles mean that ANT assumes distributed agency. Some critiques of ANT (Elder-Vass, 2008; Whittle & Spicer, 2008; Elder-Vass, 2015) argue that the type of agency unfolded by human actors is different from the type unfolded by nonhuman actors. However, the ANT assumption is not that nonhuman actors can act alone or intentionally (Latour, 1996) but that any individual actor is assumed powerless without its relation to other actors. Hence, the role of nonhuman actors should be taken as seriously as the role of human actors in understanding the effects that have their origin in a complex and distributed agency originating from the actor-network (Sayes, 2014).

The dominant SCM paradigm does not normally assume heterogeneity and distributed agency, but rather that power can, to some extent, be designated to human or organizational actors before the analysis commences. For example, a firm might be understood as powerful relative to its suppliers, or to be able to design, implement and use an information system as if it were a passive tool. In an ANT analysis, no presumption of a powerful focal firm can be made before the analysis commences. It is the empirical analysis of the formation of the actor-network that makes objects and actors powerful and raises their abilities to influence certain aspects of SCM.

The principle of performativity. In ANT, performativity assumes that reality has an episodic character and that objects become actors and gain meaning and significance only when they are performed in episodes of action. This leads to a fundamental uncertainty about the meaning of objects: "A consequence is that everything is uncertain and reversible, at least in principle. It is never given in the order of things" (Law, 1999, p. 4). Therefore, actors and actor-networks are highly dynamic phenomena because they are performative and only exist in a particular

form in the episodes that mobilize them. Furthermore, and drawing on the two other ontological assumptions, ANT assumes a performativity that is relational and heterogeneous, whereby the transformation of objects takes place via their relations to other human and nonhuman actors.

The process of translation is the concept used in ANT to capture the assumption of relational and heterogeneous performativity. Callon introduced the concept in 1980 and wrote that "translation involves creating convergences and homologies by relating things that were previously different" (p. 211). This means that ANT is interested in understanding and following the detailed and fragile process that relates to previously unrelated objects. In SCM, these objects might be the performance of suppliers and a particular set of key performance indicators in a supplier evaluation system. Translating supplier performance to this particular set of measures implies a reduction or simplification, which is a central characteristic of translation (Callon, 1986). The question in ANT is whether the actors "agree" to the translation, and to the reduction and simplification it entails. Thus, in our example, we can ask the following: Do the suppliers agree to the translation of their performance into the selected set of measures? We might also ask if the nonhuman actor, the IT system that needs to supply or store the supplier evaluation system, "agrees" with the translation, in the sense that it can find the data and arrange them as suggested in the translation. If the supplier and all other human and nonhuman actors agree, the translation is successful; if not, it requires further effort. A central element in ANT is portraying all the work that is required to succeed with the translation. In this way, ANT is interested in understanding and following the detailed and fragile process that relates previously unrelated objects to one another. Thus, taking an ANT view, managing or organizing becomes the task of getting something to stick together.

The dominant SCM paradigm does not normally assume performativity but that reality and the meaning and significance of objects and different forms of actors can be captured by a set of properties existing outside the cognition of individuals and outside the specific episodes

of practices. Returning to the example of integration, researchers taking an ANT approach would see the boundaries of the firm in question to be performed, not fixed, and the meaning and significance of integration to take its form in the specific empirical setting. Other types of critical or constructivist positions within the social sciences assume performativity (e.g., Touboulic, McCarthy, & Matthews, 2020). However, these schools of thought focus on individual cognition and interpretation, attending to how individuals construct something like a supply chain according to their perceptions, social role, and position. In contrast, ANT sees performativity as the result of episodes of association between actors: it is less to do with individuals and their perceptions and more to do with action, as well as being more inclusive of nonhuman actors.

After outlining the main principles of ANT's ontology, we now turn to explore some existing applications of ANT approaches of relevance to studying SCM. Our focus is on how these applications show the principles of ANT's ontology, along with how this enables them to contribute with alternative theoretical insights.

EXISTING APPLICATIONS OF ANT RELEVANT TO THE STUDY OF SCM

In discussing the principles of ANT's ontology, we have pointed to some possible aspects of an alternative view of SCM research and will extend this discussion further in the next section. This section, though, considers examples of ANT-inspired research that touch on at least some aspects of SCM, either within operations and SCM or in neighboring disciplines. Although very few papers using ANT have been published in the related field of operations management on topics such as lean implementation (Papadopoulos, Radnor, & Merali, 2011) and operations strategy (Adamides, 2015), the use of ANT in research to explicitly address SCM problems is almost entirely missing from core journals in our discipline (Hazen et al., 2016). This is somewhat surprising because the application in neighboring disciplines such as marketing,

management accounting, and information systems has been notable and growing over the past 20 years (e.g., Justesen & Mouritsen, 2011).

One stream of research holds particular relevance to SCM research. This is a set of contributions that draw on ANT to produce accounts of the emergence, implementation, and change of performance measurement and control systems designed to help manage and govern interorganizational relationships and supply chains (Mouritsen, Hansen, & Hansen, 2001; Mouritsen & Thrane, 2006; Thrane & Hald, 2006; Chua & Mahama, 2007; Mouritsen, Hansen, & Hansen, 2009). Studies show how the emergence of performance measurement systems in interorganizational relationships and supply chains may lead to new and unexpected consequences and effects that are dislocated from their intended target, for example, strategy reformulations, new definitions of core competencies, and new understandings of firm boundaries. In contrast to the dominant SCM paradigm, these studies use, in varying ways, the principles of ANT ontology. We review the selected papers from this literature to explore how it can help us think differently about central SCM concepts.

One recurring theme in this stream of the literature is the idea that performance measurement systems partly construct aspects of the supply chain rather than simply reflecting or reporting on them. For example, Thrane and Hald (2006) explore how firm and supply chain boundaries are set, showing that performance measurement systems actively construct the boundaries of the firms and supply chain. Indeed, Thrane and Hald (2006) develop the notion of the "supply field" instead of the "supply chain" to denote the fluid nature of the supply chain as an ever-emerging and represented space (i.e., a space that constantly emerges and dissolves as the relations between firms and activities emerge and disappear), rather than as a fixed and static structure. Thus, what is inside and outside a firm or supply chain is dynamic rather than fixed. The boundaries of the supply chain changes as practices change and create new actor-networks that may represent the boundaries of the supply chain differently.

Within the SCM literature, Carter, Rogers, and Choi (2015) acknowledge subjectivity in perceiving the supply chain; they do so in the sense that a supply chain is defined relative to a particular product; the visible horizon limits the extent to which a particular firm-as-actor can control the supply chain, which is subject to attenuation, that is, the further away from the focal firm an actor is in the supply chain. However, this perspective seems to suggest that in, for example, an automotive context, the supply chain for, say, gearboxes objectively exists, and a firm that is part of this supply chain can hope to control activities in firms that are also part of it and are within the firm's "visible horizon." An ANT approach and its constructivist underpinnings would see firm boundaries and the concept of a supply chain as temporary, potentially ever-changing, here shaped by the actions of human and nonhuman actors across the supply field.

The particular contribution made by Thrane and Hald (2006) is to show how performance measurement systems in this case serve to integrate objects that are both internal and external to the focal firm, as well as to fragment the focal firm. Thus, the theoretical contribution is to demonstrate the dynamics of integration and fragmentation within a supply chain and show how firms and supply chains have multiple and sometimes contradictory definitions of boundaries.

Other studies have shown that performance measurement systems operate in ways consistent with the notion of distributed agency. Chua and Mahama (2007) examine the conditions and networks influencing the development and operation of performance measures in longer-term supply alliances. Specifically, by adopting ANT, the authors explore how performance measures acquire their existence, form, meaning, and influence (or lack thereof) within such interfirm alliances. The central conclusions in the study are that the emergence, operation, and functionality of performance measures are network effects rather than the results of carefully constructed measures derived from a focal firm or organization. Thus, Chua and

Mahama (2007) conclude that "in order to understand the functioning of accounting controls [performance measures], one needs to apprehend the location of those calculable frameworks within a larger set of connections that extends beyond the buyer and seller" (2007, p. 80). Parallel to the observation of Flynn, Pagell, and Fugate (2020) regarding the complexity of supply chains, this highlights the importance of taking the distributed character of the supply chain into consideration when exploring supply chain phenomena. Another central theoretical contribution of Chua and Mahama (2007) is to show how the applied performance measures created stability and order in some parts of the supply chain while at the same time creating conflict and destabilization in other parts of the supply chain.

Management control systems can also lead to surprising effects that are seemingly distant from their original object. Mouritsen, Hansen, and Hansen (2001) explore the effects following the introduction of interorganizational management controls, specifically a version of open book accounting and target cost management—techniques that are explored extensively within the SCM literature (e.g., Ellram, 2006). Mouritsen, Hansen, and Hansen (2001) contribute new theoretical insights by showing how the implemented management controls not only helped the focal organization's control supply chain processes, but "also took part in representing corporate phenomena such as technology, organization, and strategy and thereby retranslating the 'identity' or 'core competence' of the firms" (p. 221). Specifically, Mouritsen, Hansen, and Hansen (2001) showed how, by implementing and operating the external supply chain controls, the firms involved achieved improved insights and input, leading to changes in their internal firm strategies, competencies, technologies, and products. This adds to theory because it shows how the implementation and operation of supply chain controls designed to function and influence external supply chain relationships can lead to new, indirect types of effects, such as strategy development inside the focal company.

Thus, the existing applications of ANT to SCM problems have been sparse, but some have appeared in journals in neighboring disciplines. Although most contributions of relevance to SCM have been concerned with performance measurement and control systems, they have potentially significant implications for more fundamental SCM questions and concerns, as well as for the methods used in SCM research. Based on this, there is the potential to bring ANT more into the center of the SCM discipline and further broaden its scope of application to other areas of SCM research. Some of these aspects are outlined below.

DISCUSSION

This section first develops a complementary ANT conceptualization of SCM, then proceeds to discuss the methodological implications of an ANT approach to SCM research, and finally develops an agenda for ANT-oriented research in SCM.

Toward a complementary ANT conceptualization of supply chain management

Building on the outline of ANT's ontological position and insights gleaned from ANT-inspired research, a comparison of the ANT conceptualization with the more conventional theoretical perspectives around both structural and managerial SCM issues is now carried out. Table 2 presents the results of this comparison; it shows how ANT looks at the supply chain not as a pre-existing structure, but rather as a field that is constantly reconstructed through the actions and activities of managers and other actors representing it. Table 2 also shows how ANT opens the potential to include nonhuman elements, such as SCM technologies, in a distributed version of agency and how this has implications for the definition of SCM and the supply chain manager, as well as the distinction between context and phenomenon. We then examine the implications of the ANT approach for methodology in SCM research.

------------------Insert Table 2 Approximately Here-----------------

Structural issues. The supply chain is traditionally understood as consisting of the focal firm, its downstream customers and market, and its upstream suppliers and raw-material sources (Stevens, 1989; Mentzer et al., 2001). More specifically, Mentzer et al. (2001) define the supply chain as "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer" (p. 4). This definition portrays the supply chain as containing three or more organizations involved in certain types of flows and an already existing structure. These structures can be categorized according to a set of characteristics such as formalization, centralization, horizontal complexity, vertical complexity, and spatial complexity (Choi & Hong, 2002).

According to this view, a supply chain is a system that is "out there" and in need of exploration and management. Thus, supply chains are assumed to exist independently of their representations and of the relations forged between them and other actors. Given this conceptualization of supply chains, much supply chain research has been about the effect of various practices and interventions on the performance of (pre-existing) supply chains or the systemic properties of supply chains. For example, researchers have examined the effects of greater integration and IT adoption (Devaraj, Krajewski, & Wei, 2007; Vanpoucke, Vereecke, & Muylle, 2017) on performance, which is sought to understand and enhance supply chain flexibility (Duclos, Vokurka, & Lummus, 2003; Seebacher & Winkler, 2015), agility (Swafford, Ghosh, & Murthy, 2008), and resilience (Ponomarov & Holcomb, 2009; Scholten, Stevenson, & van Donk, 2020). Even though this type of supply chain research has indeed progressed the knowledge about the nature and performance of different types, forms, and configurations of supply chains, it also has its limitations. One such limitation is that the

universal character, function, and identity of the central object of management in SCM (the supply chain) is, in principle, not a core part of the exploratory efforts because it is considered to be already there and, therefore, not included in the research question.

An ANT approach, we argue, holds the potential to help us better understand the emergence and change of supply chains. With its relational and performative ontological position, ANT perceives a supply chain as something that has to be built because it is not already there, or, as ANT scholars might put it, because it is not something "ready-made" (Cooper & Law, 1995, p. 239). ANT-inspired research suggests that we should not assume a certain type of supply chain structure or a particular supply chain system with a particular and predetermined set of boundaries. Instead, ANT would rather understand a supply chain as being performed via the actions of the involved actors. When involved human or nonhuman actors such as procurement managers and supplier evaluation systems design supplier relationship strategies or mobilize suppliers by "inscribing" them in performance measurement devices (Hald & Ellegaard, 2011), they represent and cluster them in particular structural and relational settings. In doing so, they translate the strategies, suppliers and supply chain to which they belong. Thus, based on an ANT operationalization, supply chains should, rather than more-or-less stable organizational structures that needs to be found and managed, be thought of as under construction because the actors in actor-networks are related in a potentially ever-changing configuration (Thrane & Hald, 2006). In this way, ANT would see supply chains as highly dynamic and constantly emerging and changing, depending on how the actors represent and relate the supply chains and their components to other actors. Thus, supply chains are seen as performative and take their form and boundaries depending on the relations and representations built to portray their existence.

Managerial issues. Traditional definitions of SCM and SCM research seem to suggest that the management of a supply chain system is concerned with a more-or-less predetermined list of

tasks, a central powerful focal managing organization, and a range of SCM technologies that can be mobilized at will, albeit with challenges associated with what might be termed implementation (e.g., Bendoly & Cotteleer, 2008). An ANT approach conceptualizes these elements of SCM differently. This difference in the conceptualization of SCM can be understood as being related to three central concerns:

- The objectives and tasks of SCM

- The managing actor(s): Who or what is the supply chain manager?

- The role of contextual factors: How does SCM relate to the context in which it occurs?

First, concerning the objective and tasks of SCM, ANT has a distinctive perspective because of its assumptions regarding relationality and performativity. The dominant SCM paradigm portrays the managerial role with a more-or-less predetermined list of tasks such as coordination, integration, and optimization of supply chain processes (e.g., Forrester, 1958; Schoenherr & Swink, 2012), and these tasks are often also part of SCM definitions (e.g., Houlihan, 1983; Stevens, 1989; Mentzer et al., 2001). These tasks assume that SCM starts at a point in time, where a particular supply chain is already an object that can be acted upon and is, thus, stable and material enough for coordination and integration to be sensible ambitions.

Although we recognize the huge and valuable body of literature discussing and defining and conceptualizing SCM and its contents (e.g., Mentzer et al., 2001; Gibson, Mentzer, & Cook, 2005; Stock & Boyer, 2009; Carter, Rogers, & Choi, 2015; Min, Zacharia, & Smith, 2019), we would also argue that the definition of SCM and its tasks are often not part of the research question in empirical SCM research. Thus, empirical research that specifically asks what constitutes SCM is rare, and this omission seems to be part of the wider assumptions of most SCM research.

However, when supply chains are understood as performative and built by relations and representations, as is the case in an ANT approach, the role of managing is also understood as

something different. Here, SCM might be understood as the task of constructing and holding a sufficiently strong coalition of actors in place to stabilize a version of a particular supply chain that can be acted upon. This view does not dismiss the possibility of purposive action on the part of human actors with particular interests and objectives. However, it does emphasize that a significant part of the actors' effort is required to accomplish some degree of stability and, furthermore, that attempts to bring about deliberate change are likely to be distorted and lead to unintended consequences arising from surprising connections and translations in a particular setting. ANT-inspired research will need to explore the definition of SCM in a concrete and specific empirical setting.

Second, and concerning the question of who or what a supply chain manager is, ANT also suggests different conceptualizations. Traditionally, we argue that it is often assumed that a supply chain manager is a centralized organizational actor and that this managerial authority holds some kind of power *ex ante* that enables a potential intervention in activities and processes in the wider supply chain. Although some research is now emerging that explores more distributed versions of power and influence in SCM (Hald & Mouritsen, 2018), the focal, centralized organization-as-manager is still a dominant perspective (Carter, Rogers, & Choi, 2015).

Following an ANT approach, the assumption is that agency is distributed across heterogeneous actors in actor-networks. One implication of this assumption is that management is not *per se* centralized but rather performed in who or what affects the activities and processes in the multiple versions of supply chains that an organization needs to manage. Thus, supply chain managers and SCM can be assumed to be distributed, collective, and diverse in their nature. This provides a view that is well aligned with the actual workings of SCM in practice. Furthermore, avoiding prejudgment as to who or what is the supply chain manager offers a way to address the call for SCM research to theorize at multiple levels (Carter, Meschnig, &

Kaufmann, 2015), along with the claim that units of analysis in SCM are often different from those used in management research (Flynn, Pagell, & Fugate, 2020). Thus, ANT opens the possibility of following the distributed action of managers and system actors as they work and make decisions that affect supply chain outcomes. Different levels or units of analysis are not assumed in advance but emerge from the empirical setting and its analysis, in a process similar to Ragin's notion of "casing" (Ragin, 1992).

The ANT assumption of heterogeneity means that SCM is achieved by actor-networks tied together and comprising human actors, but also nonhuman actors, such as systems, procedures, maps, performance measurement devices, and budgets. Although the research adopting sociotechnical perspectives has emerged within SCM (e.g., Kull, Ellis, & Narasimhan, 2013), these contributions are still rare, and SCM research is still dominated by perspectives that do not provide symmetry in the treatment of SCM technology and social factors. Traditionally, supply chain technologies are seen as designed and controlled by human actors, who are privileged and assumed as powerful in relation to these nonhuman objects. When following an ANT-inspired approach, however, supply chain technologies and systems are understood as potentially powerful "supply chain managers." Supply chain technologies and systems not only take part in the execution and control of supply chain processes but in representing strategy, identity, and core competencies (Mouritsen, Hansen, & Hansen, 2001). Technologies and systems are also able to stabilize some parts of a particular supply chain while creating conflict and destabilization in other parts of the same supply chain (Chua & Mahama, 2007). How, how much, and when the agency of nonhuman actors plays an important part cannot be known *ex ante*, but will be revealed through empirical work; the ANT-inspired researcher of SCM must, however, be constantly alert to the possibility.

Third, and concerning the question of how SCM relates to the context in which it occurs, ANT warns against assuming a pre-existing context to which SCM must respond and in which

SCM is conducted. Traditionally, SCM research has considered the context as a variable that should be considered when designing or exploring supply chain systems and practices. The context, such as the industry, the competitive environment, and the particular circumstance under which a particular supply chain system operates, is routinely and naturally considered as pre-existing when it comes to the practices that are explored. The context is assumed to hold a certain set of predefined and uncontested properties. Thus, before the study of particular supply chain practices even starts, some of the central formative features are assumed. This is exemplified by research assuming or examining the role and effect of the business environment (e.g., Kim, Suresh, & Kocabasoglu-Hillmer, 2013), the uncertain environment (e.g., Yi, Ngai, & Moon, 2011), or the competitive environment (e.g., Ralston, Keller, & Grawe, 2020) on the supply chain and its management.

ANT scholars argue that reference to context can often result from prematurely "black-boxing"[2] important phenomena and treating them too reductively instead of carefully following connections and associations at a detailed level (Latour, 2005, p. 167). In an ANT study, the supply chain practices explored are not assumed to depend on the variables that respond to a predefined context. The practices and actors they include in the actor-network help define and articulate the state and nature of the context. Thus, the context does not exist independently of the actors, but instead, it emerges when the actors relate to it. One example is when the business environment is referred to in a supply chain strategy document and characterized as, for example, either uncertain or highly competitive, or when a performance measurement system represents the business context by certain key performance indicators. Thus, in the ANT approach, the context must be explained and defined by the actors and their actions rather than

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[2] In ANT, this stabilization is often termed "black-boxing." When an object is black-boxed, it will not subsequently be questioned, at least for some time (Latour & Woolgar, 1979/1986).

assumed. This, in turn, means that the definition of a supply chain and boundary between a supply chain and its context are potentially reconstructed as various SCM processes unfold.

Methodological implications of an ANT approach to SCM research

As summarized in Table 1, ANT's ontological assumptions and their implications for the objects of study in SCM research just discussed have further implications for the methods used in SCM research adopting an ANT approach. In practical terms, data collection can proceed in ways familiar to qualitative researchers—via interviews, collection of documents, observation, participant observation, and even some forms of intervention-based research. Where ANT approaches are distinctive is in the way they abandon various assumptions, direct attention toward certain phenomena typically neglected or excluded, and shape and direct the data collection and analysis process based on underlying ANT ontological principles. As already discussed, ANT researchers do not assume a pre-existing, stable supply chain—or a black-boxed context with given characteristics—nor predetermined, theoretically derived objects of investigation with inherent properties. Rather, they enter a field of potential interest via access to a participating person or organization, preferably when the phenomenon of interest is still evolving—that is, before it is potentially stabilized and taken for granted. Of course, researchers must focus their efforts somehow; they cannot collect data about everything in a setting. However, the research will be directed according to certain principles:

- "Follow the actors"

- Pay equal attention to human and nonhuman actors

- Search for associations between actors and the making of actor-networks having distributed agency

- Follow and seek to understand processes of translation—both those that "succeed" in the eyes of particular actors and those that do not

These principles mean that a carefully designed study completely controlled by the researcher is not desirable or possible when adopting an ANT approach. The researcher must follow the phenomenon, even though this may take the research in new and unexpected directions. This point is exemplified by Mouritsen, Hansen, and Hansen (2001), who follow interorganizational management controls and find that these controls "not only had a role in enabling control of and insight into interorganizational processes at a distance. They also took part in representing corporate phenomena such as technology, organization, and strategy and thereby re-translating the 'identity' or 'core competence' of the firms" (p. 221).

That said, even an ANT-inspired researcher will usually enter the field with some initial interest. This might be an abstract concern or espoused strategy, such as sustainability, a new technology, such as additive manufacturing, or an organizational technique, such as lean.[3] For example, if one were interested in the idea of supply chain integration, to return to the earlier example, the approach would be to engage in the empirical field to map out how the involved actors (e.g., managers, systems, technologies) are related to "supply chain integration." Here, the process could start by meticulously mapping out all the associations and references made to the meaning and significance of "supply chain integration," along with how these associations and meanings might be contested or changed or even objected to by actors in the field. The analysis would explore how different translations were made as to the meaning and significance of "supply chain integration." Some actors might translate supply chain integration as an important strategic lever and relate it to firm strategy and the achievement of competitive priorities, while other actors might object to such a translation.

Even though the method may be less goal-directed *ex ante* than in some other approaches, using an ANT approach does not preclude the possibility of seeking improvement or making

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[3] The studies in management control systems discussed earlier similarly start with a focus on management control systems in general or particular novel approaches such as open book accounting.

normative claims. A purposeful human supply chain manager might want to improve sustainability, for example. An ANT approach would use the notion of translation to reveal how actor-networks consisting of actors such as managers, information systems, forms filled out by suppliers, ISO standards, and particular products combine to perform a measure or assessment of sustainability. The other ANT principles outlined already would leave open to questioning what the supply chain is that is to be rendered more sustainable and who or what could manage it to be more sustainable. Following the actors to reveal how sustainability improvement is performed in practice (both its determination and efforts intended to achieve it) will reveal the boundary of the supply chain that matters in a particular instance rather than the one assumed *ex ante*. Additional firms or organizations, such as NGOs or regulators, might turn out to be important as part of the supply chain, even if they would not routinely be included in supply chain mapping. Similarly, identifying translations that are achieved and those that are not will point to potentially surprising critical relations, connections, and translations that demand deliberate interventions. The human supply chain manager has intention, which nonhuman actors do not (except, insofar as they somehow capture and further the intention of their designer); the human manager must, however, take into account the agency of nonhuman actors in devising and carrying out practical changes.

Developing an agenda for ANT-oriented research in supply chain management

The suggestion here is that ANT has the potential to become an important perspective for the future development of SCM theory. We do not pretend to have set out a comprehensive account of all facets of ANT and, like any other field, there are differing perspectives within it. However, the present paper has identified some central claims and principles of ANT that are sufficient to give insight into the kinds of theoretical paths in SCM that might be opened up by adopting an ANT orientation. ANT is an ontological position, and a set of methodological choices that are propitious for the development of particular types of theories within SCM. It

would be useful for asking and answering different questions than the ones usually asked in SCM, as well as helping explain why some of the existing theoretical answers and practical solutions arising from them break down. Specifically, the present paper draws attention to four areas where ANT-inspired research can enable the development of SCM theory. Table 3 presents and details these four areas, how ANT can provide complementary perspectives to each, and provides specific examples of the potential new SCM theory that might be developed. These examples are indicative and speculative, intended to suggest the type of theoretical developments possible, through concrete illustrations. It is in the nature of ANT-inspired research that the precise direction of theory development cannot be known *ex ante*. Many further instances might be identified.

------------------Insert Table 3 Approximately Here-----------------

First, and based on ANT's relational and performative ontological assumptions, an ANT approach will be particularly useful in studying the fragile and dynamic character of supply chains and the systems and management technologies holding them in place. As argued, SCM research tends to start with a pre-existing supply chain, to which various management initiatives are applied (integration, lean, etc.). Although there are few studies of the creation of wholly new supply chains, some research has already examined the selection and integration of new strategic suppliers and development of supply chain relationships (e.g., Koufteros Vickery, & Dröge, 2012; Sting, Stevens, & Tarakci, 2019). However, in these studies, the focus is on active managers in focal firms, using tools such as supplier selection techniques to identify and begin working with new suppliers to achieve some kind of performance outcome, such as improved competitive advantage (Koufteros, Vickery, & Dröge, 2012).

The research questions that ANT can help address are not so much concerned with the causal performance of the supply chain system but rather complex and nonlinear change and evolution in the supply chain itself and its elements. A few examples addressing recent calls for more research that can help in understanding the complex processes of change within SCM are as follows: how and why change in supply management processes (Andreasen & Gammelgaard, 2018) and sustainable sourcing practices (Schneider & Wallenburg, 2012) take place; how and why performance measurement systems in the supply chains change and evolve; how human and nonhuman actors located outside the focal organization play a role in such change (Hald & Mouritsen, 2018); and how buyer–supplier relationships can be understood not as static, but rather as dynamic and malleable (Sting, Stevens, & Tarakci, 2019). Furthermore, and based on its concern for how stability is an accomplishment made possible by a combination of human and nonhuman actors, an ANT approach can help address recent calls for new perspectives on supply chain resilience (Wieland & Durach, 2021). Based on its ontological assumptions, ANT can help the SCM discipline develop complementary new SCM theory for explaining how and why systems and structures such as supply chains are fragile, dynamic, and resilient.

Second, and leading from ANT's relentlessly empirical focus as captured by the methodological mantra to "follow the actors" (Latour, 1987), SCM theory can be enriched by more detailed insights into how people working in SCM roles really act when managing in the supply chain space: how they relate to other actors (both human and nonhuman) and how these actors influence the task of managing the supply chain. These insights will complement much of the existing knowledge on how firms as aggregate actors are understood as supply chain managers. We argue that ANT approaches to the study of SCM will complement conventional studies in SCM because these latter studies produce conceptual objects that express relationships between states and managerial decisions but have very little to do with

management in the sense of understanding what managers do. This can also be said of the related field of operations management (Spring, 2017). Conventional SCM theorization leaves a message for managers in the form of pseudo-laws or prescriptive models about what they ought to do, but it does not seem to say much about the practice of management. Yet it is in action—in the work done to hold a supply network together, despite all that would pull it apart—that SCM gets done.

Of course, an ANT approach is not the only way to study what managers do and how management takes place. Ethnographic approaches are widely used in management research, for example, in studies of organizational routines (e.g., Rerup & Feldman, 2011) and strategy-as-practice (e.g., Jarzabkowski & Seidl, 2008). Recently, there have also been publications from within the OM and SCM fields adopting ethnographic approaches (Glover, 2020; Souza-Luz & Gavronski, 2020). However, an ANT approach encompasses those aspects that might otherwise be neglected: the principles of heterogeneity and relationality shift the focus from human actors and their systems of meaning to actor-networks of human and nonhuman actors, stressing how action comes about through translation among diverse actors. Studying SCM using an ANT approach can lead to the theorization of surprising and/or critical connections between actors and the translation processes that do or do not bring them about (Mouritsen, Hansen, & Hansen, 2009) so as to understand how potentially desirable supply chain outcomes may be achieved or thwarted. Behavioral operations and SCM might also be said to be concerned with what managers and people in SCM do. However this research is centered on the effect of cognitive biases and social preferences on decision making and typically addresses well-defined types of decisions, such as those regarding forecasts, inventory planning and auctions (Fahimnia et al., 2019) or supply chain managers' framing of sustainability issues in their supply chains (Preuss & Fearne, 2022). ANT downplays cognitive explanations in favor of sociotechnical accounts and is concerned with processes of emergence and change, rather

than isolated decisions taken in supply chains that are assumed to be stable. As such, it offers a complementary perspective.

Third, and leading from ANT's insistence on symmetrical, heterogeneous, and distributed agency, we suggest that ANT is particularly relevant for the distributed and multifaceted character of supply chains and complexity involved in managing a supply chain (Flynn, Pagell, & Fugate, 2020). An ANT approach to studying the phenomena in supply chains does not exclude any actor, human, or nonhuman, central or local, or dislocated far from what is normally considered the focal firm to be influential or formative in new and unexpected ways. In addition, the performative relationality in ANT makes it an interesting framework for studying collective action, which could be said to characterize SCM. The importance of the collective in ANT-inspired research derives from the assumption that any sort of action necessarily stems from an assemblage of heterogeneous actors. The supply chain studies that are reviewed in the current paper and that have appeared in journals in neighboring disciplines demonstrate exactly this point: performance measurement systems may act on the supply chain in new ways not imagined before and that have not found supporting evidence for by the use of more conventional methods (e.g., Thrane & Hald, 2006; Chua & Mahama, 2007).

From within our discipline, there have been recent calls for research to explore aspects of measuring and managing performance in complex organizational settings, including in supply chains (Bourne et al., 2018). Among the outlined research topics have been calls for studies to explore the role of performance measurement and management systems in complex change, reconfiguring operations and communicating intent, and also reimagining the link between strategy and performance. An ANT approach, we argue, would be particularly useful in addressing these and other similar research questions. Furthermore, for important contemporary empirical developments such as supply chain digitalization (Holmström et al., 2019), the ANT assumption of symmetrical, heterogeneous, and distributed agency seems of

particular relevance. Hazen et al. (2016) suggest ANT as particularly well-equipped to explore how big data and predictive analytics help or hinder supply chains sustainability efforts and how actors across the supply chain contribute to a firm´s adoption of big data and predictive analytics for the purpose of enhancing supply chain sustainability measures. Further, among the several characteristics of Industry 4.0, Hofmann et al. (2019) identify "CPS [cyber-physical systems] and multiagent systems making decentralized decisions" and "interoperability between machine and human and virtualization of all resources." Although ANT asserts that agency is *always* distributed across multiple heterogeneous actors, these emerging empirical settings make it increasingly problematic to assume anything else.

Fourth, ANT provides a complementary perspective on power in SCM. This may address calls for new perspectives on power that move the conceptualization of power beyond the buyer–supplier dyad (Reimann & Ketchen, 2017). Because of its concern for the construction of actor-networks holding objects in place, ANT approaches may help explain how power relations are constructed (Whittle & Spicer, 2008). This can facilitate SCM theory that can better see, explore, and model the power and politics involved in representing, interpreting, and stabilizing SCM practices and systems. Thus, it may help in better understanding how SCM in practice is also enacted in the struggles between competing translations of how objects relevant for SCM should be defined, interpreted, and used in the supply chain.

Papadopoulos, Radnor, and Merali (2011) provide an example illustrating how an ANT approach can allow researchers to see, explore, and model the power and politics involved in translating objects of relevance to SCM. The study shows how the implementation of lean thinking in a UK National Health Service Trust led to negotiations and conflicts in and around the translation of lean thinking. In the study, the use of the ANT lens enabled the researchers to "reveal the turbulent dynamics associated with the process change, allowed the characterization of 'turning points' where apparently incompatible networks could engage, and

highlighted devices that enable disparate groups (actor-networks) to engage with each other"
(Papadopoulos, Radnor, & Merali, 2011, p. 185).

Another example is Abboubi et al. (2022), which adopts an ANT approach to explore the
challenges facing a focal small-to-medium-sized enterprise (SME) in its attempts to enroll
supply chain stakeholders into SA8000 certification for social accountability. The study finds
the ANT approach in particular valuable in seeking to understand how the SME organization
establishes power and authority in instigating relationships with suppliers. This demonstrates
how ANT can be applied to explore the contemporary empirical concern for constructing
sustainable or circular supply chains that can translate and comply with different stakeholders'
norms and requirements (Spring & Araujo, 2016). In such cases, a diverse set of firms and
other organizations, as well as nonhuman actors such as competing standards and certification
schemes for sustainability may be understood as competing to construct the supply field (see
also Mouritsen, Ernst, & Jørgensen, 2000). Thus, ANT provides a complementary lens from
which our field can develop an alternative understanding of the detailed process of organizing
the supply chain and its objects.

CONCLUSION

The current paper has engaged in the exploration of the potential of ANT as an alternative
perspective on the issues of concern in SCM. Three main principles that help conceptualize the
ontological position of ANT have been identified. With its ontological assumptions of
relationality, heterogeneity and performativity, ANT can be a potentially valuable
complementary perspective to existing theories and conceptualizations of supply chains and
SCM. ANT can help challenge existing dominant assumptions and ask a different set of
research questions. In particular, ANT is particularly well equipped to explore those issues

related to supply chain emergence, supply chain implementation, and supply chain change and failure.

However, like any other study, the present study has its limitations. Concerning the dominant orientation in SCM, the aim was not to be exhaustive but rather illustrative so as to enable a comparison between the perspectives. Thus, there is a risk of oversimplifying existing SCM research, and here, it is true that SCM research is diverse. There are also other studies that propose new ways to explore SCM that can foster new SCM theory (e.g., Touboulic, McCarthy, & Matthews, 2020); however, the objective of the present paper has not been to cover all aspects of existing conceptualizations and, thus, to provide a comprehensive account of these alternatives, but merely to concentrate on the potential that ANT-inspired research provides. Further, we acknowledge that, as with any other theoretical perspective, researchers subscribing to alternative theoretical perspectives have raised criticisms of some of the main assumptions within ANT (Whittle & Spicer, 2008). For example, critical realists observe that ANT does not adequately recognize the role and powers of social structure, and that the treatment of human and nonhuman actors symmetrically is too simplified (e.g., Elder-Vass, 2008). On the other hand, Elder-Vass (2008) also observes that ANT´s concern for tracing the connections through which structures are constantly made and remade is a strength from which critical realism can learn. The argument of the present paper is not that ANT is a universally best approach from where SCM theory can be developed; however, we propose an ANT approach as a potentially strong complementary position to existing perspectives, especially for particular types of research (see Table 3). Finally, the conceptualization of ANT is selective: as within any theoretical perspective, there are different schools and interpretations. In relation to future research, the hope is that what has been done here to conceptualize the ontological position of ANT and its potential implications for SCM can provide inspiration for future

studies adopting an ANT approach. This holds the potential to question existing dominant

assumptions while providing entirely new insights into what it means to manage a supply chain.

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TABLE 1
Ontological assumptions in ANT

		Ontological assumptions
Relationality	Understanding of reality	• Reality is understood as a set of relationships between actors (e.g., phenomena, objects, systems, practices and humans).
	Characteristics of actors	• An actor does not have an inherent set of characteristics or a given form or identity. • Actors take their form as a result of their relations with other actors. • The characteristics of an actor depend on how it relates to other actors.
	Actor-network	• This relational activity takes place in the actor-network. • The actor-network ties the individual actors together as a collective.
Heterogeneity	Role of human actor	• The human is not more important than the nonhuman. • It is also not possible to point to the nonhuman as the determinant.
	Role of nonhuman actor	• Nonhuman actors are capable of influencing situations, and of making other nonhuman and human actors dependent on them.
	Understanding of agency	• Agency is distributed. No actor acts alone. • The actor receives "actorhood" through its relations to other actors. • The form of agency does not matter as long as it makes a difference in the surrounding world. • All different types of actors may become decisive in the realization of the aspiration or effects explored.
Performativity	Understanding of reality	• Reality takes on an episodic character.
	Existence of actors	• Actors exist in a particular form as long as they are performed in episodes of action and interaction. • Actors and actor-networks are highly dynamic and fragile phenomena.
	Translations	• The process of translation captures the assumption of relational and heterogeneous performativity. • Translation involves creating convergences and homologies by relating things that were previously unrelated.

TABLE 2
Contrasting conceptualizations of supply chain management

	Assumptions	ANT conceptualization	Traditional conceptualization
Structural issues	The nature and structure of the supply chain *(Relationality)*	• The supply chain does not possess an inherent set of characteristics. • The supply chain takes its form and acquires its characteristics as a result of the relations and representations built to portray its existence.	• The supply chain is a system. • The supply chain possesses certain characteristics, such as formalization, centralization, horizontal complexity, vertical complexity, and spatial complexity.
	Existence of the supply chain *(Performativity)*	• The supply chain emerges and changes in episodes, depending on the relations that are built to portray its existence, role, and performance. • The supply chain is performed via the collective actions of the involved actors.	• The supply chain is pre-existing. • The supply chain exists independently of the relations that are built to portray its existence, role, and performance. • The supply chain is to be found rather than constructed.
	Boundaries *(Relationality & Performativity)*	• Boundaries between firms in the supply chain are constructed by their representations. • Boundaries are highly dynamic and change based on the action that unfolds in practice.	• Boundaries between firms in the supply chain are based on, for example, legal ownership. • Boundaries are relatively stable but change when a firm outsources or insources activities.
Managerial issues	The objectives and tasks of SCM *(Relationality & Performativity)*	• The definition of SCM to be explored in the specific empirical setting. • SCM is concerned with constructing and holding a sufficiently strong coalition of actors in place. • The objective is to stabilize a version of the supply chain and act on it.	• Coordination, integrating, and optimization of the supply chain and of pre-existing supply chain processes and structures.
	The managing actor(s) *(Heterogeneity)*	• The collective actor-network is understood as acting/managing. • The power to act emerges via relational effort. • By relational effort actors seek to have other actors accept a proposed agenda or version of the supply chain. • Nonhuman actors (e.g., IT systems, performance measurement systems) take part in the formulation, construction, stabilization, or destabilization of supply chain strategies, activities, devices, and structures.	• The focal firm is often understood as the supply chain manager. • The central focal firm actor is often understood as holding the agency and power to act. • The focal firm is often understood as acting from a central position in the supply chain. • Nonhuman actors are influential tools in human actors' efforts to coordinate, integrate, and optimize the supply chain.
	The role of contextual factors *(Relationality & Performativity)*	• The supply chain context is constructed. • Contextual factors are nonprivileged in explaining SCM.	• The supply chain context exists independently of other actors. • Contextual factors are privileged in explaining SCM.

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TABLE 3

Examples of research areas where an ANT approach can complement existing approaches to SCM theory development

Research areas	Themes	Characteristics of a complementary ANT approach	Indicative examples of SCM theory development
Change and stability within SCM	Detailed processes of change in SCM.	• From a focus on the performance outcomes of change, to a focus on the details of change taking place as actors are related and translated. • Change in the meaning and significance of objects relevant for SCM is understood to take place when they are related to other objects. • An attention to the potential non-linear emergence and change of SCM and its systems and elements.	• How codes of conduct and industry standards shape, determine and legitimize the development of sustainable procurement. • How changes in supply chain strategy emerge from activities designed to deal with the control of suppliers.
	Supply chain resilience in practice.	• Rather than an initial assumption, stability is understood as a rare accomplishment. • Stability is made possible by relational effort. • Follow actors as they for example propose different translation of supply chain vulnerability and responses to disruptive events.	• How stability and order can coexist at the same time as conflict and destabilization in supply chains. • How different supply chain actors may develop different responses to identical disruptive events.
Supply chain management in practice	Relationship between supply chain managers and management systems.	• From a focus of firms as aggregate supply chain managers to a focus of management as it unfolds in its details in practice. • Follow supply chain managers as they manage in practice and relate to management systems.	• How managers and technology interact when managing in situations of turbulent change. • How supply chain managers use different types of documents, devices and systems when managing supply chain counterparts such as suppliers.
What and who manages the supply chain	The role and influence of nonhuman actors in SCM.	• Agency is always distributed across multiple heterogeneous actors. • Do not exclude any actor, human, or nonhuman, central or local, to be influential or formative.	• How information technology, audit procedures and performance measurement system define supply chain vulnerabilities and act on supply chains. • How choice and adoption of technology in part determines supply chain strategy as well as being a way to enact it.
Power and politics in supply chains	The emergence and consequence of power in supply chains.	• Focus on how actors construct competing actor-networks holding different versions of SCM and management systems in place. • Focus on how power relations of relevance to SCM are constructed by relational effort. • Focus on the struggles between competing translations of how objects relevant for SCM should be defined, interpreted, and used in the supply chain.	• How competing standards and certification schemes for sustainability may be understood as competing to construct the supply field. • How the implementation of management concepts such as lean in the supply chain lead to negotiations, and conflicts in and around the translation of lean thinking.