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**SEEING WITH FRESH EYES – THE POTENTIAL OF PARADOX THEORY
TO EXPLORE PERSISTENT, INTERDEPENDENT TENSIONS IN SUPPLY
CHAINS**

Abstract

Purpose – This study explores the potential of paradox theory as a novel theoretical lens to investigate persistent and interdependent tensions in supply chains. It is based on a critical literature review focusing on paradoxes observed within complex supply chains in dynamic business environments, including the articles selected for this Special Issue, “Environmental Dynamism & Supply Chain Complexity: Managing the Paradoxes”.

Design/methodology/approach – This study introduces the key concepts and the themes of the paradox theory literature and possible methodological approaches to studying paradoxes in supply chains. Through a literature review, this study also reflects on the current state of paradox research in the field of operations and supply chain management (OSCM) and proposes future research questions.

Findings – The application of paradox theory to OSCM research is in its early stages. This paper presents opportunities to explore persistent and inter-dependent tensions in supply chains using paradox theory.

Research limitations/implications – The paper suggests several new research questions that should be translated into more precise propositions. The main implication for research is a call to focus attention on how and why a paradox perspective can help supply chain researchers view complex supply chain problems with fresh eyes.

Originality/value – The study provides the first critical review of paradoxical tensions in OSCM research. While the papers in this Special Issue contribute significantly to a better understanding of these issues, there is still significant potential in understanding how to respond to paradoxes in supply chains.

Keywords: paradox theory, research agenda, paradoxical tensions

Paper type: Research paper

1. Interconnected Challenges Requires Fresh Eyes

Companies are increasingly finding themselves having to compete in dynamic business environments, where economic, technological, geopolitical, social and environmental developments place conflicting demands on their supply chains. For example, over decades, globalization has led to extended supply bases that capitalize on the cost and technology advantages of offshoring and outsourcing (Kinkel, 2012), yet recent geopolitical disruptions, such as Brexit and the US-China trade war have pushed companies to start considering more local supply alternatives. Similarly, recent events like the pandemic, have highlighted the need for companies to diversify their supply base. At the same time, investing in technologies like blockchain increases switching costs and likely places a concentration on fewer sources of supply. Likewise, platform technologies and the sharing economy have created new business models that allow many suppliers to nimbly connect to many individual buyers on a transactional basis, while sustainable/green supply chain management (SCM) practice requires transparency, a focus on accountability and due diligence in sourcing which ultimately favors a more stable supply base.

While there is already significant work on how changes in the business environment, such as the move towards digitalization or the comparative advantages of different nations, impact SCM, novel research is needed to understand the interconnectedness of these challenges. Moreover, these different business dynamics frequently create competing priorities, which pull supply chains in different directions. These competing priorities are also becoming more pronounced and frequent (Lewis, 2000). The level of competition, coupled with stakeholder pressures, leaves little room for managers to focus on one challenge at a time. These challenges exemplify paradoxes, which can be defined as “contradictory yet interrelated elements that exist simultaneously and persist over time” (Smith and Lewis, 2011, pp. 382).

Paradox theory refers to a specific approach to oppositions which present “a dynamic equilibrium model of organizing, which ... depicts how purposeful and cyclical responses to paradox over time enable sustainability – peak performance in the present that enables success in the future” (Smith and Lewis, 2011: 382). Dynamic equilibrium models acknowledge the opposing forces and sustain equilibrium by adapting to the perpetual pull of these forces. This theory has seen growing interest in management research (Schad *et al.*, 2016) and we contend that it is a compelling new lens through which supply chain researchers can understand how to better manage contexts where firms face several persistent and interrelated tensions. Whilst contingency theory encourages researchers to-date to examine tensions from an ‘if/then’ perspective, paradox theory enables new insights through its ability to enable organizations to simultaneously attend to competing demands (Matos *et al.*, 2020; Smith and Lewis, 2011).

This paper shows how persistent and interdependent tensions in dynamic business environments affect supply chains and explores how companies can manage such tensions through the lens of paradox theory. We start by introducing paradox theory, including the different types of paradoxes and approaches to managing them that have been identified in the management literature. This is followed by a review of existing supply chain research using paradox theory and a reflection on future research opportunities, with the goal of stimulating a discussion on the opportunities and challenges of supply chain research using paradox theory. The final section provides a brief overview of accepted papers in the Special Issue on “Environmental Dynamism & Supply Chain Complexity: Managing the Paradoxes”, highlighting how they fit into the development of this research stream, their key message and their contribution to theory and practice.

2. Paradox Thinking in SCM

The challenges of SCM are well-versed today. Academics and practitioners alike are aware of the complex problems that do not discriminate between companies, sectors, or geographic

regions. For example, supply chains are under increasing pressure to be environmentally and socially sustainable while delivering strong economic performance. Also, there is a heightened expectation that supply chains will operate efficiently while maintaining their adaptive capabilities, perhaps even more so during periods of major disruption such as the recent COVID-19 pandemic.

This study reflects on such pressures that create paradoxes and on how to manage paradoxes which intensify with increasing environmental dynamism and complexity (Schad *et al.*, 2016). In addition, technological advances, digitalization, and globalization exacerbate paradoxes (Lewis, 2000). By recognizing the persistence and interdependence of these pressures, this paper encourages their conceptualization as paradoxes rather than trade-offs, or irreconcilable differences too wicked to be resolved.

Paradoxes are interdependent and persistent oppositions and realities. The tensions between social welfare and commercial logics in social enterprises (e.g., Longoni *et al.*, 2019), between triple-bottom line goals (e.g., Brix-Asala *et al.*, 2018; Matthews *et al.*, 2016; Xiao *et al.*, 2019; Zehendner *et al.*, 2021) and between collaboration and competition in supply chain partnerships (e.g., Wilhelm and Sydow, 2018) are examples of paradoxes identified in the supply chain literature. These oppositions can be “logical in isolation but absurd and irrational when appearing simultaneously” (Lewis, 2000, p. 760). The interdependence of the elements makes it difficult to separate their management (Schad *et al.*, 2016). This interdependence has been theorized by some as distinct but interwoven oppositional forces (Poole and Van de Ven, 1989) and by others as mutually constructed and ontologically inseparable (Lewis, 2000). Paradoxes also embody contradictory elements (Quinn and Cameron, 1988), creating a constant tug-of-war between them. In the short term, moving toward one end may appear to be a solution, only to have a countervailing force emerge later, creating a cyclical relationship between these forces. Furthermore, paradoxes are persistent.

Paradoxes can be described as double-edged swords with positive potential that can also be destructive to supply chains, depending on how we frame and respond to these tensions (Lewis, 2000). Historically, our theorizing in SCM, like research in other areas of management, has taken a trade-off perspective, forcing us to make choices. These choices may reduce stress in the short term but may also exacerbate paradoxes in the long term (Lewis, 2000). For example, implementing tight control systems may create an excellent operating system to ensure quality in the production process today, but may also result in less flexibility and adaptability in the future. Over time, research has evolved to take a contingency perspective, e.g., to examine the context whereby one option is positioned as superior to an alternative option (Lawrence and Lorsch, 1967).

It is now time to move from the "or" perspective that dominates the discussion of trade-offs, or an "if/then" perspective as suggested by contingency theory, to a "both/and" perspective (Lewis and Smith, 2014). This requires exploring paradoxes and embracing their potential, novelty, and insights, rather than trying to irradicate them (Lewis, 2000). Adopting a paradox perspective in supply chain research changes the types of questions asked, the measures used, and the methods employed, presenting a plethora of new research opportunities. When research begins with a "what" or "when" question, the possible answers lie on the opposite ends of a continuum and either one or the other is chosen. Thinking in terms of paradoxes changes the portfolio of possible 'answers'. Acknowledging the contradictory, interdependent and persistent nature of tensions, it pushes researchers to seek solutions that recognize this. For example, research on ambidextrous organizations evolved from the acknowledgment that many organizations cannot solely focus on, or even prioritize innovation or efficiency but rather need organizational structures that continuously support both. Furthermore, how management and leadership respond to paradoxes affects not only thinking and decision-making, but also systems and processes, the latter being critical components of operations and SCM.

Recognizing the value of a paradox perspective and applying it can allow the identification of additional possible responses, some of which are better suited to dealing with persistent uncertainties, complexities, and contradictions in operations and SCM.

Such a conceptual shift requires a different way of thinking in management research. In other words, the problem is not the problem itself, but the way we think about the problem (Watzlawick *et al.*, 2011). Paradox theory allows us to reframe challenges faced that are contradictory, interdependent and persistent so that they can be accepted, embraced, and then managed - rather than attempting to eliminate them or, at worst, ignore them.

3. Classifying Paradoxes

To date, research has sought to classify paradoxes into three core categories – the nature of paradoxes, approaches to addressing and mitigating paradoxes, and finally, the impact of paradoxes - each consisting of two themes (Schad *et al.*, 2016).

The nature category includes the identification of different *types* of paradoxes and the *relationships* between the interdependent and contradictory elements that underscore paradoxes. In considering the types of paradoxes, we refer to the seminal work that has identified four types (Lewis, 2000; Smith and Lewis, 2011): (1) Performing paradoxes that arise from the multiple demands of diverse internal and external stakeholders (Kocabasoglu-Hillmer *et al.*, 2023); (2) Organizing paradoxes arise from competing structures and processes, each of which has its individual strengths in achieving a particular organizational goal, denoting an ongoing process of balancing opposing forces that encourage commitment and trust while maintaining efficiency, discipline, and order; (3) Belonging paradoxes that arise from the plurality of roles, which aim to understand how to become cohesive, influential, and distinctive by valuing the diversity of individuals and their interconnectedness; and, (4) Learning paradoxes emerge from the need for organizations to innovate and change, requiring the use, critique, and often destruction of old understandings and ways of operating, in order

to establish new frames of reference and original ways of doing things (Lewis, 2000). In summary, the literature acknowledges four types of tensions: performance (e.g., stakeholders pulling us in different directions), organization (e.g., tensions in systems: e.g., control and flexibility), belonging (who are we and they? What is coopetition?) and learning tensions (new tensions about time: the new and the old; new knowledge destroying the past).

These four paradox types can be found in the supply chain literature, although for the most part, they have not been formally acknowledged as paradoxes. What is more, these tensions are expected to be even more pronounced at the supply chain level, as this additional layer of a supply chain increases complexity. For example, the literature on sustainable supply chains focuses on performance paradoxes that examine tensions between social, environmental, and economic performance. Organizational paradoxes are observed in the discussion of centralized vs. decentralized management within supply networks. Belonging paradoxes highlight the challenges of balancing the goals and needs of an organization as a distinct entity versus as part of a supply chain. Finally, learning paradoxes are disentangled in innovation and supply management studies where the supplier is part of both exploration and exploitation activities. There is also research at the intersection of these paradoxes. For example, the coopetition literature builds on both the belonging paradox and the learning and organization paradox.

The approach category includes both *individual* and *collective* responses to paradoxes, the latter of which can be at the inter-organizational, organizational, and team levels. Collective approaches as a theme, can be aligned with Poole and Van de Ven's typology (1989), which proposes four management approaches: *opposition*, *spatial separation*, *temporal separation*, and *synthesis*. Opposition, also termed acceptance, involves acknowledging the paradox and learning to live with it. Spatial separation builds on dividing tensions along organizational structures (e.g., firm versus supply chain, Poole and Van de Ven, 1989). Temporal separation

considers each of the opposing elements at different points in time, dividing the paradoxes over time. Finally, synthesis aims to find a solution that acknowledges and accounts for the polar ends (Schad *et al.*, 2016). The last category of paradox research, namely impact, encompasses studies on the *outcomes* of the different responses and the *dynamics* of paradoxes, including the cyclical processes to deal with persistent tensions. It has been acknowledged that, to date, scholars in the management literature have tended to oversimplify the complexities surrounding paradoxes and have paid greater attention to types of paradoxes, collective approaches to responding and outcomes, with less focus on relationships within paradoxes, individual approaches and dynamics (Schad *et al.*, 2016).

It is important to recognize that paradoxes are often nested and interrelated with other paradoxes (Schad and Bansal, 2018). This requires us to adopt a more comprehensive view, linking performance paradoxes with, for example, paradoxes on learning and belonging. Often these different types of paradoxes create reinforcing cycles, such that one type of paradox affects the other (Lewis, 2000). By establishing a comprehensive view from the outset, we can better understand the complexity required to manage supply chain practices and the tensions that exist.

All this considered, a paradox perspective necessitates a change to the type of questions that are asked, the measures used, and the approach taken by researchers to analyze the phenomena. The central tenet of this paper is that SCM researchers can advance their understanding of important contemporary phenomena by shifting their theoretical framing to one that embraces the idea of paradoxes. The same is true for practitioners and SCM decision makers - there is great potential for organizations if they can explore a more nuanced and nonlinear approach to tensions, which respects their persistence, interdependence, and complexity. It is here that the 'art' of thinking paradoxically becomes relevant - relevant for managers faced with these 'perceived tensions', as well as for SCM researchers.

Within the SCM literature, we contend that paradox theory has broad applicability, although it has not been extensively explored in this context and suggests that paradox theory is a very relevant and useful lens as we seek to better address the grand challenges within the supply chain.

4. Shifting Methods to Address Paradoxical Tensions in SCM

In the previous section, we discussed paradox theory as a theoretical lens that warrants greater attention from SCM researchers. This lens would provide new research opportunities as well as enable us to re-examine various key themes in SCM beyond the confines of cause-and-effect thinking and linear associations prevalent in SCM research. However, this also means a corresponding shift in research methods will be necessary, since SCM research often relies on research methods that aim to establish and test relationships between an exclusionary set of variables, with the goal of reaching definitive conclusions. While this approach has proven valuable, it may inadvertently limit the potential of paradox theory as a novel underpinning theory in SCM research.

Paradoxical thinking requires a great focus on sensemaking. To enable access to such dynamics, paradox studies often apply more qualitative methods, which would seem appropriate given their strength in exploring phenomena and their effectiveness in developing alternatives in managing paradoxes. Case studies enable a fine-grained analysis of nested paradoxes and tensions across different levels (e.g., Andriopoulos and Lewis, 2010). When designing case study methods for investigating paradoxical tensions, there is merit in rethinking our research approach. Touboulic *et al.* (2020) highlight how critically engaged research designs offer opportunities to analyze supply chain phenomena in the context within which they are constructed. Engaged research designs, such as an in-depth case study or longitudinal field study, whilst perhaps less controlled, can offer a more developmental, behavioral, and experience-based approach (Touboulic *et al.*, 2020). This can reveal the complexity of supply

chain phenomena and contribute more relevant, multifaceted, and comprehensive conceptualizations of paradoxical tensions in supply chains. Longitudinal involvement with organizations or individuals in supply chains can be particularly valuable for challenging scholars' assumptions about paradoxical tensions in SCM. Such involvement can allow researchers to acknowledge the persistent and dynamic nature of these tensions and enable the investigation of how paradoxes become salient, evolve, and are managed over time.

Ethnographic studies perhaps come to mind most when researchers contemplate emergent and engaged types of research (see Gylfe *et al.*, 2019; Wenzel *et al.*, 2019). This can be a valuable approach to understanding how managers react and behave when confronted with emerging paradoxical tensions in supply chains, particularly in response to internal or external shocks. It can also enable researchers to explore how managers balance competing stakeholder demands in the face of paradoxical tensions. Ethnographies could allow researchers to assess such changes in supply chains with a richness and complexity that self-reported information or secondary data are unlikely to provide.

Discourse analysis is also worth considering when studying paradoxical tensions in SCM. Discourse methods help “researchers to look closer at what is going on ‘inside’ the supply chain to understand potentially differing responses on the part of diverse actors” (Hardy *et al.*, 2020, p. 27). Discourse analysis is a predominantly qualitative approach, which through the systematic study of texts and/or practices (Hardy *et al.*, 2020), allows researchers to consider the persistent and evolving nature of tensions by tracking them over time (Fairhurst and Putnam, 2019). This approach to analysis allows researchers to “problematize” existing knowledge to challenge long-standing assumptions and generate innovative research questions (Alvesson and Sandberg, 2011). Furthermore, discourse analysis allows SCM researchers to assess communicative interactions within organizations (e.g., board meetings, committees, memos) and between organizations (e.g., disseminated texts such as contracts, agreements,

emails for example). As Spee and Jarzabkowski (2011) have shown, the investigation of communicative interaction and its evolution is a powerful methodological tool that enables researchers to better understand the performance implications of various aspects of relationships, such as authority and power. Given the inherent complexity and dynamism of many relationships in supply chains, discourse analysis is well suited to examine the various paradoxical tensions in supply chain relationships, such as alliance partner selection and co-opetition.

In addition, other existing research methods can also be valuable for investigating paradoxical tensions in supply chains. Experimental designs, for instance, offer a valuable approach for SCM studies aiming to explore an individual decision maker's cognition or framing around a particular paradox and its management. Another method worth considering is archival research, despite the challenges it presents in terms of sampling, data preparation, and temporality (Miller *et al.*, 2021). Archival research offers the opportunity to provide fresh perspectives on longstanding questions and examine unexplored questions in SCM research (Calantone and Vickery, 2010). This is particularly relevant for studies on paradoxical tensions in supply chains as it provides an avenue for researchers to challenge accepted assumptions regarding trade-offs by examining trends and patterns over an extended period.

Across these proposed research methods, metaphors can prove valuable in stimulating creativity and imagination in SCM theorizing. Conceptual research with metaphors allows researchers to visualize problems “with fresh eyes” (Stephens *et al.*, 2022). To consciously explore paradoxical tensions in supply chains, we need such approaches that take us beyond the confines ‘black and white’ methodologies. As a field, we have already faced criticism for gravitating further from field-based research and for offering “rigorous answers to narrow questions” (Fisher, 2007, p. 369).

For this reason, we lastly draw attention to paradoxical inquiry. Beyond considering the content of paradox theory, when studying SCM paradoxes, we can also apply a research process of working through paradoxes. In other words, rather than finding a solution to respond to the paradox, researchers could also focus on creating an environment in which paradoxical thinking is encouraged. A significant and persistent challenge while investigating paradoxes is the tendency to shift to the prevalent mode of linear thinking in order to devise solutions. Yet paradox theory rests on the view that these tensions are enduring and that leaning into one side creates a counterforce from the interdependent, opposing tensions. Paradoxical inquiry offers a process that can help researchers make sense of ‘messy’ or wicked problems, surfacing latent paradoxes and reframing the problem through a series of (iterative) steps (Lüscher and Lewis, 2008). The framework of paradoxical inquiry builds on the works of Tomm (1987a, 1987b) on interventive questioning and follows a series of steps, including linear questioning to identify the symptoms of a problem, circular response enabling researchers to explore different perspectives, reflecting questions to generate alternative conceptualizations and strategic questioning to stimulate ongoing experimentation by challenging all identified solution.

As noted in earlier sections, researchers may also take a more explorative approach. Starting with a less-defined research question, researchers may apply a research design guided by the paradox perspective. Although we are not proposing a grounded theory approach, it is worth noting that more flexible approaches can help researchers in identifying SCM paradoxes and enhancing our understanding of them. Indeed, we acknowledge the potential for research that does not initially focus on paradoxes but instead addresses tensions that emerge during data collection and analysis. Such flexibility requires a research design that invites open-ended questions and follows a highly iterative process. Some of the methods identified here can equip researchers with this flexibility that allows them to explore paradoxical tensions more organically, as they emerge during the research process.

5. Overview of SCM Research on Paradoxical Tensions

To gain a better understanding of the current state of research on various paradoxical tensions in SCM, a literature search was conducted on the Web of Science. The search encompassed the period from 1994 to 2023 and includes the abstracts, keywords, and titles of all articles published in 13 major OM and SCM journals. The keyword used for the search was "paradox*". Initial exploration of closely related other words, such as tensions returned work that did not assume interdependence and persistence, which is fundamental to paradox theory. Our search yielded a total of 116 articles. Then, each article was manually reviewed to confirm if the appearance of the term paradox is indeed aligned with the definition of the paradox discussed earlier. Articles using "paradox" to denote to temporally tensions or to characterize counterintuitive phenomena were discarded. This resulted in 54 articles (Table 1).

----- Table 1 about here -----

The first article on paradoxical tensions in the context of SCM dates back to 1994. However, it was not until after 2016 that the number of published articles on this topic started to increase steadily. The peak in publications occurred in 2021, with a total of 11 articles being published (Figure 1). It can thus be said that paradox research remains a relatively under-explored area in SCM research.

----- Figure 1 about here -----

To uncover key themes in SCM research on paradoxical tensions, we conducted manual coding on the abstracts of 54 articles (Table 1). This coding process followed the inductive coding approach proposed by Thomas (2006), which refers to "approaches that primarily use detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher" (Thomas, 2006, p. 238). Our analysis produced seven themes (Table 1) and the results suggest that SCM research on paradoxical

tensions is primarily centered around two main themes: sustainable SCM and production and manufacturing management.

The first theme, sustainability, constituted 29.2% of the paradoxes investigated in the articles in the sample. Many recent studies have investigated paradoxical tensions in the context of sustainable SCM, particularly focusing on the paradoxical tensions between sustainability and profitability (Longoni *et al.*, 2019; Xiao *et al.*, 2019), as well as the conflicting objectives among different stakeholders (Busse *et al.*, 2016; Fayezi *et al.*, 2018; Zehendner *et al.*, 2021). The second theme, internal manufacturing process management, was the focus of 27.8% of the paradoxes investigated in the articles analyzed. Within this theme, paradoxical tensions related to the management of internal manufacturing processes, such as lean manufacturing (Erthal *et al.*, 2021; Maalouf and Gammelgaard, 2016), quality management (Duray, 2002; Mellat-Parast and Dignan, 2008) and mass customization (Duray, 2002) were investigated. The third theme, external relationship management, accounted for only 11.0% of the paradoxes mentioned in the articles analyzed. Although fewer in number, these studies investigated important paradoxical tensions arising from managing relationships with supply chain partners such as co-opetition (Mirzabeiki *et al.*, 2021) and supply chain partner integration (Jin *et al.*, 2013). In summary, this analysis reveals that more research on paradox thinking is still required on the relationship level/procurement level, or broadly speaking supply chain level issues.

Furthermore, we manually coded the abstracts to find the nature of the paradox addressed in each article (Figure 2). It became obvious that a considerable amount of academic attention has been paid to the performing paradox (44.3% of the paradoxes in the articles) and the organizing paradox (41.8% of the paradoxes in the articles). However, comparatively less research has been conducted on the belonging paradox and the learning paradox. Regarding the methodology, our analysis suggested that both qualitative and quantitative empirical

methods constituted a significant portion, comprising over two-thirds of the articles in our analysis (Figure 3).

----- Figure 2 about here -----

----- Figure 3 about here -----

6. Future Research Agenda on Paradoxes in SCM

The application of theory is essential to the development of the SCM discipline (Ketchen *et al.*, 2022) and through this paper, we aim to shed light on the potential of paradox theory. As highlighted, to embrace the concept of paradoxes, requires a different approach as a researcher, from the questions that are asked to the methods that are employed. In terms of theory development in this area, we assert that paradox theory is a valuable theoretical lens, allowing us to leverage new insights into ‘old’ problems (as also highlighted by a number of other scholars, e.g., Matthews *et al.*, 2016; Rindova, 2011; Wilhelm and Sydow, 2018). In helping scholars navigate the theory application and development context, we offer some potential research questions, as well as reflections that they might wish to consider around the process of theorizing and levels of analysis.

Potential Research Questions

Given the relatively recent introduction of paradox theory to supply chain research, there are many opportunities to develop new research questions (and reformulate old ones). Table 2 provides potential future research questions. While the paradox is more clearly stated in these research questions, this is for illustrative purposes and does not need to be so explicit. Building on the foundations of paradox theory, the intention here is to illustrate how many of the questions and challenges that we face as SCM researchers, can be embedded in a paradox context, be it either in terms of how we define a problem (categories of paradoxes), how we address the tensions we face (approach to paradoxes) or how we interpret the consequences or outcome of these tensions (impact). Research questions may take a more neutral position,

introducing a paradox perspective in the operationalization of the constructs and choice of methodology. Yet as Smith and Lewis (2022) stress: the most impactful first step toward both/and thinking is changing the question. Furthermore, we contend that it is important for supply chain researchers to understand not only how to ask more paradoxical questions, but also to position their studies to systematically draw from and contribute to paradox theory.

----- Table 2 about here -----

While the paradoxical tensions provided in Table 2 are common across different supply chains, they are not always salient. In the day-to-day management of supply chain operations, these tensions can remain latent, therefore inconspicuous, and unnoticed (Smith & Lewis, 2011; Kocabasoglu-Hillmer et al., 2023). But they become salient when a major shock occurs that draws attention to the underlying tensions (Schad et al., 2016). This is because these shocks are characterized by plurality, change, and scarcity, disrupting supply chain structures and relationships (Smith & Lewis, 2011). Plurality refers to all inconsistencies in perspectives among supply chain partners, resulting from different views and uncertainties after such a shock. Shocks also create new opportunities for sense-making, due to new realities, often creating competing yet co-existing roles and emotions (Huy, 2002). Finally, the shocks intensify scarcity in human and material resources.

These shocks show one or more of the following characteristics: their response encompasses competing goals; they accentuate the finite resources organizations have; or they spur change (Smith and Lewis, 2011).

Change is the one constant in SCM. It follows then, in our theorizing that we must accommodate it appropriately. Prior research suggests that paradoxes can be intensified by environmental dynamism and complexity (Schad *et al.*, 2016). Environmental dynamism is a measure of the rate and magnitude of changes external to the organization (Rojo *et al.*, 2018; Rosenzweig, 2009), which translates as changes in product design, technology, and customer

preferences (Achrol and Stern, 1988; Dess and Davis, 1984; Miller and Friesen, 1983). Dynamic environments exhibit unpredictability and instability (Kovach *et al.*, 2023; Miller and Friesen, 1983; Schilke, 2014). It is for this reason that recent global events have accentuated the inherent paradoxes in supply chain strategies and structures (Harper, 2022; Matos *et al.*, 2020). Alternatively, complexity captures the parts and components of a system as well as the unpredictability of its response to change (Bozarth *et al.*, 2009). Complexity can be about products, processes, and even relationships. Environmental dynamism captures the impact of the external environment, where complexity captures that of the system, that is, the supply chain on paradoxes. Given the increasing prevalence of complexity and turbulence as core themes of interest in SCM, it is even more critical that SCM scholars consider the usefulness of paradox theory as they approach theorizing around these grand challenges.

The Process of Theorizing

Rindova (2011, p. 20) describes the first stage in the process of theorizing, as involving “a series of activities, to which authors can give more or less attention depending on their predispositions and/or training”. As we outlined before, more effective theorizing around paradoxes in SCM, requires a more novel approach to the questions that we ask and how we ask them. To stimulate this paradoxical mindset, researchers should be cognizant of their predispositions and the biases of their current cognitive frames, in order to leverage the forces that enable creativity in theory development. More specifically, this requires looking both at centripetal forces that define and buffer a conceptual theoretical core as well as centrifugal forces aimed at challenging the core and extending its boundaries through exploration and creativity (Sheremata, 2000). These forces can be seen as paradoxical—contradictory, yet also interdependent—and propose that engaging them is vital to the development of theory. While extant paradox research helps us grasp the tip of the iceberg, creative and provocative studies will uncover new insights. Indeed, understanding centripetal and centrifugal forces and their

interplay can help surface and open the remaining “black boxes”, combining continuity (centripetal forces) and novelty (centrifugal forces) (McKinley *et al.*, 1999). This “out of the box thinking” is not about replication in our approach to dealing with problems, but asking ‘is this really a problem, or tension’ and how might we first reframe what we perceive as the ‘problem’, casting it not automatically as negative but rather questioning the norms and assumptions that have surrounded the way we interpret and respond to the tensions. As researchers, we too have an obligation to adjust our mindset to help positioning research agendas and formulating questions differently. In terms of approach, we refer to the work of Ketchen *et al.* (2022) who highlighted the role of configurational research within the SCM context, as opposed to linear research which is most commonly used within the discipline. We contend that more novel approaches to theory development, through the adoption of configurational theorizing (as an example) will allow researchers to approach the conceptualization of paradoxes and subsequent theory development in a more parsimonious manner, but befitting of the complexity of the tensions under study when it comes to innovation and disruption within the supply chain.

Level of Analysis

Compared to other disciplines, the supply chain field focuses less on the individual decision maker as the unit of analysis. We would like to encourage SCM researchers to also think about the individual decision maker given how an organization’s framing, cognition, and culture around operational and supply chain decisions is so often driven by individuals and their mindsets. For example, within the innovation literature, in a product innovation context, Andriopoulos and Lewis (2009, 2010) explore nested paradoxes around strategic intent (profit-breakthroughs), customer orientation (tight-loose coupling), and personal drivers (discipline-passion) and long-term adaptability against short-term survival. As we start to pay more attention to exploring tensions within SCM, we contend that some focus should also be levied

at individual sense-making and the role of emotion and cognition– looking at how individuals experience and respond to tensions and how it can affect the management of the tension. The role of individual perception was further highlighted in Sharma and Bansal’s (2017) study that questions the definition of a paradox from the position of dynamic poles and asks whether paradoxes are a state of mind as opposed to an objective reality (Smith *et al.*, 2017). Thus, in taking the concept of the paradoxical mindset forward, we suggest that this mindset should be conceptualized at different levels: particularly that of an individual, but not to the exclusion of a team, department, organizational, supply chain or even societal level of analysis, mirroring the paradox literature to date.

7. Review of Papers in the Special Issue

There is a paucity of literature which uses a paradoxical perspective to understand persistent and interconnected supply chain challenges. The four papers included in this Special Issue on “Environmental Dynamism & Supply Chain Complexity: Managing the Paradoxes” display a range of research questions and methods, but share at their core, the central tenets of paradox theory in both identifying and resolving the conflicting tensions seen in supply chains in complex, multi-faceted environments. We now provide a brief explanation on how each of the papers fits in the special issue, and how it contributes to paradox thinking in a supply chain context. More specifically, we refer to how these papers contribute to paradox thinking (see Table 2) by: helping define the problem (i.e., types), how to address the tensions (i.e., approaches) and/or how we interpret the outcome or consequences (i.e., impact). While paper two and three focus on exploring an existing paradox (i.e., types), paper one and four are also looking into response strategies to cope with paradoxes (i.e., approach). In addition, paper one is also providing insights into the outcomes of the response strategy (i.e., impact). A summary and the main conclusions for each paper can be found in Table 3.

----- Table 3 about here -----

The first paper in the Special Issue focuses on a performing-organizing paradox in supply chains. More specifically, it analyzes how supply base concentration creates a performance paradox for companies who want to simultaneously reduce costs and decrease supply risk. This is particularly important in dynamic environments, where tensions between cost-reduction and risk-reduction strategies are very prominent. The study explores a collective approach taken in response to this paradox by analyzing how digitalization intensity and breadth, by enabling the development of information processing capabilities, alter the paradoxical effects of supply base concentration on a firm's cost efficiency and idiosyncratic risk. Furthermore, the authors discuss the impact of this response strategy: firms with higher digitalization intensity are better able to identify, monitor, and cope with the risks of supply chain disruptions, eventually alleviating the exacerbating effect of supply base concentration on idiosyncratic risks, while broad scope of information technologies tends to separate and intensify the paradoxical tensions.

The second paper explores an organizing-learning paradox that arises from supplier development in technology-based luxury supply chains. The paper shows how supplier development, while supporting the value co-creation in buyer-supplier relationships also inadvertently brings about questions on how to capture this value, as continuing the existing relationship might not be the best decision for the buyer or supplier, thus contributing to the discourse on the relationship between paradoxes. Thus,, supplier development helps improve the supplier's capabilities, which paradoxically also weakens their willingness to commit to the existing relationship and presents other opportunities. The paradox is exasperated in technology-based luxury supply chains, where the targets are very demanding and there is a limited number of suppliers that both have the capability and the willingness to accept small volume sales.

The third study examines a performing/organizing paradox by exploring the paradoxical tensions between organizing processes used to manage indirect greenhouse gas (GHG) emissions in supply chains. The authors found that a higher level of supply chain transparency and coordination initiatives paradoxically increase scope 3 emissions measured in absolute terms but are also associated with relative improvements in the long term. It highlights the importance of acceptance as part of the approach taken to manage this paradox. The paper contributes to the literature on sustainable SCM by explaining why companies' efforts to improve the sustainability aspects of their supply chains often lead to paradoxical results, using paradox theory as a theoretical underpinning. Furthermore, this paper is one of the few quantitative empirical papers on this topic using a large data set over a period of 20 years.

The final paper adopts a contrasting context to the other papers in the Special Issue, with a focus on temporary supply networks (TSN) – specifically, humanitarian disaster response networks. While choosing a context that has a shorter timeline might seem counterintuitive to studying interdependent challenges that persist over time, the paper provides unique insights into how decisions made during that time can create long-term tensions that continue even after the crisis is perceived to be resolved. This single case study paper examines the 2015 Nepalese earthquake to explore the nature of the paradoxical multifaceted tensions in terms of performing, organizing, belonging and learning experienced in this temporary supply network and approaches taken to respond to the tensions. Given the criticality of time in humanitarian supply networks – both in terms of identification of need and pressure to act, this paper sheds light on the role of outcome dynamics (i.e., impact) in the manifestation of paradoxes but also in the response strategies adopted. To manage the approach taken in response to these paradoxes, the paper presents a framework of enabling mechanisms (engagement, knowledge, specialization and innovation/standardization), suggesting a hierarchy of strategies, contingent on the complexity of the tension, which consequently encourages us to think about the

challenge of managing paradoxes in uncertain and dynamic environments where there is a threat to life and a pressure therefore to respond appropriately.

8. Concluding Remarks

This paper was developed with the purpose of inviting the supply chain community to reflect on the inter-dependence and persistence of the different challenges managers face. It offered paradox theory as a lens with which to identify such tensions and explore how to respond to them.

The use of paradox theory in supply chain research is growing but is still in early stages. In addition, our analysis of past supply chain research using paradox theory suggests that supply chain research to date has focused on a subset of themes identified in paradox literature. For example, while there is some work on organizing and performing paradoxes in supply chains, work on belonging or learning paradoxes is nascent. Similarly, there is limited work on how to respond to such paradoxes. Supply chain research also mimics the larger paradox literature in that work on the relationship between paradoxes, responses at the level of the individual and dynamics of paradoxes have received less attention than those that identify the types of paradoxes seen in supply chains, the collective response and mitigation strategies and reflections on the consequences of different responses. For this reason, supply chain research utilizing the lens of paradoxes has also an opportunity to contribute to paradox theory.

The four selected papers for this research paper and Special Issue show the variety of supply chain challenges that can be discussed through paradox theory. We hope that they will provide a stepping-stone for future work, enabling researchers to organically analyze paradoxical tensions in complex supply chain challenges by using innovative research methods.

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Table 1 Published articles per journal and themes of SCM research on paradoxical tensions. (Note: since an article can have more than one theme, the sum of the articles by theme is greater than the total number of articles, 54).

	No of articles	%	Sustainability	Internal manufacturing process management	External relationship management	Technology management	Procurement	Servitization	Innovation	Total number of articles by theme
International Journal of Operations and Production Management	14	25.9%	3	6	2		1	2	2	
International Journal of Production Economics	14	25.9%	2	9	1	4	1	2	1	
International Journal of Physical Distribution and Logistics Management	5	9.3%	5	1	1		1			
Journal of Supply Chain Management	5	9.3%	3		2		2		1	
International Journal of Logistics Management	3	5.6%	2	1						
Journal of Operations Management	3	5.6%		1		1		1	1	
Production and Operations Management	3	5.6%	2	1		1				
Supply Chain Management: An International Journal	3	5.6%	2		1					
Journal of Business Logistics	2	3.7%	1			1	1			
International Journal of Production Research	1	1.9%	1		1					
Management Science	1	1.9%		1						
Decision Sciences	0	0.0%								
Journal of Purchasing and Supply Management	0	0.0%								
Total articles	54	100.0%								
No of articles by themes			21	20	8	7	6	5	5	72
%			29.2%	27.8%	11.1%	9.7%	8.3%	6.9%	6.9%	100%

Table 2 Potential research questions.

<p>Category 1</p> <p>NATURE</p> <p>The different features in defining paradoxes</p>	<p><i>a. Types</i></p> <p>Categories of paradoxes (e.g., performance, organization, belonging, learning) at different levels of analysis</p>	<ul style="list-style-type: none"> - How to balance globalization and localization in supply chain design. - How to respond to the persistent, divergent expectations of different supply chain actors. - How to manage the cooperative versus competitive activities between suppliers. - How the supply chain goals of the organization comprise of both efficiency and flexibility. - How, across the organization, different functions will often have different, competing areas of focus/priority. - How procurement’s focus is on social fabric of relationships with the supply chain, but contracts/governance/monitoring have different emphasis. - How to balance the short- and long-term goals of procurement.
	<p><i>b. Relationships</i></p> <p>The interdependence between the opposing poles</p>	<ul style="list-style-type: none"> - How resource scarcity shapes relational and contractual governance of suppliers and how they inform each other. - How innovation drives inter-dynamics of stability versus dissolution of buyer-supplier relationships - How supply chain efficiency enables supply chain innovation and supply chain innovation enhances supply chain efficiency - How supply scarcity accentuates the tensions in managing competing, yet co-existing customer demands/expectations - How the emergence of social enterprises brings supply chain identity to the forefront (nurturer vs. profit-making entity) - How changes in trade relationships, such as Brexit, shape the globalization-localization discussions. - How catastrophic events make the need for both breadth and depth in supplier relationships salient. - How supply chain managers can use discursive strategies to help frame radical innovations as both enablers and barriers to supply chain disruptions.
<p>Category 2</p> <p>APPROACH</p>	<p><i>a. Collective</i></p> <p>Mitigation approaches (e.g., opposition, spatial separation, temporal separation,</p>	<ul style="list-style-type: none"> - How companies can manage the paradoxical supply chain risks (e.g., inventory protecting against supply risk but increasing inventory risk) - How spatial and temporal separation can be used to manage the social, environmental, and supply chain goals - How supply teams can work through conflicting functional goals

How actors address paradoxical tensions	and synthesis) at different levels of analysis	<ul style="list-style-type: none"> - Whether or not the dual supply chain goals of flexibility and efficiency can be synthesized. If yes, how? - How the balancing of centralized and decentralized decision-making processes can support cross-functional teams' response to SC disruption warnings. - How SMEs can maintain innovative capabilities with limited slack resources during disruptions.
	<p>b. Individual</p> <p>Individual actors' capabilities, cognitive, emotional, and behavioral reactions to paradox</p>	<ul style="list-style-type: none"> - How the cultural background (e.g., Eastern vs. Western mindset) informs the responses of supply chain managers to paradoxes. - How the individual's comfort with uncertainty, ambiguity, and defensive stance relates to opportunistic supply chain relationships? - How to address the paradoxical talent and capacity needs of supply chain managers - What the cognitive, emotional, and behavioral traits of the supply chain manager are and how they affect their response to persistent supply chain tensions - How cognitive, behavioral, and structural factors at the individual level trigger dysfunctional conflict, constructive interaction, and their interplay after supplier-induced disruptions.
Category 3	<p>a. Outcomes</p> <p>Consequences of different responses to paradoxes</p>	<ul style="list-style-type: none"> - How embracing or ignoring paradoxes affects supply chain performance. - How co-opetition affects the buyer and suppliers' performance and their relationships <p>How different responses to managing co-opetition affect these outcome variables.</p>
IMPACT	<p>b. Dynamics</p> <p>Cyclical processes that emerge as approaches address persistent tensions</p>	<ul style="list-style-type: none"> - How to manage the cyclical centralization versus decentralization pull in purchasing. - How managers create vicious vs. virtuous cycles in supplier relationship management? - How paradoxical short-term and long-term supply chain goals can undermine or support each other.

Table 3 Summary of the papers in this Special Issue.

<i>Study</i>	<i>How does digitalization alter the paradox of supply base concentration? The effects of digitalization intensity and breadth</i>	<i>The paradox of supplier development in technology-based luxury supply chains</i>	<i>Navigating the “performance-organizing” paradox: tension between supply chain transparency, coordination, and Scope 3 greenhouse gas (GHG) emission performance</i>	<i>Paradox-responding in Humanitarian Temporary Supply Networks: Exploring Strategies and Enabling Mechanisms</i>
Research question	How does digitalization intensity and breadth impact the paradoxical performance implications of high supply base concentration.	How do supplier development, supplier capabilities and buyer-supplier relationship relate technology-based luxury supply chains.	What are the tensions between organizing processes involved in managing firms’ indirect GHG emissions.	How does paradox-responding take place in humanitarian temporary supply networks (TSN) and what enables response?
Paradox	Cost efficiency vs. idiosyncratic risks of supply base concentration	Developing vs. leveraging paradox in the buyer-supplier relationship	Supply chain transparency vs. supply chain coordination Sustainability transparency vs. sustainability performance	TSNs’ management of enduring elements vs. temporary (e.g., logistics); formal vs informal (e.g., communication); local vs international (e.g., governance)
Nature of paradox	Performing / organizing paradox	Organizing / learning paradox	Performing / organizing paradox	Performing / organizing / belonging / learning paradoxes
Resolution strategies	Digitalization in terms of breadth and intensity	-	Acceptance of the paradox and having a long-term perspective as well as a better stakeholder communication strategy.	Explores juxtaposition, combination, spatial separation, temporal separation, and transcendence as responding strategies for network-level paradoxes.
Methods	Regressions on panel data	Case-based research on six dyadic buyer-supplier relationships of two luxury manufacturers	Panel data analyses of a unique data set created by using multiple databases such as Refinitive and Compustat.	Qualitative single case study – 2015 Nepalese earthquake
Contribution to paradox theory	Exploring the performance paradox in supply base concentration, establishing digitalization as a mitigation strategy	Exploring the value co-creation vs. value capture paradox in supplier development	Exploring the complex interconnection and nestedness of various paradoxes.	Exploring the importance of context on paradoxes through looking at temporary network structures & associated resolution strategies. The role

				of enabling mechanisms in paradox response.
Future research questions	Extending the dimensions beyond the breadth and intensity of digitalization to better understand its impact on performance-impact of internal capabilities and the external environment on the paradox	Exploring possible mitigation strategies, especially in the context of potential relationship dissolution or separation	Addressing self-report bias of emission data.	Exploring the role of enabling mechanisms in other contexts. Extending this study beyond single setting design to look at temporary networks in other humanitarian settings.

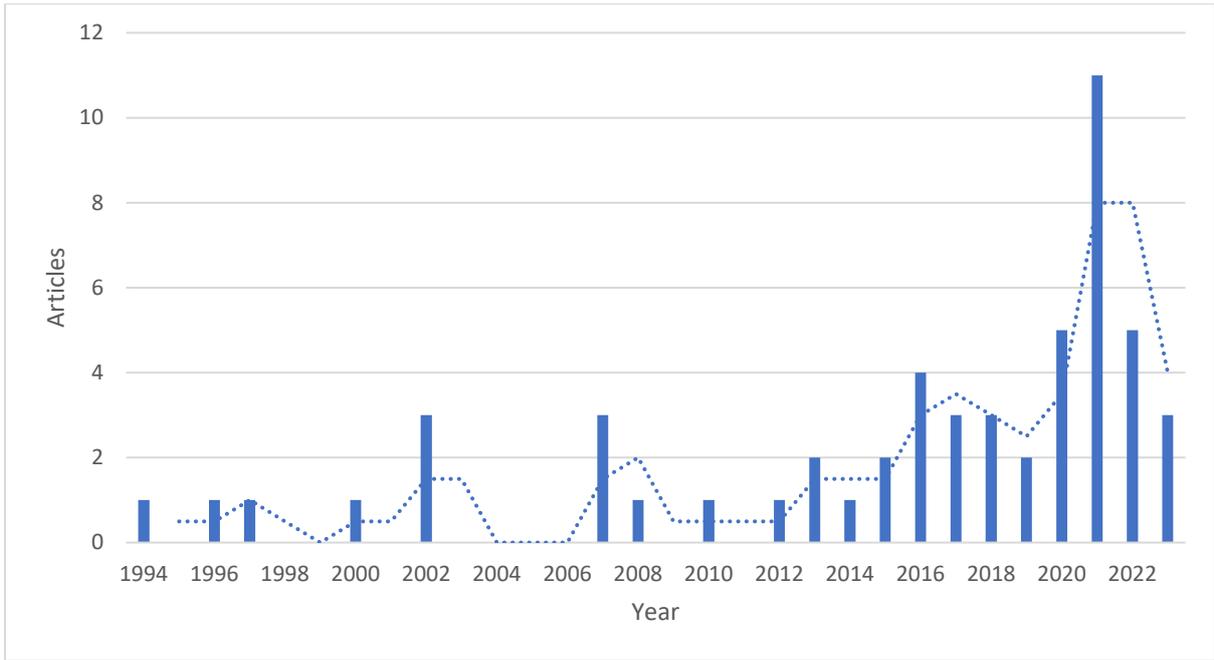


Figure 1 The number of articles published per year.

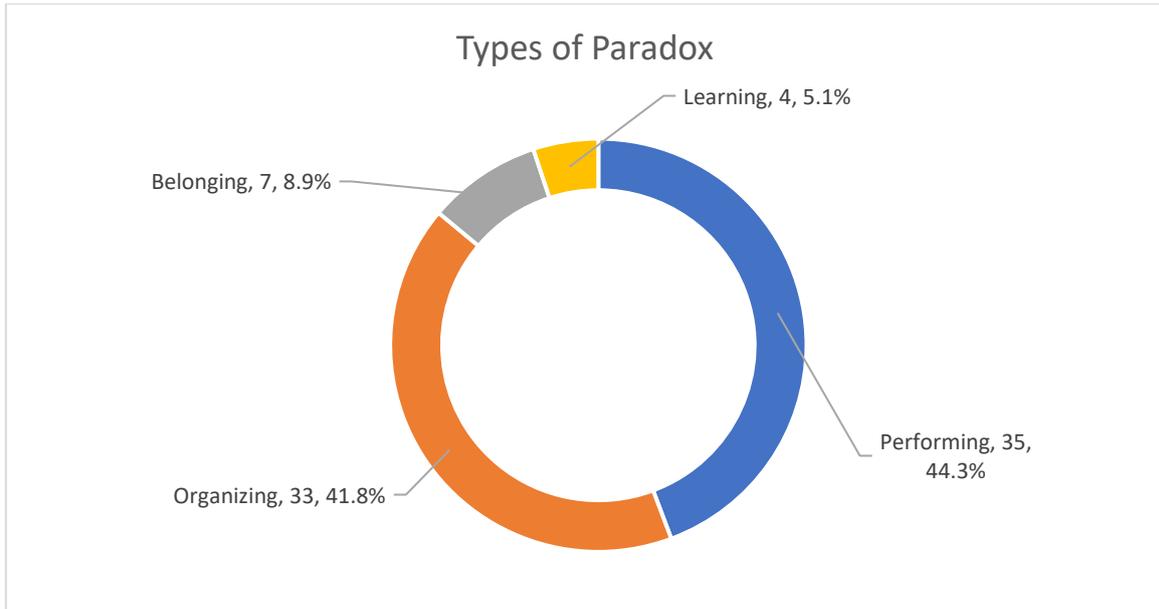


Figure 2 Types of paradox investigated (Note: since an article can cover more than one type of paradox, the sum of the articles by type is greater than the total number of articles.)

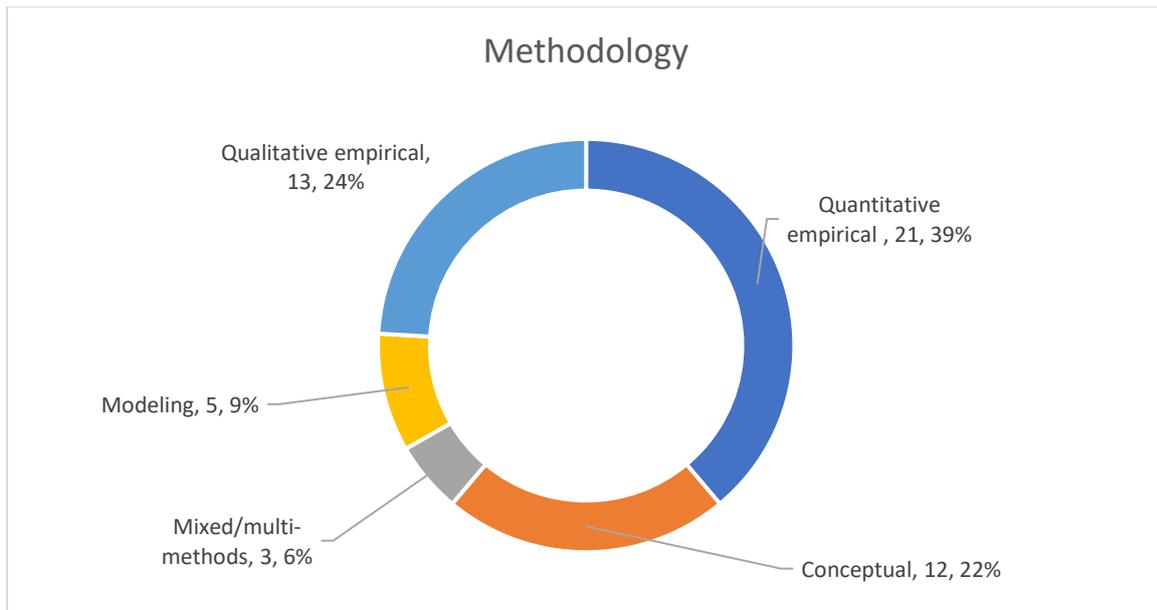


Figure 3 Types of the methodology employed