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Process Research Methods for Studying Supply Chains and Their Management

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ABSTRACT

Processes are fundamental to supply chains and their management. Yet, traditional research approaches to supply chain management (SCM) reflect only a limited understanding of process, offering accounts that overlook the constitutive role of dynamically interrelated processes and how their interplay over time shapes the trajectories of supply chains. This article argues that a process-philosophical perspective is better suited as a starting point for identifying, analyzing, and interpreting the fluid and interwoven processes of supply chains and their co-evolving environments. Drawing on examples from SCM research, the article offers insights into the nature of process-thinking and process-theoretical assumptions, including the analytical choices and challenges entailed in process research. Besides providing methodological guidance, the article highlights how process research methods equip SCM scholars with a powerful lens for studying transformational issues in this field, including sustainability, resilience, and the use of digitalization and technology.

1 | Introduction

Supply chain management (SCM) has been defined as "the integration of key business processes" across multiple organizations (Croxton et al. 2001, p. 13), including the management of customer and supplier relationships, customer service, demand, order fulfillment, manufacturing flows, product development and commercialization, and returns (Lambert and Enz 2017). Consistent with this definition, supply chains, and their management can thus be conceptualized as made up of *processes*, understood as dynamic flows of activities and materials evolving over time.

Traditional SCM research has yielded only a limited understanding of processes, above all because it proceeds from a view of supply chains either as *objects* to be optimized, re-engineered, and coordinated (primarily to reduce costs, enhance quality, and maximize the speed and efficiency of operations) or as *networks* of interlinked organizational entities (Mentzer et al. 2001). Approaching supply chains as more or less fixed entities in this way inevitably risks overlooking and downplaying the constitutive role of processes over time. For example, although Chopra and Meindl (2016, p. 20) define a supply chain as "a sequence of processes and flows that take place within and between different stages," this perspective on processes actually reflects the "dominant supply chain narrative of cost reduction and responsiveness" (Wieland 2021, p. 58). Rooted in a systems engineering view similar to other process management tools (such as business process re-engineering and business process improvement), this view is both normative and reductionist, reflecting an understanding of process as a sequence of material flows and activities that can be deconstructed into composite parts, which supply chain managers can then rearrange to optimize efficiency.

We place author names alphabetically to indicate equal contributions.

Critiquing this traditional approach, some leading SCM scholars have recently proposed a different view of processes. For example, Wieland (2021, p. 59) has argued for the need "to replace the modernist tropes of designing, planning, and optimizing the supply chain" with a new approach that acknowledges interconnectedness and constant change as inherent characteristics of supply chains. This requires a fundamentally different theoretical understanding of process. Put simply, supply chains are conceptualized from this alternative process perspective as dynamic phenomena rather than as connections between static entities, as always *becoming* rather than *being*. Because chains and their management are understood from this perspective as being open to a multitude of evolving contextual influences, their development over time is intrinsically complex and far from perfectly predictable (Wieland 2021, p. 59).

To advance this alternative theoretical understanding of process and explore its methodological implications for SCM scholars, we draw on process philosophy and its applications to management studies (Helin et al. 2014; Langley and Tsoukas 2016; Tsoukas and Chia 2002). A process-philosophical view is better suited to identify, analyze, and interpret fluid and interwoven processes within supply chains and their environments, we argue, because *processes* are understood in this view as continuous phenomena that are indivisible and fully constitutive of the world (Langley et al. 2013). Adopting such a process-philosophical approach is especially crucial when considering unexpected events such as the COVID-19 pandemic or major fluctuations in demand and supply (Azadegan and Dooley 2021; Gereffi 2020). More concretely, this approach is needed to explain the rapidly expanding role of *technological innovations* in SCM (Holmström et al. 2019; Tang 2022), along with pressing issues of *sustainability* and *resilience* in light of potential disruptions and discontinuities (Craighead et al. 2007; Omar et al. 2012; Pettit, Croxton, and Fiksel 2019; Reinecke and Donaghey 2021; Shen and Sun 2023).

A process-theoretical approach can contribute significantly to understanding and addressing these novel phenomena in and around supply chains, not least by shedding light on the material repercussions of supply chains over time (Reinecke and Lawrence 2023). This is crucial because the complex interdependencies that constitute supply chain phenomena can render the outcomes of SCM interventions unpredictable and potentially divergent or recursive (Choi, Dooley, and Rungtusanatham 2001; Cloutier and Langley 2020). Process theories can capture the rippling nature of outcomes over time, including by revealing how short-term gains often transform into longer-term relational, social, or ecological problems. By contrast, traditional views are prone to overlook the temporal ramifications of changes in the complex interplay between multiple processes. Importantly, SCM research from a process-theoretical perspective not only highlights the need for *ongoing* efforts to sustain supply chains as complex and dynamic phenomena but can also identify specific activities needed to adapt to and overcome disruptions. In short, the process research methods we explore in this article can help scholars develop a better understanding of supply chain stability, resilience, and change (Feuls and Hernes 2023).

Our overarching aim in this article is thus to offer key insights into the nature of process-thinking and process-theoretical assumptions and to elucidate and illustrate effective ways in which they can be incorporated into empirical SCM research. In doing so, we focus on the potential of process research methods to yield insights into issues currently at the forefront of supply chain–related concerns among scholars and practitioners alike, including sustainability, resilience, and the effects of proliferating digitalization and technology. These themes cannot be sufficiently grasped with existing methods.

In the remainder of this article, therefore, we clarify the assumptions underpinning process research and the applicability of process research methods to SCM scholarship, using studies on supply chains that have begun to move in this direction as illustrations to emphasize the characteristics of process research. Building on these examples, we introduce a repertoire of methodological tools useful for process research of supply chains, exploring the choices and challenges involved. We conclude by laying out directions for further research.

2 | Process Research and Its Application to Supply Chains

> Process studies address questions about how and why things emerge, develop, grow, or terminate over time, as distinct from variance questions dealing with covariation among dependent and independent variables [...] Process research, thus, focuses empirically on evolving phenomena, and it draws on theorizing that explicitly incorporates temporal progressions of activities as elements of explanation and understanding.
>
> (Langley et al. 2013, p. 1)

The distinction expressed in the above definition between "process questions" and "variance questions" is critical to understanding the nature of process research. Variance questions take variables to be the most important elements of theorizing and emphasize the identification of correlations or causal relationships between variables as the key purpose of empirical research (see also Cornelissen, Stephens, and Matthews 2024). From this perspective, there is often little attention paid to temporality per se other than the recognition of a lag between independent and dependent variables. In contrast, process questions focus on qualitatively different kinds of concepts—not variables, but rather events, activities, and choices interacting over time. Process research aims to understand the ways in which these events, activities, and choices unfold through temporal sequences or other kinds of recursive or non-linear patterns that imply change or continuity in organizational phenomena (Cloutier and Langley 2020). This is an entirely different form of explanation that appears almost orthogonal to variance thinking. Put simply, a process-theoretical view apprehends phenomena as brought into existence through ongoing events and activities and thus as always to some degree emergent.

Variance thinking has tended to dominate academic scholarship in many fields, including the study of supply chains. In a frequently

cited framework of SCM developed by Mentzer et al. (2001), for example, the authors position supply chains as constructs composed of sets of dimensions or variables with causal antecedents (e.g., a firm's supply chain orientation) and consequences (e.g., lower costs, improved customer value and satisfaction, and competitive advantage). Although this perspective can be useful for understanding relations between supply chain variables, it tends to leave the dynamics of supply chains and the complexities of their temporally evolving flows in the shadows.

In contrast, process research can illuminate the interplay of multiple processes as they emerge and unfold over time to explain why and how supply chains evolve and respond to surrounding phenomena. Such a focus is especially salient as supply chains become increasingly global and fragmented. For example, process research can shed light on the linkages between different geographies and help understand how downstream supply chain dynamics (e.g., supplier sourcing choices or purchasing practices by end-user retailers) affect people and operations in the upstream (e.g., lead times or order volatility) (Reinecke and Donaghey 2021). In the case of sustainability initiatives undertaken across supply chains, the sheer complexity of organizational changes involved in such initiatives (Omar et al. 2012) calls for process perspectives to better understand how transitions can be achieved. Similarly, process perspectives can contribute to the understanding of resilience by capturing effective responses to disruption events and crises. This is because resilience is not only about stability but also about adaptation and transformation (Wieland and Durach 2021).

In response to these issues, SCM scholars have begun to argue for the relevance of process-oriented theories that consider the unpredictability, complexity, and tensions underpinning the emergence and evolution of supply chains. For example, scholars have proposed complex adaptive systems theory (Choi, Dooley, and Rungtusanatham 2001; Villena and Gioia 2018), paradox theory (Matthews et al. 2016; Xiao et al. 2019), and actor–network theory (Hald and Spring 2023; Pablo et al. 2021) as approaches better suited to understand the evolution of supply chains. Others have stressed the need to unravel the *transformative* power of supply chains (Wieland 2021), to *humanize* SCM research by focusing on actor experiences and power dynamics (Kull, Ellis, and Narasimhan 2013; Soundararajan, Wilhelm, and Crane 2021), and to capture "multidirectional causalities, and feedback loops, which often disturb the steady, linear progression toward 'equilibrium'" (Omar et al. 2012, p. 15).

These theoretical perspectives demand the application of methodological tools that may still be unfamiliar to many SCM scholars, suggesting a need for greater methodological guidance to facilitate their adoption. Providing such guidance is precisely the aim of our present article. We do so by focusing on the choices and challenges involved in undertaking process studies, drawing on examples of studies on supply chains that have begun to move in this direction.

3 | Methodological Considerations in Process Research: Choices and Challenges

At the outset of any empirical study, researchers need to make methodological, conceptual, and onto-epistemological choices, each of which involves certain opportunities and challenges. In discussing these challenges in the context of process research and considering their implications for SCM scholarship, we draw on a range of SCM studies to illustrate important methodological insights into process-oriented research. To identify relevant examples, we scanned SCM scholarship and related areas such as interorganizational theory, networks, and alliances, looking for work that explicitly mentions processes and that draws on different onto-epistemological assumptions, research designs, data, and modes of analysis. Table 1 summarizes the empirical articles we found particularly illustrative of the relevant choices and challenges. Our selection is not intended to be exhaustive but rather to exemplify a range of perspectives on process research and to illuminate important methodological considerations. The articles also vary in the extent to which they appropriate all aspects of process methods, enabling us in some cases to draw attention to opportunities for further development.

Several studies consider the processes involved in collaboration between buyers and suppliers—a theme inherent to the very notion of managing a supply chain. These studies have advanced our understanding of how such collaboration can generate tensions and complexities over time, both for individual managers (Omar et al. 2012) and participating organizations (Barbieri, Dattée, and Mahapatra 2023; Sting, Stevens, and Tarakci 2019), potentially resulting in cyclical dynamics and even leading to relationship dissolution (Chen, Dooley, and Rungtusanatham 2016). Our selection also includes studies of interorganizational relations, networks, and alliances, with a specific focus on processes of interaction between multiple organizations (Berends, van Burg, and van Raaij 2011; Gulati 1995; Howard et al. 2019; Paquin and Howard-Grenville 2013). The articles we draw upon address in different ways the themes mentioned above as critical to current concerns in SCM. Indeed, the complexities of managing buyer–supplier relations have been deepened by pressure to implement greener and more sustainable supply chains, and these issues are addressed by several articles in our collection (Grimm and Reinecke 2024; Jia, Hendry, and Stevenson 2022; Nair et al. 2016; Reinecke and Donaghey 2021; Soundararajan and Brammer 2018; Villena and Gioia 2018). Other themes explored from a process perspective include the issue of supply chain resilience (Abushaikha, Wu, and Khoury 2021) and the role of digital technologies in transforming supply chain processes (Hausman et al. 2010).

The methodological themes we examine below are partly inspired by more general methodological texts on process research methods (Jarzabkowski, Le, and Spee 2017; Langley 1999, 2009; Langley et al. 2013; Pettigrew 1992; Tsoukas and Chia 2002; Van de Ven 1992). We present the themes under five broad headings related to onto-epistemological assumptions, research design, data collection, data analysis, and theoretical contributions (see Table 2 for an overview).

3.1 | Onto-Epistemological Assumptions About Processes

Process studies focus in one way or another on the temporal flow of activity over time (Langley et al. 2013). Within this broad framing, however, there are different ways to understand the precise nature of processes. Here, it bears reiterating

TABLE 1 | Examples of process studies dealing with supply chain management and related phenomena.

Author(s)	Research question(s)	Context	Theoretical resources	Temporal orientation	Unit(s) of analysis	Sampling	Data sources	Analytical strategy	Conceptual product
Abushaikha, Wu, and Khoury (2021) *Journal of Operations Management*	How do the economic activities of refugees shape humanitarian relief operations inside a refugee camp?	Emergence of informal supply networks in the Za'atari refugee camp in Jordan	Social capital theory (the role of bonding, linking, and bridging ties in networks)	Real time (Jan 2016–Sep 2018) and retrospective (2012–2018)	Informal supply networks	Single case study with embedded units of analysis: three informal supply networks in a refugee camp	Observations (five visits); 52 interviews; photos, videos, and archives	Grounded theorizing; comparative cases; visual mapping	Process model showing reciprocal linkages between network configuration, network legitimation, and network resilience
Barbieri, Dattée, and Mahapatra (2023) *International Journal of Operations & Production Management*	Why and how are supplier development activities managed by innovative, technologically complex, luxury product firms?	Automotive industry (two buyers and their suppliers)	Paradox theory	Real-time (2012–2014 and 2016–2017)	Buyer–supplier dyads	Multiple cases with embedded units of analysis: two firms managing supplier development activities at three suppliers (six dyadic relationships)	74 Interviews with buyers and suppliers; observational notes; written data	Grounded theory; comparative cases; causal loop diagrams	Process causal loop model revealing how successful supplier development may paradoxically lead to the demise of the relationship over time
Berends, van Burg, and van Raaij (2011) *Organization Science*	How do interorganizational and interpersonal networks interact over time?	Development of new aircraft material with partners at Glare	Inter-organizational networks theory	Retrospective (1986–2008)	Episodes of change in network structures	Single case with embedded unit of analysis: 34 episodes reflecting changes in network structures	30 Interviews; emails; technical books; archives	Narrative strategy; temporal bracketing; grounded theory	Process model showing the recursive structuration of interpersonal and interorganizational networks
Chen, Dooley, and Rungtusanatham (2016) *Journal of Purchasing and Supply Management*	What is the process whereby product failure can lead to the dissolution of a strong buyer–supplier relationship?	Dissolution of the Ford-Firestone buyer–supplier relationship	Supplier network perspective	Retrospective (Feb 2000– May 2001)	Events leading to relationship dissolution	Single "extreme" case of a strong relationship that dissolved; 158 events leading to dissolution	1059 Media articles; 141 congressional hearing transcripts; other archives	Narrative strategy; quantification; sequence analysis	Five generalizations about event sequences leading to relationship dissolution, highlighting the critical role of mutual blame in this process
Grimm and Reinecke (2024) *Academy of Management Journal*	How do multiple interaction arenas affect frame alignment and how do actors navigate across different arenas?	Garment industry (multiple stakeholder groups)	Framing theory; inter-organizational collaboration	Real-time (2015–2021) and retrospective (2014)	Interaction traces	Single case of a textile partnership involving five different stakeholder groups	92 Interviews with 48 individuals over time; observations; documents	Narrative strategy; temporal bracketing; grounded theory	Process model highlighting multiple interlocking interaction arenas, and the mechanisms of mutual influence between them

(Continues)

TABLE 1 | (Continued)

Author(s)	Research question(s)	Context	Theoretical resources	Temporal orientation	Unit(s) of analysis	Sampling	Data sources	Analytical strategy	Conceptual product
Gulati (1995) *Administrative Science Quarterly*	With whom do firms ally? How does social structure affect interfirm alliance formation patterns?	Automotive firms co-developing new materials; industrial automation	Strategic alliances; network theory; resource dependence	Real-time (1970–1989)	Dyads (including all possible interfirm dyads in each sector)	Multiple cases: 166 firms across three sectors	Documents (from databases, industry reports, and articles)	Network analysis; regression analysis; comparative analysis	Confirmation of six hypotheses regarding the effects of social structure on interfirm alliance formation patterns
Hausman et al. (2010) *Journal of Supply Chain Management*	How are cross-border trade processes organized and how could IT-enabled global trade management improve them?	Exporters and intermediaries in China to US trade lane for apparel	Business process engineering; transaction cost analysis	Current operations; process snapshot	Cross-border trade processes	Single case of the China-to-US trade lane for apparel goods	19 Sources of information (interviews; documents).	Grounded theory; visual mapping; scenario analysis	Process model of IT-enabled global trade management for global trade lanes, with 106 steps
Howard et al. (2019) *British Journal of Management*	How do governance mechanisms make functional and/or dysfunctional contributions to exchange performance over time?	Acquisition of new ship assets for the UK Royal Navy	Governance theory; inter-organizational theory	Real-time (2005–2012) and retrospective (1997–2006)	Dyadic relationships	Multiple cases: Two contractual relationships selected to compare processes underlying successful and unsuccessful exchange relations	40 Interviews; observations	Grounded theory	Three propositions regarding the positive/negative impacts of formal/informal governance mechanisms on relationship exchange performance over time
Jia, Hendry, and Stevenson (2022) *International Journal of Operations & Production Management*	How is supplier absorptive capacity developed via boundary objects in sustainability-oriented supplier development (SSD) initiatives?	Garment industry (one buyer and four suppliers)	Learning theory; boundary objects theory	Real-time (two phases over a 12-month period)	Suppliers' responses to SSD initiatives	Single case with embedded units of analysis: four suppliers of the same firm in relation to an SSD initiative involving two boundary objects	50 Interviews with 26 people across four suppliers; observations; reports	Abductive coding; comparative analysis	Process model of supplier absorptive capacity development, and six propositions about learning processes in the context of SSD initiatives
Nair et al. (2016) *Journal of Supply Chain Management*	How do environmental innovations emerge and proliferate in supply networks?	Supplier networks of Hyundai Motor Company and Samsung SDI	Complex adaptive systems; Theories of multi-level learning	Real-time (2003–2010)	Supply networks of original equipment manufacturers (OEMs)	Multiple cases: two OEMs' and their supplier networks	Interviews, archival materials, documents	Abductive coding; narrative; visual mapping; temporal bracketing	Process model of emergence and proliferation of environmental innovations in supply networks through four subprocesses

(Continues)

TABLE 1 | (Continued)

Author(s)	Research question(s)	Context	Theoretical resources	Temporal orientation	Unit(s) of analysis	Sampling	Data sources	Analytical strategy	Conceptual product
Omar et al. (2012) *Journal of Business Logistics*	How do supply chain managers perceive, interpret, and react to pressures to change to a supply chain mindset?	Supply chain managers within seven manufacturing organizations	Interpretive ontology; organizational change	Retrospective; process snapshots	Individual managers	Multiple cases with embedded units of analysis: seven firms, with a focus on 121 employees, customers, and suppliers	121 Interviews; documents	Grounded theory	Process model of how managers make meaning from experiences and interactions as they prospect, implement, and respond to change
Paquin and Howard-Grenville (2013) *Organization Studies*	How do orchestrators build a new inter-organizational network and how do their actions shape and respond to the network over time?	National Industrial Symbiosis Programme (NISP)	Network orchestration theory	Real-time (2005–2009)	Inter-organizational networks	Single case of an industrial symbiosis network with embedded units of analysis (orchestrator and industry participants)	Over 50 interviews (NISP staff and companies), observations, archives	Grounded theory; network analysis	Processual understanding of orchestrated network assembly and growth over time
Reinecke and Donaghey (2021) *Journal of Management Studies*	What role do MNCs play in developing dialogical processes at the workplace level? How does this affect the nature of political CSR?	Workplace dialog in Bangladeshi apparel factories	Political CSR; industrial democracy	Real-time (2014–2019)	Individuals	Single case of a workplace dialog program organized aimed at improving working conditions in global supply chains	50 Interviews; observations; documents	Grounded theory	Process model of how MNCs enable deliberative spaces in their supply chains and how this is likely to change the nature of political CSR
Soundararajan& Brammer (2018) *Journal of Operations Management*	What processes are involved in the response of sub-suppliers to the social sustainability requirements of intermediaries?	Garment industry sub-suppliers and intermediaries	Bounded self-interest theory; framing theory	Retrospective (Dec 2012–May 2017)	Intermediary–sub-supplier dyad	Multiple cases: 11 intermediary–sub-supplier dyads (with one intermediary connected to two sub-suppliers)	111 Semi-structured interviews; informal conversations; observations; documents	Narrative strategy; grounded theory; comparative cases	Process model of how framing shapes perceptions of fairness and response reciprocity among sub-suppliers in a social sustainability initiative
Sting, Stevens, and Tarakci (2019) *Journal of Operations Management*	How may temporary de-embedding influence supply chain performance?	Automotive industry: one buyer and one supplier (Nissan)	Complexity theory	Real-time (1999–2012)	Relationship between buyer and supplier	Single case of the relationship between Nissan and one supplier over time	Documents; 23 interviews on both sides	Temporal bracketing; grounded theory; computational simulation	Four propositions on how temporary de-embedding can influence supply chain performance

(Continues)

TABLE 1 | (Continued)

Author(s)	Research question(s)	Context	Theoretical resources	Temporal orientation	Unit(s) of analysis	Sampling	Data sources	Analytical strategy	Conceptual product
Villena and Gioia (2018) *Journal of Operations Management*	How do MNCs manage sustainability concerning both their Tier 1 and lower tier suppliers? How do their practices differ?	MNCs and suppliers in automotive, electronics, and consumer–product/pharma industries	Sustainable supply chain management	Real-time (Jan 2013–Nov 2015)	Supply network	Multiple cases with embedded units of analysis: three MNCs and their supply networks (nine first-tier and 22 lower tier suppliers)	165 Interviews; observations; archives	Grounded theory; comparative analysis	Empirically grounded theoretical framework for managing a sustainable supply network, with recursive elements

that we are not referring to the optimization of business processes as typically considered in SCM practice but rather to process as a philosophical perspective underpinning research in which phenomena are viewed as continually evolving over time. Yet, even within this perspective, scholars may adopt onto-epistemological assumptions that differ in specific ways which is important to understand. To aid in this effort, we draw on a typology proposed by Fachin and Langley (2018) to identify four ideal-type orientations toward process studies: *process as evolution*, *process as narrative*, *process as activity*, and *process as withness*.

The most common orientation is *process as evolution*, in which the focus of research is on examining how entities (e.g., supply chains or buyer–supplier relationships) evolve over time, assuming that these phenomena are observable in the real world. Scholars adopting this perspective focus their attention on capturing concrete events and temporal sequences of activities or phases that contribute to change in focal entities over time. They then look for ways to understand the relationships among these events. A good example of a study that takes this perspective is Chen et al.'s (2016) documentation of 158 events that led to the dissolution of Ford's buyer–supplier relationship with Firestone, with their analysis focused on the linkages between these events.

In contrast, research from a *process as narrative* perspective focuses less on concrete events documented in the "real" world but rather on how people construct narrative interpretations of past, present, and future as they make sense of and recount their experiences. Omar et al.'s (2012) interpretive study of how 121 operations managers experienced the process of adapting to a new supply chain orientation is representative of this narrative perspective. The focus here is on the *subjective* meanings attributed by people to temporally evolving experiences rather than on *objective* patterns in event sequences.

Note how these first two perspectives on process are likely to require different types of research designs, data, and analysis. For example, a process-as-narrative perspective is likely to require access to individual interview accounts, whereas a process-as-evolution perspective might benefit from longitudinal archival data, perhaps accompanied by complementary sources such as interviews and observations.

Process as activity, the third perspective in Fachin and Langley's typology (2018), also has distinct implications for research. Drawing on ideas developed by key process philosophers such as A. N. Whitehead (1929/2010), this is sometimes called a "strong" process perspective, as in this view, "substances are considered to be subordinated to and constituted by processes" (Langley and Tsoukas 2010, p. 8). For example, although we often speak about supply chains as if they were fixed entities or substances, they are in fact made up of ongoing activities and exchanges that need to be continually reproduced every day. Consistent with this understanding, a process-as-activity perspective focuses on how ongoing activities and practices *constitute* phenomena rather than on how defined entities evolve over time. Although this perspective is not common in the supply chain literature, Abushaikha, Wu, and Khoury (2021) come close to adopting this approach

TABLE 2 | Checklist of choices and challenges for process studies in SCM.

Choices and challenges	Focus and description	Implications and/or examples
1 Onto-epistemological assumptions		
• Process as evolution	• How entities (e.g., supply chains and buyer–supplier relations) evolve over time	• Longitudinal case studies (e.g., Chen, Dooley, and Rungtusanatham 2016; Nair et al. 2016)
• Process as narrative	• How people construct subjective narratives to make sense of their temporal experience	• Interview studies of individuals' experiences (Omar et al. 2012)
• Process as activity	• How ongoing activities and practices constitute phenomena	• Ethnographic studies (Abushaikha, Wu, and Khoury 2021; Grimm and Reinecke 2024)
• Process as withness	• How researchers themselves also evolve over time together with the people/processes they study	• Action research, collaborative studies (Hausman et al. 2010)
2 Design choices & challenges		
• Temporal orientation	• Retrospective: Tracing back to explain known outcomes • Real time: Following forward to capture emerging processes • Mixed: Collecting data in successive waves to combine real-time and retrospective approaches	• Efficient but may be subject to hindsight bias (Berends, van Burg, and van Raaij 2011) • Richer data but open-ended and uncertain (Grimm and Reinecke 2024) • Combining strengths but resource-intensive (Barbieri, Dattée, and Mahapatra 2023)
• Units of analysis	• Organizational and intra-organizational units of analysis (e.g., individuals and subunits) • Dyadic and network units of analysis (e.g., supplier–buyer relations and supplier networks) • Temporal units of analysis (e.g., events and episodes of change)	• Eases data collection but may not capture SCM complexity (Omar et al. 2012) • Captures complexity, but may involve access challenges (Sting, Stevens, and Tarakci 2019) • Needs strong documentation of key events (e.g., Chen, Dooley, and Rungtusanatham 2016)
• Sampling	• Single case • Multiple cases (sometimes embedded within a single overarching case) used in different ways • Sampling of data sources *within* cases	• Enables rich detail and revelatory insights (Grimm and Reinecke 2024) • Links processes to outcomes (Soundararajan and Brammer 2018) • Shows similar processes across different settings (Nair et al. 2016) • Reveals variety in processes (Abushaikha, Wu, and Khoury 2021) • Ensures cases are "saturated" with data from all relevant sources
3 Data choices and challenges		
• Quantitative data	• Using statistical methods to capture and analyze events and sequence patterns	• Best if enriched with a qualitative account (Chen, Dooley, and Rungtusanatham 2016)
• Qualitative data	• Gathering data from interviews, observations, and documents ("the big 3"), but also possibly other sources such as video, email, visuals, diaries, etc.	• Interviews are prone to retrospective bias; best to elicit multiple viewpoints and complement these data with other sources.
4 Analytical choices and challenges		
• Induction vs. Deduction vs. Abduction	• Bottom-up coding using grounded theory-based methods (Gioia, Corley, and Hamilton 2013) • Top-down coding drawing on a priori theories (e.g., complexity theory) • Abductive approach combining top-down and bottom-up coding	• Links data to concepts, but may be descriptive (Villena and Gioia 2018) • Strong links to prior theory, but frameworks may appear imposed on data • Connects to theory but allows novel insights from data (Nair et al. 2016)

(Continues)

TABLE 2 | (Continued)

Choices and challenges	Focus and description	Implications and/or examples
• Other analytical methods (Langley 1999)	• Narrative: Drawing on different sources of data to develop case chronologies • Visual mapping: Representing data in visual form (e.g., flow charts) • Temporal bracketing: Decomposing data into temporal blocks for comparison	• Useful to organize data for coding (Soundararajan and Brammer 2018) • Can capture event linkages over time (Nair et al. 2016) • Structures analysis according to temporal phases (Sting, Stevens, and Tarakci 2019)
5 Products of process research		
• Patterns	• Models showing patterns in temporal flows (linear, bifurcational recursive, and multi-level)	• See Figure 1. (For other variants, see also Cloutier and Langley (2020))
• Mechanisms	• Explanations of the mechanisms underpinning process patterns (e.g., life cycle, teleological, dialectical, and evolutionary mechanisms (Van de Ven and Poole 1995))	• Examples: teleological mechanisms (Villena and Gioia 2018), dialectical mechanisms (Barbieri, Dattée, and Mahapatra 2023)
• Theoretical propositions	• Formal statements predicting flows and/or contingencies that may change flows	• Examples: Chen, Dooley, and Rungtusanatham (2016); Soundararajan and Brammer (2018)

in their study, showing how informal supply chains emerged through ongoing activities and exchanges between actors in and around a refugee camp.

The final perspective, *process as withness*, draws on ideas developed by process philosopher John Shotter (2006), who emphasized how researchers themselves are evolving over time along with the processes and people they are studying. Since researchers cannot step outside time or separate themselves from the contexts they study, Shotter argues for a shift in perspective, urging researchers to work actively *with* those they are studying and to jointly learn and discover ways forward into the future rather than simply explaining the past. This perspective thus reflects a pragmatist philosophy (Lorino 2018), resonating remarkably well with traditions in operations management and SCM research that have often been oriented towards practical action. We see this, for example, in Hausmann et al.'s (2010) analysis of approaches to improving global trade management.

Beyond onto-epistemological assumptions about the *nature* of process per se, different scholars also adopt distinct onto-epistemological assumptions about the *research process* more broadly. Such assumptions are typically identified as falling into three main positions: positivist and post-positivist, interpretive (or constructivist), and critical (e.g., Cornelissen, Stephens, and Matthews 2024; Guba and Lincoln 1994). Positivist and post-positivist assumptions alike imply a belief that an objective reality exists and that the researcher's role is to capture that reality as faithfully as possible, positioning the researcher as separate from the phenomena they are investigating. In contrast, an interpretive view implies an assumption that reality is socially constructed and thus that the researcher's role is to capture the range of interpretations available and the ways in which collective meanings are shaped. A critical view also assumes that reality is socially constructed, but implies that this construction occurs through socio-historical processes that favor some participants' interests over others, producing taken-for-granted inequalities. Here, the researchers' job is to unmask these socially constructed processes to encourage a rebalancing of inequalities (Guba and Lincoln 1994). Scholars approaching phenomena from interpretive and critical perspectives assume a more subjectivist stance with respect to their research sites, recognizing the impossibility of stepping completely outside the situations they study.

These research paradigms do not necessarily fit perfectly with any particular set of assumptions about the nature of process. However, a process-as-narrative perspective would normally imply an interpretive paradigm because it involves a focus on the subjective interpretations of respondents about links between past, present, and future. Positivist or post-positivist assumptions seem a priori more compatible with a process-as-evolution view. Yet, a focus on evolution could also be consistent with social constructionist assumptions, as could research undertaken from process-as-activity or process-as-withness perspectives. It all depends on whether events and activities and other temporally embedded phenomena are considered to be objectively identifiable or socially constructed in and through interactions and the understandings of participants.

Overall, therefore, it is vital for researchers to carefully think through their a priori onto-epistemological assumptions because these will make a difference to the types of research questions posed and research methods needed to address them. To take a very simple example, let us suppose that a researcher wishes to undertake a process study of sustainable supply chains. In doing so, they might explore any of a wide variety of research questions from various process perspectives, as in the following examples:

> What is the sequence of steps that organizations go through to achieve sustainable supply chains? (*process as evolution*)

How do different supply chain actors (i.e., procurement managers, suppliers, and workers) experience the transition to sustainable supply chains? (*process as narrative*)

What activities and interactions are involved in enacting sustainability in supply chains? (*process as activity*)

How can we intervene to improve the sustainability of a supply chain? (*process as withness*)

Although the differences between these questions may seem quite subtle, they can have important consequences for subsequent choices and challenges concerning research design, data, and modes of analysis, as well as theoretical outcomes. Below, we discuss these choices and challenges in more depth.

3.2 | Design Choices and Challenges

As with any research enterprise, undertaking process studies requires scholars to give some thought to their research design, preferably prior to entering the field. Below, we discuss three aspects of research design: temporal orientation; units of analysis; and case selection.

3.2.1 | Temporal Orientation

By definition, capturing temporality is extremely important in process studies; yet, this may be done in several different ways. Specifically, process studies may trace processes *backward* retrospectively, or they may follow them *forward* in real time (Bizzi and Langley 2012; Langley and Tsoukas 2010) or potentially combine both. Retrospective studies most often work backward from a known outcome in order to understand how a process unfolds, typically with the aim of explaining that outcome. For example, to understand the dissolution of Ford's buyer–supplier relationship with Firestone, Chen, Dooley, and Rungtusanatham (2016) start from the endpoint in their case (i.e., the dissolution event) and then draw on archival material (e.g., newspaper articles, documents, and press releases) to reconstruct the historical events leading to this outcome. From this, they deduce event patterns (e.g., buyer–supplier interactions and interactions with external stakeholders) that help them show how dissolution becomes increasingly likely through different types of interactions that resonate with one another over time.

The advantage of drawing on retrospective data is that the outcome is known, creating a clear end point in the analysis. This enables retrospective studies to be much more efficient than real-time data collection, where the focus of attention may be less clear and where time may need to pass for relevant events to occur and be captured. On the other hand, there is a significant risk of hindsight bias in retrospective studies. Moreover, the data will almost certainly be less detailed than data collected in real time. This is not to say that researchers cannot counterbalance these risks and downsides. For example, in their retrospective longitudinal study of how formal contractual relations among buyers and suppliers were shaped over time by interpersonal contacts, Berends, van Burg, and van Raaij (2011) exemplify procedures that may be used to mitigate the risk of hindsight bias. First, the authors collected data from different respondents across time and across organizations to detect any differences in perspectives. Second, they triangulated interview and archival data to cross-check whether written documentation and interview accounts were aligned. Third, they structured interviews around specific memorable events, with two interviewers present. Fourth, respondents were asked to double-check the case description in order to reconcile differences in interpretation.

Nevertheless, we argue that research that builds on real-time data generally offers a stronger basis for understanding a process as it unfolds. In particular, having no advance knowledge of outcomes can reveal dynamics that would be less obvious if traced retrospectively. This is the case in Grimm and Reinecke's (2024) study of the German Textiles Partnership, for instance, where the authors traced processes in real time as downstream lead firms negotiated a shared commitment to govern their upstream textile supply chain processes more sustainably. As the authors followed these unfolding developments, they could not know in advance whether the multi-stakeholder negotiations would succeed or fail in improving overall supply chain sustainability. It was only later during the research process, after repeated rounds of interviews with stakeholder representatives during the negotiation process itself, that the authors were able to observe the surprising outcome that negotiating parties were successively strengthening their commitments over time. Crucially, it was their witnessing the uncertainty of each round of negotiations in real time that alerted the researchers to the fragility of stakeholder dynamics. From this, they derived the key insight that the constant risk of partnership failure increased the parties' willingness to make compromises, ultimately strengthening the partnership.

Studying processes in real time also involves challenges and risks, of course, including the possibility that research may lack focus while data are still being collected. Moreover, there is a risk that researchers may lack historical context for understanding the processes they are witnessing. To mitigate the latter risk, many authors who engage in real-time data collection also collect complementary retrospective data. For example, Abushaikha et al.'s (2021) single case study of the emergence of informal supply chains in a refugee camp draws on ethnographic observations and semi-structured interviews to capture real-time interactions and the relationships between different actor groups in the camp as they unfold. However, they also draw on other materials, such as retrospective photographs and videos, as well as on archival records, to reconstruct the physical infrastructure and history of the camp. Having both real-time and retrospective data helped the authors to triangulate across different data sources and add insights into social and cultural issues they might not have detected otherwise.

Other ways of carrying out real-time process studies include conducting a sequence of more or less intense waves of data collection spread out over time. For example, Barbieri, Dattée, and Mahapatra (2023) collected data on supplier development in two luxury product firms in two phases (2012–2014 and 2016–2017). Although the intense data collection phases enabled the authors to trace the dynamics of buyer–supplier

interactions unfolding at that time, the second phase interviews also enabled them to reconstruct events that had occurred between one phase and the next. This strategy is ideal for allowing sufficient time to pass for events to progress while reducing demands for continuous involvement. A similar design, with four separate waves of data collection between 2012 and 2017, is described by Soundararajan and Brammer (2018) in their study of the responses of sub-suppliers to social sustainability initiatives.

Studies adopting a process-as-narrative perspective may also be carried out at a single point in time using a retrospective focus. Here, the purpose is not so much to trace events as to capture meanings and to understand how people make sense of changes that have occurred within their personal experiences. For example, based on interviews held at a single point in time, Omar et al. (2012) were able to show how individuals constructed different phases of meaning-making associated with the activities of prospecting for change, implementing change, and responding to change, constructing links at the moment between past, present, and future. Here, as long as a process-as-narrative onto-epistemological perspective is adopted, hindsight may be regarded less as a concern and more as a feature of the way process is understood. Indeed, when actors refer back to happenings and events that were meaningful to them, it is the meanings they make in the present that will shape their future actions and understandings, constituting process as they experience it.

Although taking time into account is important in process studies, simply assessing or measuring concepts at different points in time does not make a process study. Successive measurements of a variable over time can generate only what Pettigrew (1992) labels "comparative statics." This cannot help authors understand processes unless their study also includes some kind of retrospective or real-time data capable of capturing *how* change unfolds through chains of activities and events.

Beyond these considerations of the upsides and downsides of retrospective versus real-time data collection, the very nature of time and temporality is an important philosophical issue that has preoccupied many process scholars (Blagoev et al. 2024; Hernes 2022). The implications of this issue for SCM scholarship relate notably to sustainability, where the temporal assumptions adopted by supply chain actors may prove critical, including whether priority is given to the long-term or the short-term and whether the focus is on objective clock time or more subjective "process time." For example, drawing on ethnographic data to study Fairtrade supply chain certification, Reinecke and Ansari (2015b) highlight how conflicts arise when supply chain participants evince conflicting temporal assumptions. The authors show how inspections of suppliers' sustainable development process were based on a "clock time" orientation that focuses on measuring supplier progress against concrete development outcomes at fixed points in time, such as whether a certain number of schools are built or environmental targets are reached. This promoted short-term deliverables but undermined Fairtrade's intent to promote long-term trajectories of change for sustainable development. In contrast, a "process time" perspective captures the indivisible change that happens *in between* supplier inspections, such as empowering supplier farmers to improve their health, education, or organizational capabilities.

These examples underscore how temporal assumptions are highly consequential for the ways sustainability is managed in supply chains, meaning SCM scholars also need to consider their own temporal assumptions in designing research on supply chain sustainability. In particular, a process-as-evolution view tends to be associated with pinpointing specific milestones in clock time, potentially missing ongoing changes associated with process time. A process as activity perspective that captures such ongoing activity is thus more compatible with process time assumptions.

3.2.2 | Units of Analysis

Given the complexity of transnational supply chains that consist of multiple supply chain tiers, it is intrinsically challenging to decide upon the most appropriate unit of analysis to study (i.e., which entity or process element to focus upon and analyze). Researchers who consider supply chains as linear may choose to focus accordingly on one or several elements along the chain. However, it is also possible to zoom out on relationships and interactions *between* supply chain actors. As such, process studies of supply chains may need to consider multiple units of analysis as well as interactions among these units (see Table 1).

In their review of research on sustainable supply chains, Brammer, Hoejmose, and Millington (2011) found that 66% of studies focused on phenomena at organizational level. This finding indicates a strong tendency to study mid-level processes rather than endeavoring to understand the roles of individuals (lower level) or of interactions among organizations (higher level). Meanwhile, only 8% of studies focused on *interorganizational* aspects such as interactions between buyers and suppliers. Yet, interorganizational dynamics are crucial for understanding interrelated processes both *within* and *between* supply chains. It is encouraging, therefore, to see that the complexities generated by interorganizational dynamics are increasingly explored in recent empirical process studies of supply chains (Abushaikha, Wu, and Khoury 2021; Barbieri, Dattée, and Mahapatra 2023; Hausman et al. 2010; Nair et al. 2016; Soundararajan and Brammer 2018; Sting, Stevens, and Tarakci 2019; Villena and Gioia 2018).

Scholars can also learn from previous studies of interorganizational alliances and relationships where researchers tend to zoom in on networks and dyads as units of analysis to understand a firm's behavior in interorganizational settings (Berends, van Burg, and van Raaij 2011; Gulati 1995; Howard et al. 2019). For example, Gulati (1995) used multi-industry data on dyads of possible alliance partners to identify the role of information flows and emerging trust relationships in the formation of interfirm strategic alliances. Similarly, Soundararajan and Brammer (2018) took the intermediary-sub-supplier dyad as a unit of analysis to understand the implementation of social sustainability standards in multi-tier supply chains. Over a four-and-a-half-year period, these authors collected data on how intermediaries framed buyers' social sustainability

requirements to sub-suppliers in South India's knitwear garment industry. By developing narratives for each dyad, the authors traced how the interaction with intermediaries shaped sub-suppliers' perceptions of fairness and reciprocity. In another example, Barbieri, Dattée, and Mahapatra (2023) conducted a multi-case study of buyer–supplier dynamics at two Italian luxury automotive companies. By taking dyadic relations as their unit of analysis, the authors were able not only to theorize how supplier development activities were managed by the buyer but also—and more importantly—how the *relationship* between buyer and supplier interrelated with these developments and the suppliers' capabilities over time. Zooming in on the interconnection between different organizational units thus enabled the authors to develop a process model that reveals paradoxical interorganizational dynamics involved in supplier development.

For process research aimed at advancing the understanding of global supply chain dynamics, the unit of analysis may also stretch across geographical boundaries. Reinecke and Donaghey (2021) highlight the value of studying how processes of supply chain governance are interconnected across the upstream and downstream ends of chains spanning the Global South and the Global North. In particular, the authors show the effectiveness of combining interviews and observations at both ends of a chain, in their case with Western retailers and supplier factories, workers, and union representatives in Bangladeshi factories. By focusing on the "coalface" where worker rights violations occur, their research was able to reveal that improvements made at factory level can expose the exploitative business models and purchasing practices at the retail end. This linkage underscores how improving factory conditions for supply chain workers requires changing business practices at both ends of a supply chain.

Finally, temporal elements may also serve as focal units of analysis for process studies. For example, Chen, Dooley, and Rungtusanatham (2016) focus on specific events within their single case study and analyze the temporal precedence among different event types. Berends et al. (2011, p. 945) explicitly take "episodes" as the unit of analysis. Defining an episode as a "change in the structure of the interorganizational network" whose evolution they were studying, the authors identified and investigated 34 different episodes over a period of 5 years, enabling a comparative analysis of different processual chains within the same case.

As these examples illustrate, units of analysis in SCM process-oriented studies are often multiple and may span spatial and temporal boundaries. This adds complexity and can complicate access, data collection, and analysis. Indeed, these challenges should not be underestimated in conducting process studies on supplier–buyer dyads, which entails gaining access to informants on both sides of complex relationships in which serious issues of power, confidentiality, and trust may be involved—all of which can affect the willingness of informants to collaborate with researchers. Dealing with these challenges may thus require some ingenuity on the part of researchers. This is exemplified in Sting et al.'s (2019) study of Nissan and its oscillating relationship with one of its (unnamed) tier 1 suppliers over several years:

> To encourage supplier interviewees to talk freely, we did not mention their company's name during our interviews with Nissan, choosing instead to query Nissan interviewees about all three main suppliers of the component in question. The length and in-depth nature of our interviews enabled us to gather sufficient information from Nissan about our focal supplier.
>
> (Sting, Stevens, and Tarakci 2019, p. 117).

This stratagem appeared necessary to acquire sufficiently rich and credible process data from respondents on both sides of the relationship without betraying confidences.

3.2.3 | Sampling

As with all qualitative research, sampling for process studies is a crucial design decision. All such sampling should be purposeful to some degree because it determines the kinds of inferences that can be made and sets up the possibilities for transferability to other settings. We consider two types of sampling: (1) sampling *of* cases and (2) sampling of data sources *within* cases. Both are important, but the criteria for judging them may be different.

In the sampling *of* cases, one needs to consider how many cases should be chosen and how they should be organized to enable fruitful comparisons and to increase the potential for transferability. Process studies can either use multiple cases or draw on a single case study. Single cases typically allow for more in-depth analysis of a specific setting and thus can reveal interesting and unusual dynamics that offer opportunities to reconsider prevailing perspectives (Pflueger, Wieland, and Chapman 2024). For example, Grimm and Reinecke's (2024) study of a multi-stakeholder partnership in the textile industry showed how such partnerships can succeed "on the edge of failure," contrasting with other studies that question the viability of such efforts.

Nevertheless, the first reason for conducting multiple case studies is to replicate patterns found in different settings, thereby strengthening the argument for transferability (Lincoln and Guba 1985). This is the logic applied by Nair et al. (2016) in developing a process model for the emergence and proliferation of environmental innovations in supply networks. In both of the supply networks they studied (Hyundai and SDI), the process patterns they observed showed fundamental similarities, enabling the authors to argue for the broad applicability of their model.

A different reason for and way of using multiple cases is to identify processes that explain differing outcomes. This is the logic underpinning Soundararajan and Brammer's (2018) sampling of 11 intermediary-sub-supplier dyads selected from the same sector and country in order to ensure their comparability. Focusing on sub-suppliers' responses to the social sustainability requirements of intermediaries in the garment industry, the authors show how different types of framing used by intermediaries at the beginning of the processes they traced had important repercussions on subsequent events. Soundararajan and Brammer (2018) combined process analysis (looking at how

events flow over time for each case) with variance analysis (seeking to explain different outcomes). By including multiple cases and showing both positive and negative pathways, moreover, they increased the probable replicability of their findings. Their study thus exemplifies a powerful design for process research on supply chains. Such a design is challenging to implement successfully, however, as it requires extensive longitudinal data as well as multiple cases to assess similarities and differences.

A third rationale behind multiple case analysis lies somewhere between the two outlined above, with the primary purpose being not so much to explain differences or to replicate similarities but to reveal interesting variants in the way processes play out, thereby helping to enrich process models. For example, although Abushaikha, Wu, and Khoury (2021) undertook their study in a single refugee camp, they focused on three emerging supply networks. The variations they identified as emerging across the three networks yielded cumulative insights, enabling the authors to capture different contingencies within a single overarching process model that shows how ongoing activities and interactions generate and sustain these informal networks.

Turning to the sampling of data sources *within* cases, it is important to note firstly that scholars can create multiple comparative units of analysis within their cases, as in the example of Abushaikha et al.'s (2021) single case study. Sometimes such within-case comparisons can be made on the basis of temporality. Thus, Chen, Dooley, and Rungtusanatham (2016) compare multiple events, whereas Sting, Stevens, and Tarakci (2019) compare different time periods to examine the evolving relationship between Nissan and one of its suppliers.

Secondly, it is important to note that a critical concern in qualitative process research is that each case or sub-case chosen should be *saturated*. This means that enough information from as many sources as relevant has been collected to thoroughly capture the process studied for the chosen unit of analysis. A single interview would clearly not be sufficient to capture a process in a single firm, let alone in a buyer–supply relationship or supply network. Although a single interview *can* capture a narrative of a particular person's experience if the unit of analysis is the individual (Omar et al. 2012), even here, a series of interviews with the same person can offer more powerful evidence. However, the sheer volume of data (e.g., the total number of interviews) may not be an appropriate indicator of the quality of a study. The purpose is to gather sufficient data from the full range of relevant perspectives to understand the unfolding of a process within a specific setting.

In summary, design choices in process studies depend on the researchers' questions and the kinds of insights they seek to gain. What is most crucial is that researchers consciously choose a design that enables them to detect the types of similarities and differences in process patterns or trajectories over time that are salient to the dynamics of interest.

3.3 | Data Choices and Challenges

Up to this point, there has been an implicit assumption that process research is necessarily qualitative. Yet, is this really the case? In this section, we briefly explore the potential for quantitative process research before considering a range of suitable qualitative sources.

3.3.1 | Quantitative Process Research

The vast majority of empirical-quantitative scholarship within the SCM field engages in variance theorizing (Mohr 1982). The question we address here is whether quantitative methods can also be used to study processes. Some argue that quantitative methods tend to reify processes, treating them as fixed and stable entities and transforming them into variables (Langley 2007), for example, by assessing relations between suppliers and buyers as more or less collaborative on a quantitative scale rather than revealing what activities are being accomplished. If researchers extend their use of such methods beyond typical variance theorizing, however, quantitative research can yield valuable insights into process dynamics.

Techniques like event sequence modeling can capture temporal dependencies, critical events, and inter-event relationships, providing insights into how processes unfold and evolve over time. By analyzing how changes in one process element (e.g., supplier lead time) influence subsequent events (e.g., supply chain disruptions, fluctuations in inventory levels, or delivery times), researchers can identify and understand sequential dependencies and pinpoint critical linkages. This is the approach adopted by Chen, Dooley, and Rungtusanatham (2016) to capture the relationship between events leading to the dissolution of a buyer–supplier relationship. In this case, the authors additionally paired their quantitative analysis with qualitative narrative analysis.

Relatedly, Poole et al. (2016) have provided a repertoire of quantitative techniques for event and sequence analysis to assist in developing process understanding. This includes the "'bottom-up' identification of sequence types, comparison of sequences, and characterization of the properties of sequences such as their complexity" (Poole et al. 2016, p. 254). The authors argue that when considering longitudinal data on a large number of cases, unaided human pattern recognition capabilities characteristic of qualitative research methods are limited and that applying quantitative methodologies can offer valuable insights into process patterns that would otherwise be unavailable.

There is also much value in combining qualitative and quantitative methods. For example, to better understand the temporal embeddedness and evolution of the relationship between their case company Nissan and one of their strategic first-tier suppliers, Sting, Stevens, and Tarakci (2019) first drew on a 12-year-long qualitative case study of the buyer and its suppliers before proceeding to build a computational simulation model. In this way, they were able to confirm the findings of their qualitative case study while highlighting how the frequency, duration, and intensity of de-embedding affect supply chain performance. The authors note that without the qualitative study, they would have been confined to a static view of buyer–supplier relationships and they would have lacked an understanding of how these relationships evolve and how different periods in this evolution affect performance. Instead, the quantitative study enabled them to refine their analysis and offer more generalizable insights. Paquin and Howard-Grenville (2013) also

combine qualitative and quantitative methods in their study of the processes of orchestrating an interorganizational network dedicated to industrial symbiosis. The authors first qualitatively coded their data for patterns before engaging in quantitative network analysis to track the changing structure and project progress over time.

Quantitative methods have some limitations for process analysis, however. Even when sequence methods are used, these are generally restricted in application to the perspective we label *process as evolution*. Moreover, adopting pre-defined variables and a pre-defined focus on certain (hypothesized) causal relationships may be ill-suited for following a process forward in real time since it is difficult to adapt variables of interest as patterns emerge. This is likely to neglect essential features of complex processes, specifically the constant flux, and emergence that characterizes them. It is no surprise, therefore, that most of the studies we identified as exemplifying process research are qualitative in nature.

3.3.2 | Qualitative Process Research

Qualitative research methods are generally much better suited to capture the unfolding of temporal dimensions over time, enabling a more fine-grained understanding of (temporally connected) processes (Nair et al. 2016; Soundararajan and Brammer 2018). This especially applies to the complexity of supply chain phenomena (Omar et al. 2012) and the interpersonal dynamics (Bastl, Johnson, and Choi 2013) that are key to transforming economic systems (Erhun, Kraft, and Wijnsma 2021).

As shown in Table 1, the predominant source of data in the SCM studies we identified as using process research methods was clearly interviews, although many refer to complementary documentary data from archival records, and some make more or less limited use of observational material. Yet, although interviews are inarguably an important source for gaining insights into respondents' interpretations, they can be prone to retrospective bias and possibly impression management (Langley and Meziani 2020), raising concerns about whether interviews may have been overused in process research at the expense of other sources (Hinings 1997). When using interviews to capture processual phenomena at the level of an organization, supply chain, or a supply chain relationship, therefore, it is all the more important to have access to several respondents to ensure corroboration and to saturate one's understanding as much as possible of the unit of analysis under consideration.

Other data sources likewise have complementary strengths and weaknesses. Although documents and archival data are important for reconstructing event chronologies, they are often superficial and/or merely descriptive in character, yielding little or no insight into underlying reasonings. By contrast, observations can be an invaluable means of capturing phenomena as they unfold, enabling researchers to gain rich insights into behaviors, activities, and interaction patterns. The drawback of observations, meanwhile, is that they rely heavily on the researcher as an instrument and require time-consuming and repeated access to sites. For all these reasons, combining different data sources may yield richer insights than any one type of source could offer by itself.

The value of combining sources is especially apparent in the study by Abushaikha, Wu, and Khoury (2021) of how humanitarian relief operations in the Za'atari refugee camp in Jordan—the largest Syrian refugee camp in the world—were shaped by the economic activities of refugees themselves. To uncover how refugee-led informal supply networks emerged in the camp, the authors triangulated interviews, observation material, and archival records. It was particularly important in this extreme case setting that the authors were able to speak native Arabic and were sufficiently sensitized to conflict-induced refugee narratives to be able to generate approachability in interviews and detect nuances in the phenomena they observed. Their observations, including camp visits, community visits, and participation in events, were crucial for the authors to capture interactions between actors, activities in the camp, and the progress of programs. Meanwhile, the authors used their 52 semi-structured interviews with refugees, residents, managers, and officials to understand the perceived relationships among refugees, as well as between refugees and other entities. Furthermore, the observations provided invaluable opportunities for collecting additional forms of ethnographic material (including 200 photographs and 20 videos) that proved critical for appreciating the physical infrastructure of the camp, ultimately enabling the authors to reveal how the supply network was impacted by its context. Lastly, archival records helped the researchers reconstruct the history of the camp.

Villena and Gioia's (2018) study similarly draws on a combination of semi-structured interviews, structured observations, and archival data, using these for different purposes to theorize the process of sustainability management in a supply network. Although their 165 semi-structured interviews were crucial to gather information on sustainability initiatives both within each firm as well as between the organizations included in the study, their structured observations (45 ethnographic interviews and fieldnotes) proved no less crucial for grasping how corporate initiatives were implemented within suppliers' factories. Lastly, the authors collected archival data to compare with the information gathered from interviews and observations.

In both of the studies discussed above, combining interviews and documents and observations—or what Bizzi and Langley (2012) term the "big three"—enabled the authors to construct rich and credible datasets. It is important not to overlook the potential for combining additional sources beyond these big three, however, including the opportunities afforded by the availability of email records and video recordings to reach beyond the archival retrospective data commonly used in most contemporary studies. Other real-time sources that could be valuable to complement typical sources include the use of diaries (Balogun, Huff, and Johnson 2003), respondent-led videos and photographs, as well as digital traces (e.g., through "scraping" social media).

3.4 | Analytical Choices and Challenges

Deriving conceptual insights from any data gathered via process research methods is inherently challenging, not least because

such process data comprise mainly qualitative empirical material from diverse sources. This analytical challenge is greatly exacerbated in the case of data from process research on supply chains, above all due to the intrinsic complexity of the myriad emergent processes that constitute these phenomena. In discussing the *analytical challenges and choices* involved in this task, we first consider the use of inductive versus abductive approaches to data analysis before exploring the potential of various specialized analytical approaches that pay distinctive attention to temporality and are thus well suited for analyzing process data.

3.4.1 | Induction Versus Abduction

Most SCM scholars studying processes engage in inductive bottom-up coding to develop theory *grounded* in their data, typically drawing on *grounded theory* methods to compare data across respondents and/or specific incidents (Charmaz 2006; Glaser and Strauss 1967; Strauss and Corbin 1990). Many have increasingly worked with the "Gioia methodology" (Gioia, Corley, and Hamilton 2013) to guide their inductive coding (Abushaikha, Wu, and Khoury 2021; Barbieri, Dattée, and Mahapatra 2023; Sting, Stevens, and Tarakci 2019; Villena and Gioia 2018). This typically involves the construction of a data structure diagram to illustrate how first-order codes deeply grounded in the data are clustered into more abstract second-order themes and how these themes in turn may be further grouped into aggregate dimensions that form the key conceptual categories of a theoretical model.

For example, Villena and Gioia (2018) applied the Gioia methodology to derive insights into how lead firms in supply chains across different industries manage first-tier and lower-tier suppliers to reduce sustainability-related risks. By comparing three different MNCs' supply networks, they created a repertoire of second-order codes reflecting the managerial practices evident in their data, finding that lower tier suppliers posed the biggest sustainability risk in supply networks and that MNCs can be "ambidextrous" in acting both proactively and reactively to manage sustainability threats. These codes were then further grouped into four inductive and more abstract overarching process categories before they were finally displayed together in a sequential model showing recursion between different processes over time.

One advantage of this particular style of bottom-up coding is that it rigorously and transparently displays how snippets of data from respondents are brought together and are clustered into larger abstract categories, tightly connecting data and the emerging theory. Yet the Gioia methodology has also been subject to criticism, among other reasons for the way in which it may lead authors to break down holistic process data into disconnected fragments, limiting the type of theoretical outputs that emerge (Cornelissen 2017). Critics have pointed out that there are many other ways to implement bottom-up coding, arguing that scholars should be encouraged to experiment with different approaches to discover which ones best fit their needs (Pratt, Sonenshein, and Feldman 2022). In the following section, we discuss some of these other analytical methods that can also be used inductively while preserving temporal connections within the data.

An alternative perspective to the bottom-up inductive approach is to draw more extensively on an a priori theoretical framework to help in data analysis. For example, Nair et al. (2016) derive strong inspiration from complex adaptive systems theory in analyzing their data on the proliferation of innovations in supply networks through *pattern matching*. Drawing on a technique suggested by Yin (2017), they show how the spread of innovations through interlinked suppliers can ultimately become self-organizing (a concept from complexity theory), reaching beyond the control of the original equipment of manufacturers who launch the innovations in the first place. The overall analytical process applied by Nair et al. (2016) is described as *abduction*, that is, an iterative process of moving back and forth between (top-down) pattern matching of concepts from the literature and (bottom-up) grounded coding to generate an overarching framework (Sætre and Van de Ven 2021). The advantage of drawing at least in part on an a priori framework is that it may enable researchers to connect research findings to existing literature more easily, thereby achieving stronger theoretical consistency. The downside is that theory might be imposed on the data. Meanwhile, a purely inductive approach has its own downsides, as it may lead to descriptive findings that do not connect strongly to prior work.

Overall, a central underlying tension in analyzing process data lies in the need to stay close to the data and to offer insights deeply grounded in the phenomenon studied while rising above the particular setting to connect to theoretical ideas that will have resonance beyond it. Scholars may begin from different starting points, but to make a strong contribution they ultimately need to find a way to build connections between data and theory.

3.4.2 | Strategies for Theorizing About Processes

Beyond grounded theorizing and pattern matching based on existing theories, a variety of other analytical strategies have been proposed by Langley (1999) that may be especially helpful for analyzing process data (see also Wieland, Tate, and Yan 2024). One such approach is a *narrative strategy*, which is about reconstructing the history of a case or a series of crucial events. For example, Soundararajan and Brammer (2018) draw on Langley's narrative strategy to create unique narratives for each intermediary-sub-supplier dyad in their case. In developing a chronological account of key incidents that respondents encounter in each dyad, they add further context to their narratives by using data collected from multiple actor groups. Writing up complete case narratives can be a particularly useful strategy at an early stage of analysis for bringing together disparate sources of data and creating a chronological account that may then serve as a basis for further coding.

Another strategy proposed by Langley (1999) is *visual mapping*, which implies the use of flow-charts, tables, figures, and drawings to represent data in graphical rather than narrative form. Such visualizations offer an alternate form of coding that enables authors to represent processes succinctly while preserving temporality and linkages between events that otherwise may sometimes seem to disappear in more verbal bottom-up coding techniques, where the temptation may be to

create abstract conceptual categories rather than focusing on linkages between events happening over time. For example, because the SCM phenomenon they investigated comprised an unfolding sequence of events, Nair et al. (2016) combined a narrative strategy with visual mapping of their cases to show graphically how the proliferation of innovations took place through supplier networks over time. Hausman et al.'s (2010) study of global trade processes also applies visual mapping to develop a set of detailed flow-charts describing the empirical steps typically encountered in such processes, including certain alternate pathways. They then use these descriptive flow-charts to analyze the potential of new IT-based processes. This is an intuitive approach to SCM that also approximates the kind of approaches with which supply chain practitioners themselves are more familiar.

As our examples demonstrate, process analysis strategies are not mutually exclusive but can be effectively used in combination (Langley 1999). The study by Nair et al. (2016) illustrates well how researchers can draw on a variety of strategies to good effect. Thus, in addition to using grounded theory and pattern matching in combination with a narrative and visual mapping strategy, these authors draw on another strategy proposed by Langley called *temporal bracketing*. Put simply, temporal bracketing is about separating processes into time periods to transform process data "into a series of more discrete but connected blocks" that can subsequently be compared analytically with one another (Langley 1999, p. 703). In Nair et al.'s study, temporal bracketing was crucial for developing a process model to capture several temporally connected processes, enabling them to understand how the environmental innovations in their case emerged and spread into supply networks. Sting, Stevens, and Tarakci (2019) also use temporal bracketing to mark the two major triggering events that set the three periods in their study apart, each indicating a different level of relational embeddedness between buyer and supplier.

Among the repertoire of approaches considered in this section for analyzing process data, the key shared quality found alike in narrative strategies, visual mapping, and temporal bracketing is their focus on temporality. It is this capacity for capturing and deriving insights from emergent processes unfolding over time that makes these approaches most suited for making process-theoretical contributions.

3.5 | The Products of Process Research and Why They Matter

3.5.1 | Process Theories

Regarding the products of process research, we have already emphasized that these theoretical outputs will depend on the onto-epistemological perspective adopted, the research design employed, the kinds of data collected, and the analytical choices made. The products generated by most of the studies we have investigated in this article approximate most closely to what we would call *process patterns*. By this, we mean they chiefly identify regularities and steps in the evolution of a process over time, often representing these through visual process models (see examples in Figure 1)[1].

Process patterns may involve linear or sequential stepwise processes, bifurcated parallel pathways, or recursive elements that include feedback loops (Cloutier and Langley 2020). The more linear patterns revealed in these studies often resonate with the prevalent understanding in SCM research of what processes comprise, as typified in Lambert and Cooper's (2000) definition of "process as 'a structured and measured set of activities designed to produce a specific output'" (p. 76). It is this understanding that Jia, Hendry, and Stevenson (2022) reflect in their model of how a supplier's absorptive capacity for sustainability develops over time. Following four companies over a 12-month period, these authors generated a linear three-step model showing how absorptive capacity can be developed through (1) explorative learning, (2) transformative learning, and (3) exploitative learning (see Figure 1a). With this model, the authors highlighted how an input variable influenced the three-step learning process and how the output of this process led to an established supplier organizational structure and routine.

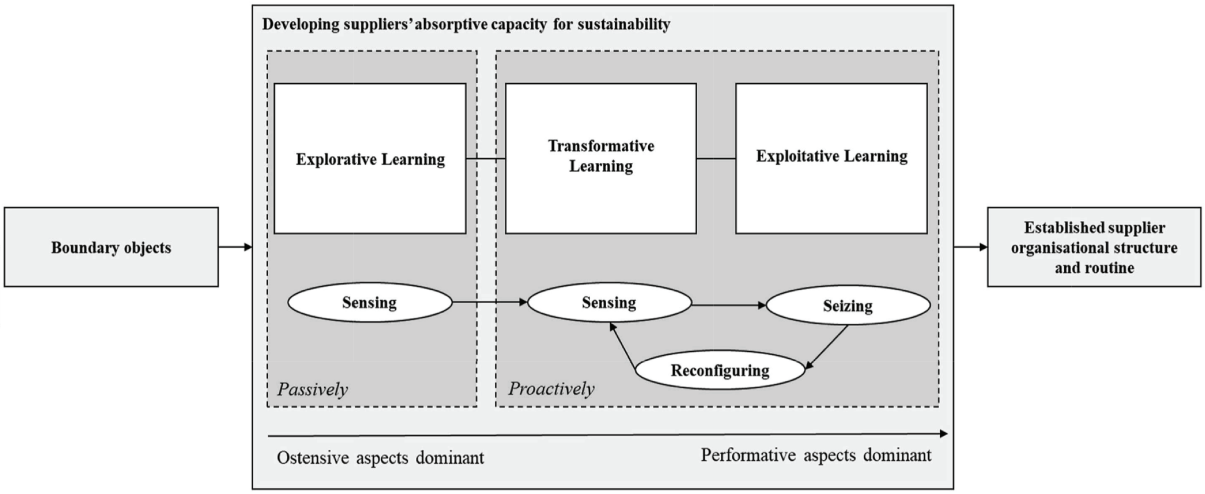
Other process models highlight bifurcations in linear processes, showing how different sub-processes may either proceed in parallel (Nair et al. 2016) or may take different pathways based on various contingency elements (Hausman et al. 2010; Soundararajan and Brammer 2018). Nair et al.'s (2016) process model (see Figure 1b) is particularly interesting because the sub-processes they illustrate also show the development of supply networks.

Although Villena and Gioia (2018) and Omar et al. (2012) also draw out process patterns that reflect regularities in their data, these authors present stages and activity elements as interactive and recursive rather than occurring linearly or unidirectionally. As illustrated in Figure 1c, although Villena and Gioia's (2018) model shows a linear progression (from "committing to a sustainable supply network" to "managing such a network"), it also includes a cyclical dimension and mutually interdependent processes of building sustainability capacity, assessing sustainability practices, and managing sustainability risks and opportunities.

Finally, Grimm and Reinecke's (2024) process model (Figure 1d) reflects a complex variety of elements. The authors construct their model progressively throughout their findings section. The model includes a linear part (left side of the model) and a recursive process (right side of the model), as well as interacting processes for different stakeholders (or levels of analysis) (expressed in the upper and lower parts on the left side of the model). The authors show how cyclical processes develop over time and highlight the moment at which the linear progression is disrupted and cyclical processes are transformed.

Beyond simply describing empirical patterns or regularities in their data and representing these with process model diagrams, researchers should ideally extend their process analysis to theorizing the underlying *mechanisms* that drive the patterns observed. In drawing attention to the importance of undertaking this step in process research, Van de Ven and Poole (1995) point out the need to offer *explanations* beyond mere description and thus contribute to efforts to generalize beyond specific settings.

(a)



(b)

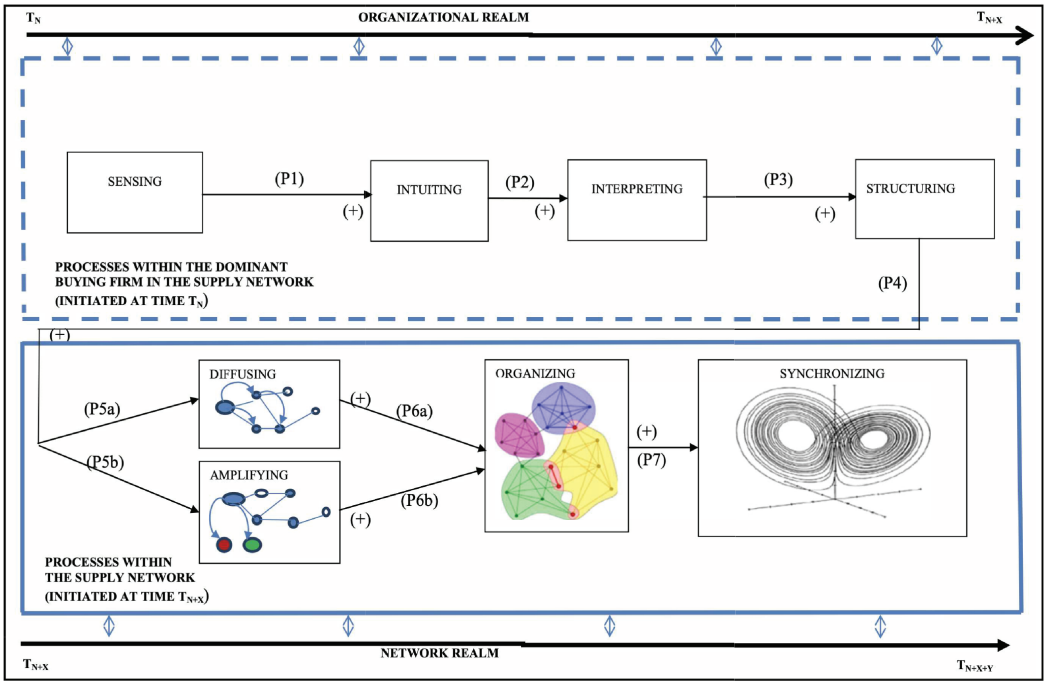


FIGURE 1 | Examples of process patterns expressed in visual process models. (a) Linear process model (Jia, 2022); (b) Linear process model with bifurcated pathways (Nair et al., 2018); (c) Recursive process model (Villena and Gioia, 2018); (d) Multilevel, interactive, and recursive process model (Grimm and Reinecke, 2023). [Colour figure can be viewed at wileyonlinelibrary.com]

The authors suggest the following four canonical process mechanisms, or "motors," that underpin process explanations, either alone or in combination:

> *life cycle mechanisms*, which presuppose linear deterministic progressions based on the inherent genetic characteristics of the focal entity;
>
> *teleological mechanisms*, which assume that processes are driven forward by human agency and learning processes;
>
> *evolutionary (or ecological) mechanisms*, which presuppose Darwinian interactions whereby naturally occurring variations are selected and retained depending on resource limitations;
>
> *dialectical mechanisms*, which assume that tensions and contradictions drive processes forward.

Among the studies we examined, theorizations of supply chain processes often invoke teleological mechanisms in explaining

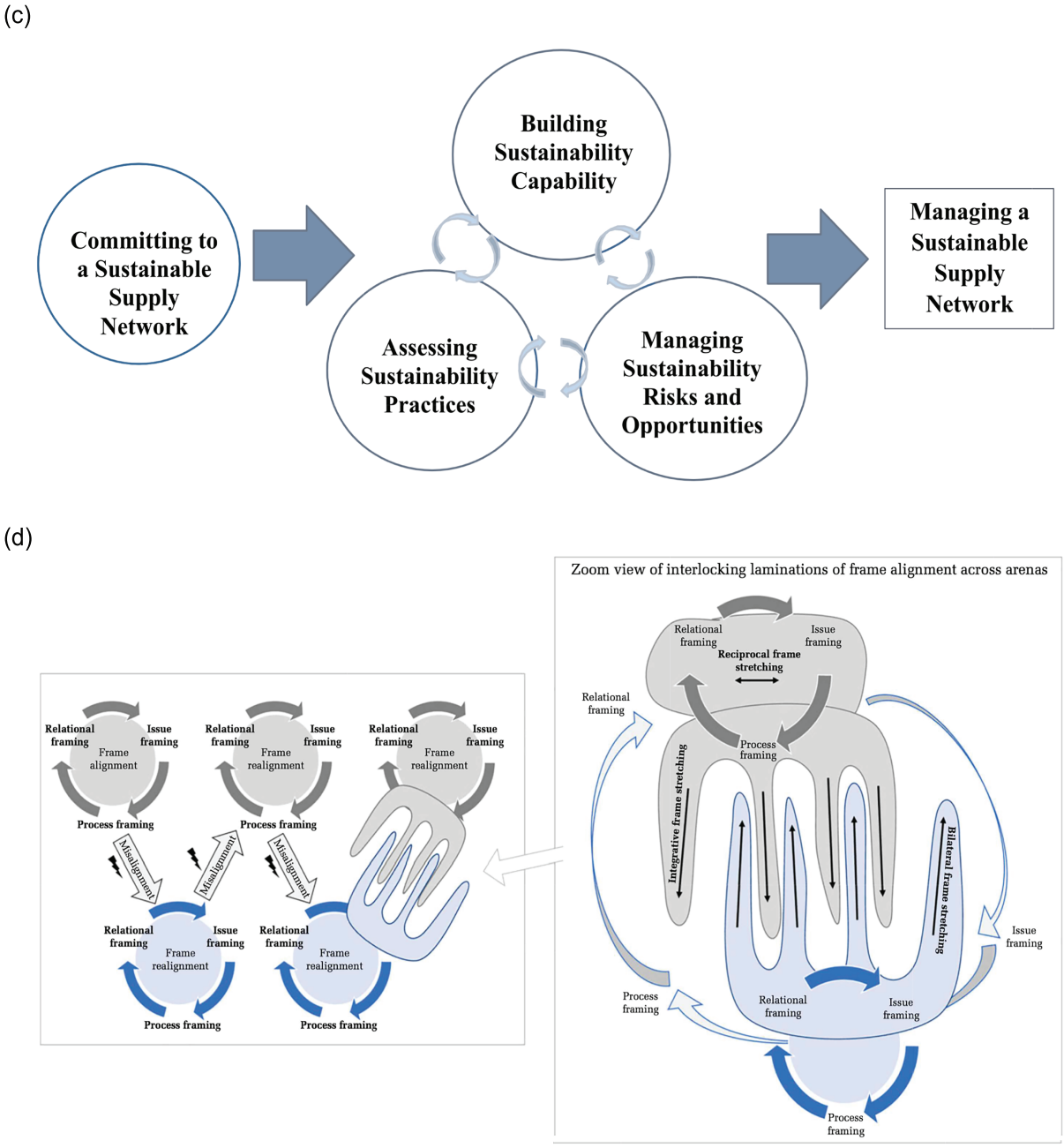


FIGURE 1 | (Continued)

change as a process of learning and adaptation driven by collective goals. This emphasis on teleological mechanisms may reflect the historical focus of SCM scholars on process improvement, as is evident in the studies by Jia et al. (2016) and Villena and Gioia (2018). Reflecting the centrality of interorganizational relations in supply chains and the significant tensions and contradictions such relations can generate, however, some of the selected studies also identify and elaborate dialectical mechanisms. For example, Barbieri, Dattée, and Mahapatra (2023) draw on paradox theory to generate insights into the ways in which competing interests among supply chain participants play out over time, progressively transforming the nature of interorganizational power relationships in unintended ways. Other studies draw on complex adaptive systems theory (Nair et al. 2016; Sting, Stevens, and Tarakci 2019), which is classified by Poole and Van de Ven (2021) as involving evolutionary mechanisms. Here, multiple agents are viewed as interacting with each other in complex multi-layered systems characterized by limited resources, potentially producing unexpected and nonlinear outcomes.

Many of the studies we selected incorporate combinations of different mechanisms. In Reinecke and Ansari's (2015b) study of Fairtrade certification, for example, the authors recognize the importance of teleological (agent-driven) mechanisms aimed at orienting learning among suppliers yet also consider the consequential role of tensions between different actors holding divergent perspectives. Most notably, they shed light on the effects of

tensions ensuing from contradictory perspectives and orientations concerning the nature of time and temporality.

Van de Ven and Poole's (1995) typology offers a repertoire of generic process mechanisms that researchers can use as a sensitizing device to help them extend analysis beyond empirical patterns. However, scholars can also draw on a range of other more specific theoretical frameworks reflecting a process sensibility, including actor–network theory, structuration theory, sensemaking theory, and complexity theory. Clearly, process researchers endeavoring to extend analysis beyond description must continually ask themselves *why* the processes they are investigating emerge and play out in precisely the ways they do. Although their data may provide partial answers to this query (e.g., as respondents offer their own explanations), researchers often need to dig deeper into the literature to incorporate other relevant theoretical ideas into their analysis.

Some supply chain scholars use process data to generate formalized empirical generalizations or *theoretical propositions* (see also Cornelissen, Stephens, and Matthews 2024), although this is seen less frequently in recent process studies in management journals. Sometimes these generalizations are expressed in terms of process features like the ordering of events or subprocesses (Chen, Dooley, and Rungtusanatham 2016; Nair et al. 2016). However, other studies offer predictions concerning contingencies that may lead to different outcomes. As a case in point, Sting, Stevens, and Tarakci (2019) developed four propositions on how temporary de-embedding can influence supply chain performance, with these predictions being their main theoretical contribution from applying process analysis strategies to a dataset covering a 12-year period.

Finally, we note that process studies on supply chains also generally take great care to consider the managerial and/or societal implications of their insights. Such explicit consideration is important to establish the value and import of process research, showing a commendable concern for consequentiality that could be emulated by scholars in many other fields.

3.5.2 | Writing up Process Studies

We conclude this section with some reflections to guide aspiring process researchers in considering how to write up and present their process studies most effectively. Here, a fundamental choice lies between presentations that follow an issue-organized analytical structure (e.g., Barbieri, Dattée, and Mahapatra 2023; Berends, van Burg, and van Raaij 2011; Chen, Dooley, and Rungtusanatham 2016; Howard et al. 2019) or that follow a temporal chronology (e.g., Grimm and Reinecke 2024; Paquin and Howard-Grenville 2013; Sting, Stevens, and Tarakci 2019). Researchers using an issue-organized analytical structure present their findings with analytical patterns or concepts as the main headings. In Howard et al.'s (2019) study, these patterns (dynamics, relationships, functions and dysfunctions, and mechanisms) are introduced case by case. Berends, van Burg, and van Raaij (2011) also chose not to structure their findings chronologically (even though their case played out over 5 years) but rather according to the five different types of episodes they identified in their data, each of which reflected different patterns of relations between interorganizational and interpersonal dynamics.

Researchers who decide to present their findings by chronology usually structure their empirical accounts according to distinct phases. To elevate their findings beyond a descriptive level to an analytical level while ensuring that readers remain engaged, scholars may include sub-headings that refer to common conceptual elements across different phases. For instance, in presenting their insights from a study of the process of assembling and developing an interorganizational network over 5 years, Paquin and Howard-Grenville (2013) refer to shifts in actions as well as in structure and composition across temporal phases.

As Berends and Deken (2021) point out in regard to structuring the presentation of insights from process studies, articles that start out by presenting an empirically driven narrative and only subsequently introduce analytical concepts run the risk that readers may be unable to grasp the connection between the empirical narrative and the concepts. Conversely, articles presenting a full conceptual model upfront and using this to orient an empirical narrative run the risk of seeming to impose the model on the data. A preferable alternative to either of these extremes may be found in an intermediary solution that uses various concepts to structure the narrative and then pulls these together in a model at the end.

A common and prerequisite feature of all good presentations of process studies is that authors use their fine-grained data to develop detailed stories that vividly illustrate and emphasize the generative mechanisms they theorize (Van de Ven 2007). In their study of the German Textiles Partnership, for example, Grimm and Reinecke (2024) present their detailed stories in the form of "composite vignettes" to demonstrate "critical moments" identified from among the multiple interactions observed in their data. These vignettes served the crucial function of helping readers understand how the authors had theorized the processual dimensions of their longitudinal data. As Jarzabkowski, Bednarek, and Lê (2014) have argued, composite vignettes can be a highly effective way to portray "a critical event or moment in the field [...] to illuminate a theoretical concept [...] alongside more interpretative explanatory text" (p. 280).

4 | Discussion and Conclusion

The overarching aim of our preceding analysis of the key methodological choices and analytical challenges involved in process research is to guide scholars who wish to apply process research methods to supply chain phenomena. Below, therefore, we highlight three areas for future research where adopting process-thinking and methods could prove especially helpful for advancing understanding of SCM phenomena: supply chain sustainability, resilience, and digitalization and technology. In each subsection, we first outline how and why applying a process lens could prove particularly productive in that domain before proposing some key process-type research questions that scholars could usefully pursue in such research.

4.1 | Supply Chain Sustainability

Sustainability has become an increasingly central topic in SCM research (Gualandris et al. 2024) as scholars seek to contribute to efforts to address the substantial social and environmental impacts of corporate supply chains on carbon emissions (specifically in Scope 3), resource depletion, waste, and inequality. For example, the Carbon Disclosure Project reports that supply chain emissions are on average over 11 times greater than emissions from a company's own operations (CDP 2023). Shockingly, the International Labour Organization (2022) estimates that supply chains enlist the forced labor of almost 28 million workers worldwide. Given the scope and severity of these challenges, SCM scholars can and should play a crucial role in advancing sustainability research. By applying process methods to identify and explain the mechanisms and dynamics at play in SCM, their work can enhance our understanding of how to move beyond a compliance-driven approach to regulation by integrating sustainability principles into the core of supply chain processes (Jia, Hendry, and Stevenson 2022; Nair et al. 2016; Soundararajan and Brammer 2018; Villena and Gioia 2018).

As an example of how this potentiality could be realized to support the transition to more sustainable supply chains, a process view could inform research on how to achieve a circular economy in the sense of "an industrial economy that is restorative or regenerative by intention and design" (Ellen MacArthur Foundation 2013, p. 14). A fundamental feature of circular economy is the temporal reconfiguration of economic relationships and resource flows in order to shift from the "take–make–use–dispose of" sequence characteristic of the linear economy to a circular pattern of production and usage. The concept of circularity emphasizes these processual and temporal dimensions as it links constituent elements of business models (e.g., production, logistics, and consumption) in a recursive manner. The processual and temporal qualities (e.g., timing, pace, or duration) of one element affect the other elements in a linked fashion (Holmes, Wieser, and Kasmire 2021).

SCM scholars could use the methods we have described to focus on the substantial processual changes entailed in transitioning from linearity to circularity. For instance, they could study the process of transitioning from linear to circular modes of production and usage, for instance, through the creation of circular modes of reuse and recycling, such as design for disassembly. A process lens would further allow for a focus on the temporal dynamics involved in slowing and closing resource loops and on the development of strategies for the temporal coordination of resource flows needed to achieve circularity. Scholars could also investigate business model strategies for slowing the tempo both of production and consumption in order to keep products and materials in use for longer periods. This would include exploring how to achieve longer product life cycles through the introduction of initiatives such as the right to repair. Most impactfully, research could focus on processes at ecosystem level, because building a circular economy not only requires changes in a specific company's business model and supply chain practices but also necessitates orchestrating a circular economy ecosystem to manage processual interdependencies. (For an example of such a study, see Paquin and Howard-Grenville 2013).

Insights from process research could also inform a more sophisticated approach to assessing sustainability performance in global supply chains. This is urgently needed to respond to growing demands for corporations to disclose their supply chain sustainability performance and an increasing trend towards adopting legislation to enforce such disclosures (e.g., the EU's 2024 Corporate Sustainability Due Diligence Directive). Process research would be particularly useful for understanding the dynamic interactions between environmental, social, and economic factors within supply chains and how these interactions shape long-term sustainability outcomes. Adapting a processual approach to assessing supply chain impacts involves shifting from the mere measurement of static outcomes to the identification of dynamic impacts and temporal trajectories, as is consistent with a process perspective that views sustainability as a continuous flow of ongoing processes rather than a snapshot of static output (Reinecke and Ansari 2015a). Identifying trajectories can be especially useful for helping firms formulate climate transition plans, particularly for companies that have made net-zero pledges or are exposed to significant climate-related risks. For instance, rather than measuring absolute greenhouse gas (GHG) emissions, such studies would include a focus on inferring future trajectories of GHG emissions from all relevant prior data, including qualitative data on key processual dynamics. This approach is likely to be far more informative when devising decarbonization and GHG emission reduction strategies.

4.2 | Supply Chain Resilience

Process methods can also be useful to shed light on the emergent dynamics of supply chain resilience and disruption. Although a traditional SCM perspective would conceptualize disruptions as deviations from a supposed stable equilibrium, thus requiring a return to "normalcy," this view has been challenged by Wieland and Durach (2021). These authors argue that resilience must be comprehended less as a matter of striving for stability and more as one of undertaking continuous efforts aimed at adaptation and transformation. This resonates with a process approach that highlights not only the non-linear dynamics of disruption but also the role of ongoing social relations and material and capital flows in maintaining supply chain processes over time (Reinecke and Lawrence 2023).

This perspective enables scholars to better capture how seemingly minor changes at one end of a supply chain can trigger cascading effects across the entire chain, including potential disruptions. Such analysis could explain ongoing vulnerabilities as well as reveal critical points of intervention and opportunities to build adaptive capacity within a specific context. A process approach would emphasize how disruptions can trigger unforeseen adaptations in SCM, thereby alerting managers to the need for dynamically reconfiguring supplier networks but also how adopting improvised solutions may ultimately lead to emergent new patterns of supply chain coordination. Responses to the COVID-19 pandemic provide compelling examples both of the challenges and potential opportunities of managing supply and demand disruptions, highlighting the relative effectiveness of different types of resilience strategies. Above all, the pandemic revealed the need for new patterns of collaboration within and between supply networks (Azadegan and Dooley 2021; Gereffi 2020).

In sum, resilience as seen through a process lens may not arise from a neatly pre-planned strategy but rather emerges from a myriad of ongoing interactions and adaptations among diverse actors within the supply network. Studying such emergent adaptations using process research methods can both reveal the context-specific nature of resilience and offer valuable insights into how to build adaptable and responsive supply chains that endure and even thrive in the face of future disruptions.

4.3 | Supply Chain Digitalization and Technology

A process approach also offers a valuable lens for examining the intricate interplay between processual dynamics in global supply chains and the use of digitalization and technology, especially artificial intelligence (AI). Often simplistically conceptualized as a matter of merely automating existing processes, AI-facilitated digitalization in fact also reconfigures and creates new complex webs of interdependencies between actors and digital information systems. By analyzing the emergent dynamics of these interdependencies, scholars can gain a deeper understanding of the opportunities and challenges presented by these transformative developments. For example, scholars could focus on how AI interacts with human actors and extant processes, and how these interactions influence decision-making within the supply chain (see Hendriksen 2023).

Although AI and digitalization have immense potential for improving supply chain efficiency and resilience, process research can help to highlight new vulnerabilities and ethical dilemmas arising from efforts to harness this potential. Process scholars could study how increased reliance on complex algorithms and interconnected systems can create glitches and network failures and expose data security risks and other vulnerabilities in AI-powered supply chains. As AI has become more ubiquitous in the management of supply chains, multiple ethical dilemmas related to data privacy, algorithmic bias, and job displacement are emerging that demand scholarly attention. Process methods can shed light on such ethical dilemmas by studying the intricate interactions between human and digital actors.

4.4 | Conclusion

This article has showcased and discussed the value of a range of process research methods, illustrating the application of various approaches and techniques in several recent examples of process research on SCM. All these studies in various ways demonstrate how adopting a process perspective can equip scholars with a powerful lens for investigating the complexities of contemporary supply chains and shedding light on salient emergent themes in SCM, including issues surrounding sustainability, resilience, and the application of digitalization and technology. In elucidating these possibilities, our aim is to encourage researchers to move beyond static models and extend the scope of their inquiries to embrace and account for the ongoing emergence and evolution of the myriad dynamic interlinkages that constitute supply chains. We specifically hope that supply chain scholars will be stimulated to pursue these opportunities and that our discussion of the specific methodological issues will help guide them in tackling the intrinsic challenges of conducting process research.

Endnotes

[1] All images in Figure 1 are reproduced with permission.

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