

# Supply Chain Transformations Towards Resilience Through Developmental Work Research: Conceptual and Analytical Considerations

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**Abstract:** This essay makes ontological, epistemological and methodological considerations in order to propose the developmental work research model as a promising alternative for studies on supply chain resilience. The fundamental issue addressed here refers to the possibility of new understandings about the learning dynamics between organizations in the scope of social, cultural and human agency conditions. In this sense, the material, labor and relational transformations are interpreted as an object, at the same time, conditioning and conditioned to the action of the participants of the supply chain. The ontological and epistemological stance accuses dialectical materialism and practice as understandings able to explain transformations in turbulent, complex contexts and contradictory interests among organizational actors. The methodology of developmental work research seeks to explain the expansive transformation through the analysis of the interactions between individual and collective action. This methodology consists of five stages: questioning, analysis, modeling, application, and consolidation and reflection. Finally, it is considered that explanations of transformations towards supply chain resilience can advance in the perspective that actors know, practice and learn as interactions evolve.

**Key words:** supply chain, resilience, organizational learning, epistemology of practice

**JEL codes:** M1, O3

## 1. Introduction

This paper presents ontological, epistemological, and methodological considerations to propose research foundations focused on understanding the resilience of the supply chain. The theoretical framework and methodological structure related to Developmental Work Research are employed here to bring forth a perspective of learning among various organizational systems through distributed and situated workgroups (Engeström, 2001). Despite being a well-explored methodology in studies on productive organizations and widely used to examine everyday activities and process transformation in organizational networks (Foote et al., 2021; Malloch et al., 2021; Mukute et al., 2018; Engeström, Lompscher, Rückriem, 2016), Developmental Work Research has been neglected in supply chain management research.

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It is argued here that the application of this methodological approach provides an alternative path for researching learning in supply chain resilience by: a) involving practices in the context of situated interactive everyday activities, where these activities are understood by the dynamics of being formed by socio-cultural elements while transforming them (Lindley, Lotz-Sisitka, 2019); b) blending knowledge and change capability with a focus on potentials for continuous longitudinal transformations (Juvonen, Koivisto, Toiviainen, 2022); c) managing for the joint configuration of new tools and concepts that can facilitate the development of new capabilities (Lassila, Mäntylä, Kantola, 2007); d) developing practices and learnings in multiple relationships revealing the dynamic process of negotiation based on different interests and positions (Schmachtel, 2021).

Combined, these four new research perspectives can provide new explanations about the potentials of supply chain practices and address new research questions related to change processes in supply chain interactions through the approach of resilience-related transformations as an ongoing social and cultural learning activity. In this sense, Developmental Work Research can address interventions for change towards supply chain resilience through collective communication strategies, while addressing recovery processes as intertwined with mutual influences and diverse interests in networked activity. Finally, this methodological framework can also advance learning and intertwining with distributed operations and activities for supply chain resilience.

In line with the principles of Developmental Work Research, this study explores ontological and epistemological instances to explain how such a methodological approach can uncover internal contradictions beneath the surface of everyday problems, disruptions, or discrete innovations that occur in organizational work and supply chain interactions. The main concern is to provide a research framework that can facilitate the broadening of understandings related to everyday work and relationship problems, creating possibilities for change and learning. Overall, Developmental Work Research represents “a radical reconceptualization of the possible role of workplace research in facilitating practical changes” (Engeström, 2000).

## **2. Foundations**

### **2.1 Supply Chain Resilience Theory**

The supply chain resilience theory constitutes a body of knowledge that comprises explanatory models about organizational capabilities to prevent or recover from disruptions in material, informational, and financial flows. This framework includes multiple concepts and disciplines that combine foundations of organizational theory (Irfan et al., 2022) (i.e., organizational structure, organizational culture, organizational learning), supply chain management (Pettit, Croxton, Fiksel, 2019) (i.e., supply chain design, continuity planning, performance measurement), risk management (Anbumozhi, Kimura, Thangavelu, 2020) (i.e., risk identification, risk assessment, risk mitigation, risk transfer, risk monitoring), and operational research (Zamani, 2022) (i.e., decision support systems, optimization techniques, simulation modeling).

The primary objective of merging with this interdisciplinary framework is to create capabilities to recover from undesired events and improve overall performance. Resilient supply chains are collaborative organizations that form a network capable of adapting to undesired circumstances and avoiding disruptions (Pimenta et al., 2022). This requires managerial and operational skills to, in the case of disruptive events, quickly restore key activities and processes (Hald, Coslugeanu, 2022). Thus, supply chain resilience involves the development and implementation of measures to boost operations and identify risks, as well as the creation of contingency plans.

According to the supply chain resilience theory, the key characteristics of a resilient supply chain are: redundancy, flexibility, responsiveness, adaptability, and post-disruption recovery. Redundancy involves building a network of multiple partnerships and suppliers (Umar, Wilson, 2021). This includes designing the distribution channel network and facility infrastructure as a set of alternative production and logistical routes (Ghanei; Contreras, Cordeau, 2023). Flexibility refers to rapid responses to new external conditions (Ghomi et al., 2023). Key features related to supply chain flexibility are active supply strategies, responsive logistics systems, and adaptable manufacturing processes (Ivanov, 2021).

In turn, responsiveness is the quick and effective response to disruptions through decision-making, processes, and information flow supported by a relevant IT system infrastructure (Giannakis, Spain, Dubey, 2019). Adaptability is a characteristic of resilient supply chains built on adaptive process design and the creation of technological and creative responses to supply chain disruption threats (Yang, Huo, Gu, 2022). Finally, post-disruption recovery means employing approaches and practices to enable the recovery of supply chains after disruptions (Holgado, Niess, 2023). This may require selecting critical processes, advancing recovery efforts, and learning from the disruption to develop resilience.

With the incorporation of these characteristics, the supply chain resilience theory provides a model for identifying, assessing, monitoring, mitigating, and acting on risks and undesired occurrences in organizational networks. The goal is to improve performance related to supply chain resilience (Siagian, Tarigan, Jie, 2021). Equally important is understanding supply chain resilience as a continuous effort to enhance organizations' agility and adaptation to market-related externalities and other contextual threats.

## **2.2 Philosophical Standpoints**

### **2.2.1 Ontology: Addressing Change in Supply Chains Towards Resilience through Dialectical Materialism of Practice**

Research based on the realistic ontology of cognitivism, i.e., information processing as a procedure of the mind in relation to an external reality (Van Ments, Treur, 2021), treats resilience developments within supply chains as individuals' perception derived from their lived experiences as managers and professionals (Buhalis et al., 2019). While resulting from accumulated sensory experiences of the real world, supply chain disruption risks and resilience realization models exist as an abstract entity evaluated by internal cognitive processes of the mind.

In contrast to the realistic ontology for examining supply chain resilience, Wieland and Durach (2021) point out that there is an underlying social construction of resilience in supply chains as participants seek new configurations of interactive networks. The view of supply chain resilience in the ontology of social construction advances its intersubjective character. In the ontology of social construction, supply chain resilience is implemented in sense-making activities embedded in the social structure of norms, values, and ethical standards (Tan et al., 2022).

Despite being distinct ontological views, these separate perspectives result in a framework indicating the existence of a) cognitive/individual; b) intersubjective/interactive; and c) sociocultural elements that permeate the ontological foundations of resilience in terms of supply chain structure, processes, and interactions. This work advocates a third complementary ontology, which unifies supply chain resilience in terms of its interactive-dynamic relationships between subjective, intersubjective, and sociocultural levels: dialectical materialism of practice.

This mutable nature implies the ontological stance of a dialectically becoming being. The ontology related to dialectical materialism of practice offers transcendence from individualistic and sociocultural views (Miettinen, 2006). To overcome this “social versus individual” duality, the conception of “activity-practice-critique” is fundamental (Engeström, Sannino, 2020). Activity-practice-critique refers to the mundane and community work of using and producing tools to address and direct activities with a conscious motive (Leont'ev, 1981). The critical aspect of these collective practices refers to “transformative interactions” between individuals, artifacts, and activities (Miettinen, 1999, p. 175). Approaching these interactions with a dialectical materialist foundation translates collective practices as an evolutionary mutual transformation of the individual and the social through material relations.

Developmental Work Research is proposed here as a departure from adaptive models of transformation where resilience-related developments stem from the lived experience and perception of supply chain management professionals (Creazza et al., 2022). This experience-based model considers the accumulated construction of experiences and respective perceptions as enabling individuals to undertake the cognitive operation of adapting, studying, and unifying activities towards supply chain resilience. Even in the perspective where transformations occur as organizations learn and adapt to new collaboration patterns with a community (Brown, Duguid, 1991), it is also a process of adaptation unfolding in the creation of new types of activities directed towards resilience and organization. For example, Belhadi et al. (2021) captured practices combining big data processing and digital technology with relational efforts and cooperation to overcome disruptions from the COVID-19 pandemic. However, this perspective falls into the static view of learning (i.e., 1) technology-based information, 2) evaluation and interpretation, 3) decision-making, 4) network coordination). It is argued here that the ontology of dialectical materialism can bridge “Digital Transformation” and “Industry 4.0” as emerging and simultaneously foundational tools for changes in supply chain resilience practices.

The historical-cultural activity theory as the foundational theory of the Developmental Work Research model refers to placing material tools (i.e., Big Data and Industry 4.0 devices), activity (i.e., managing, coordinating, cooperating), and individuals (suppliers, distributors, stakeholders) on the same ontological basis of dialectics. This view provides a path for advancing change as it dynamically unfolds. Returning to the learning view of supply chain resilience, it is important to note that learning in preparation for an event is predominantly experiential, thus making the significance of the learning uncertain prior to the event (Scholten et al., 2019). Nevertheless, by leveraging the experiences of others, learning becomes more reliable in ensuring that the acquired insights will enhance the resilience of the supply chain.

The ontological foundations of Developmental Work Research, assuming mutually necessary and changing beings, represent critical contributions to the above notion. More importantly, it is argued here that it provides an enhanced basis for empirical findings towards mutually supplying new forms of preparation and disruption recovery.

#### 2.2.2 Epistemology: Expansive Transformations Through the Epistemology of Practice

In this section, the epistemological foundation of Developmental Work Research is compared, contrasted, and connected with current stances in supply chain resilience research. Particularly, the epistemology related to positivist and social constructivist perspectives is analyzed for their potentials and limitations in current supply chain resilience research. Contemporary challenges in studying supply chains are associated with the complex and unstable context of markets (Ivanov, 2021; Hastig; Sodhi, 2020).

Objectivist epistemology places the researcher in a detached position concerning their external object of investigation. This separation aims to enable knowledge and understanding of an objective world (Miracchi, 2021). Reductionism advocates the isolation of elements (Grewatsch; Kennedy; Bansal, 2021). This reduction to some relevant and stabilized proponent's results, for supply chain resilience studies, in understandings where the general properties of management and/or organizational behavior allow the necessary engagement for resilience development.

The objective and impartial role of the researcher can also take on a qualitative character and present relevant aspects of situations and locally delimited contexts. Following these terms, positive case studies have provided insights into the supply chain resilience learning process (Modgil, Singh, Aníbal, 2022; Kim, Bui, 2019). At its best, this current strand of case studies will enhance our knowledge of interaction patterns by exploring dynamic and possibly blurred roles in the supply chain (SARKIS, 2020). However, these pluralistic understandings of roles and intertwined interactions with supply chain resilience practices require further advances that are limited by the positivist approach.

Models resulting from empirical positivism need to be seen as early stages for practical outcomes, thus current research is needed to bridge the divide between the model and the ultimate resolution (Tapp and Hughes, 2008, p. 276). In this gap, professionals deal with uncertainties and incomplete information that research can only capture if it can access the world as perceived by the actors. Focusing on the evolving perceptions of participants involved in supply chain interactions and resilience development activities can provide new insights into managing within contemporary business networks (Yaroson et al., 2021). The philosophical basis to elucidate this alternative investigation is grounded in subjective interpretivist epistemology.

Interpretivism seeks to understand the perspective of participants in specific contexts. It contributes to a dynamic view of phenomena by focusing on actors' behavior, examining how they sustain, articulate, and share socially represented everyday experiences (Duberley, Johnson, Cassell, 2012). The epistemology of interpretivism, bounded by pluralistic views, is relevant to supply chain resilience by explaining how actors shape their perceptions through shared understandings and the role of the broader social context in producing these perceptions.

Epistemological foundations of Developmental Work Research ground a dialogical approach between the researcher and participants enacting the vision of multiple understandings, beliefs, and commitments shaping the resulting interpretations (Evans, 2021). Despite the similarities that align the epistemological stances of Developmental Work Research with the notions of a subjective, interpretivist, and pluralistic epistemology, Developmental Work Research is fundamentally different from current research strands being proposed in supply chain resilience.

The main distinctive feature of the epistemological foundation in Developmental Work Research is to bring forth "processes that encourage more knowing-in-action and their outcomes" (Raelin, 2007, p. 496). This approach transcends the dualistic view of subjective interpretivism versus objective empiricism by recognizing that the nature of work has epistemological consequences. Actors anticipate cultural tools and how they interact, control, and reproduce roles, meanings, and forms of organization (Leont'ev, 1978, p. 23).

### **3. Methodological Outline: Analytical Stages**

This section of the present study introduces and fundamentally examines the five stages of collective learning

through Developmental Work Research. In this regard, it is proposed to explore supply chain resilience through conceptual foundations, objectives, and related investigations made accessible through a development-oriented analysis in the methodological context. Fundamental to understanding and explaining this expansive transformation is the movement from individual action to collective activity and back to individual action (Engeström, 2001).

The first analytical task is to outline the activity system and delineate the dilemmas and uncertainties of participants in their everyday work. These everyday actions are viewed in terms of emerging tensions, disruptions, or minor innovations in regular work. The introductory focus, therefore, pertains to these tense and troubled everyday performances that constitute individual actions at work. The main objective of this first analytical stage is to examine the difficulties and disruptions in carrying out daily tasks in relation to the implementation of supply chain resilience. This first stage of Developmental Work Research relates to questioning and potentially explains how internal contradictions and learning opportunities relate to transformations towards supply chain resilience.

The second stage of Developmental Work Research — Analysis — concerns everyday problems as they appear in common work practices and interactions. Thus, everyday problems and tensions taken as random incidents are related, analyzed, and interpreted through the fundamental contradictions that originated such events. Stage two connects the lower level of individual actions to the higher collective structure at the level of activity systems analysis.

To understand the transformation of supply chains beyond localized relationships and comprehend the broader context permeating practices related to resilience, it is necessary to analyze the materialized cultural tools, rules, and divisions of labor at play for transformation. This need to understand the broader context is related to comparing various locations and situations using multiple cases within a single organization and its networks and between different organizations. Representing activity systems in terms of tools, rules, and division of labor is a good starting point for researchers to account for the process and outcomes of supply chain interactions.

The third stage of the expansive learning cycle in Developmental Work Research — Modeling — refers to the emergence of new instruments that could resolve contradictions expressed in disruptions, conflicts, and dilemmas. The potential for development is indicated by the participants' recognition of the need for resolution and creation of new models of action. The prospective new activity system is recognized analytically through the zone of proximal development.

The concept of the zone of proximal development can be defined as an intermediate space that exists between the actions involved in the present activity, which are influenced by past conflicts and contradictions, the anticipated activity where most conflicts are resolved, and the anticipated activity where conflicts have resulted in the reduction and elimination of opportunities (Engeström, 1999).

Stages two and three of the proposed methodology could explain the evolution of interactions among multiple actors with divergent perspectives and identify the nature of these interactions.

The fourth stage — *Application* — refers to the application of the instruments constructed in stage three for activity transformation. In the fourth stage, the analytical focus returns to individual tasks and actions. The level of analysis returns to actions related to the implementation of new tools in the “real world”. This stage is permeated by conflicts generated by the new form of action clashing with long-standing conventions, characters, and mechanisms (Dionne, Jornet, 2023). Fieldwork regarding the fourth stage of Developmental Work Research concerns exploring how supply chain management can enable transformation and learning towards supply chain resilience.

The fifth stage — Consolidation and Reflection - shifts the analytical focus to the historical transformation of activity. This stage of expansive learning involves reflecting on the process while consolidating and generalizing the new practice (Moffitt, 2022). This analytical stage guides possible explanations for the evolution of learning within supply chain interactions.

#### **4. Conclusion**

This study serves as an introductory proposal of philosophical and methodological considerations that underpin the design and conduct of Developmental Work Research in the context of supply chain resilience. The philosophical stance, grounded in the ontological perspective of dialectical materialism of practice and the epistemology of practice, corresponds to a deeper exploration of research questions addressing continuous forms of interactions, collaboration, and dynamic transformations related to managerial change and learning. It has been argued here that these advancements needed to be addressed from new philosophical and methodological standpoints. The demand to capture transformations that can drive supply chain resilience was presented here through dialectics as the primary constituent of object change and practice as the epistemology of human agency and social conditions for change.

This work contributes to a management and learning perspective within the transformations leading to supply chain resilience. As supply chain interactions are constantly changing, Developmental Work Research can enable a perspective of transformations towards resilience as an evolving practice in an intrinsic relationship with practice and learning. Consequently, a perspective that actors know, do, and learn as interactions evolve can be brought to the forefront. This means that managerial transformation can be seen as simultaneous actions of navigating the supply chain and interacting in multiple locations and learning to direct new movements and interactions within the emergence of new challenges.

It is suggested here that future research applying the principles of Developmental Work Research can capture these movements of supply chain resilience practice in these terms. In this sense, future research may potentially unveil the dynamic process of vertical and horizontal movements within and between supply chain activity systems.

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