




Pandemics and Supply Chain Management Research: Toward a Theoretical Toolbox*

Christopher W. Craighead[†] 

Department of Supply Chain Management, Haslam College of Business, University of Tennessee, 311 Stokely Management Center, Knoxville, TN 37996, e-mail: craighead@utk.edu

David J. Ketchen Jr. 

Department of Management, Raymond J. Harbert College of Business, Auburn University, 405 W. Magnolia Ave. | Office 445, Auburn, AL 36849, e-mail: djk@auburn.edu

Jessica L. Darby 

Department of Supply Chain Management, Raymond J. Harbert College of Business, Auburn University, 405 W. Magnolia Ave. | Office 401, Auburn, AL 36849, e-mail: jldarby@auburn.edu

ABSTRACT

The COVID-19 pandemic paralyzed the world and revealed the critical importance of supply chain management—perhaps more so than any other event in modern history—in navigating crises. The extensive scope of disruption, massive spillover of effects across countries and industries, and extreme shifts in demand and supply that occurred during the COVID-19 pandemic illustrate that pandemics are qualitatively different from typical disruptions. As such, pandemics require scholars to take a fresh look at what lenses offer understanding of supply chain phenomena in order to help supply chain managers better prepare for the next pandemic and foster *transiliency* (i.e., the ability to simultaneously restore some processes and change—often radically—others). To help scholars and managers achieve these aims, we offer an agenda for supply chain management research on pandemics by considering how the key tenets of well-known and emergent theories can illuminate challenges and potential solutions. Specifically, we consider how resource dependence theory, institutional theory, resource orchestration theory, structural inertia, game theory, real options theory, event systems theory, awareness–motivation–capability framework, prospect theory, and tournament theory offer ideas that can help scholars build knowledge about pandemics’ effects on supply chains as well as help managers formulate responses. [Submitted: May 12, 2020. Revised: May 14, 2020. Accepted: May 16, 2020.]

Subject Areas: Analytical Research, Behavioral Research, Conceptual Development, Empirical Research, Pandemics, Theory, and Transiliency.

* The authors gratefully acknowledge Xenophon Koufteros and Mark Ferguson for their thoughtful suggestions for improving an earlier version of this paper.

[†] Corresponding author.

INTRODUCTION

The COVID-19 pandemic was one of the most impactful events in modern history—it spread to over 200 countries and territories around the world and induced the worst economic downturn since the Great Depression (International Monetary Fund, 2020). Although historically pandemics of this magnitude are rare, we only have to go back to 2009's H1N1 outbreak to witness another example of pandemics' startling effects. Given trends such as increased population, urbanization, and international travel, it is likely that another pandemic will occur. We highlight this reality, not as alarmists, but rather as academics who believe business scholars must play a role in improving firms' ability to navigate these cataclysmic events.

COVID-19 brought to the forefront—more than any event in the last several decades—the importance of supply chain management. Scholars and practitioners have long emphasized the importance of diagnosing and overcoming major supply chain challenges. For example, events such as port strikes, natural disasters, product safety problems, supplier bankruptcy, and terrorist attacks have all been carefully scrutinized for lessons about how to prepare for, manage, and respond to disruptions from both scholarly and managerial perspectives (e.g., Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007; Bode, Wagner, Petersen, & Ellram, 2011). Despite the informative body of research and arsenal of company exemplars, neither fully prepared firms to effectively respond to the COVID-19 pandemic, the “Great Lockdown,” and the tidal wave of disruptions that plagued every industry and geographic region. We suggest that this is because pandemics qualitatively differ from typical supply chain disruptions along three interrelated dimensions:

- (i) *Scope*: A typical disruption is localized geographically and/or by sector. Examples of the former include a port strike cutting off commerce in part of a country and a hurricane disrupting commerce in a specific region. An example of the latter is the 9/11 terrorist attacks, which disrupted various travel industries while farming and retailing pressed on after short pauses. In a pandemic, the whole world and all industries absorb impacts.
- (ii) *Spillover*: A typical disruption often unfolds like a rock thrown into a lake—a large initial shock generally dissipates into minor ripples. In a pandemic, a torrent of roughly equivalent waves spills over from region to region and sector to sector. In response, governments adopt a war footing wherein they take steps such as closing borders, urging or dictating pivots to industry, and restricting individuals' freedom of movement. These actions are intended to mitigate effects, but some actually exacerbate the spillover.
- (iii) *Shifts*: A typical disruption reshuffles the proverbial deck regarding supply and demand—often affecting one, but not the other. For example, a supplier's bankruptcy can result in a temporary loss of supply, but may have little, if any, effect on demand. In a pandemic, the force of disruption is strong enough to force supply and demand to extreme highs and

lows. Consider, for example, the nationwide panic buying of household items and the complete evaporation of new car purchases in the United States during the COVID-19 pandemic. These dramatic shifts also occurred in the same product category as stay-at-home orders created skyrocketing demand for consumer-grade toilet paper (i.e., soft tissue on small rolls) but flushed demand for industrial-grade versions (i.e., large rolls that fit dispensers).

Although these dimensions are not intended as comprehensive descriptors of how pandemics differ from typical supply chain disruptions, they highlight significant points of departure. Distilling lessons learned from the pandemic and anticipating a future one also requires a departure from the traditional scholarly emphasis on continuity and resiliency (e.g., Mena, Melnyk, Baghersad, & Zobel, 2019; Azadegan, Mellat Parast, Lucianetti, Nishant, & Blackhurst, 2020). Specifically, we suggest that companies need to foster *transiliency* (i.e., the ability to simultaneously restore some processes and change—often radically—others) to address pandemic-induced challenges. More simply, the concept of transiliency melds the concepts of resiliency and transformability. For example, a grocery store may need to restore its depleted products (i.e., resiliency) by improving its replenishment processes while simultaneously converting its operations (i.e., transformability) to mimic a “quasi” distribution center by picking, packing, and delivering orders to curbsides or households.

Albert Einstein famously proclaimed: “in the midst of every crisis lies great opportunity.” For managers, the COVID-19 crisis creates an opportunity to foster transiliency and thus better cope with the next pandemic. For scholars, the crisis offers an opportunity to help managers think and act in new and unfamiliar ways by revisiting the conceptual lenses used to understand supply chain disruptions. To help scholars capitalize on this opportunity, we create an agenda for supply chain management research on pandemics by considering how the key tenets of a series of well-known and emergent theories can illuminate challenges and solutions. In doing so, we hope to catalyze meaningful, impactful research that helps alleviate the next pandemic’s impacts on supply chains.

A TOOLBOX OF THEORETICAL PERSPECTIVES

Tools enable craftspeople to accomplish tasks that they could not accomplish otherwise. As previously accomplished in research on best value supply chains (Ketchen & Hult, 2007), new product development (Wowak, Craighead, Ketchen, & Hult, 2016), and sustainability (Connelly, Ketchen, & Slater, 2011), creating a toolbox of theories involves providing scholars with the means to generate new insights about a phenomenon of interest.

In this section, we present 10 theories and consider their implications for understanding supply chain behavior before, during, and after a pandemic. The set offered is a mix of theories that are well established in the supply chain literature and emergent perspectives that have not been leveraged much yet but seem poised to shed important light on pandemic-related challenges. In an effort to emphasize new ways of thinking, we steer clear of theories that have been extensively applied

by supply chain researchers such as the resource-based view and transaction cost economics. We also recognize that other perspectives such as the behavioral theory of the firm, punctuated equilibrium, industrial organization, contingency theory, and evolutionary economics could help explain pandemic effects and the pursuit of transiliency. Although we offer detailed consideration of 10 theories, these others merit future attention as well. Table 1 summarizes the key tenets of each theory, highlights each theory's key insights for supply chain management research on pandemics, and proposes potential research questions.

Resource Dependence Theory

Resource dependence theory (RDT) posits that firms depend on other actors in their environment for access to vital inputs such as materials, labor, and cash (Pfeffer & Salancik, 1978). Dependence creates uncertainty because the flow of resources from outside actors (e.g., suppliers) could stop due to those actors' wishes, failures, or both. Firms respond by pursuing strategies and structures that reduce, minimize, or even eliminate their dependence on external entities. As such, RDT is a natural fit with supply chain research (e.g., Jean, Kim, & Sinkovics, 2012; Touboulic, Chicksand, & Walker, 2014) that could transcend into the pandemic context (see Table 1). Yet, pandemics' daunting effects may necessitate revisiting the dependence concept in at least two ways.

First, although implemented strategies to manage dependencies may be effective in normal modes of operation, they may be ill-equipped to handle the hyper-time-sensitive nature of pandemics when the need for transiliency is heightened. RDT suggests that a firm's ability to respond to extreme shifts in supply and demand will be constrained by external entities who control the resources it requires (Pfeffer & Salancik, 1978). Thus, in the presence of an abnormal spike in demand, a critical bottleneck may surface. For example, during the COVID-19 pandemic, hospitals' ability to respond to massive increases in demand for treatment was (initially) constrained by limited supplies of personal protective equipment (PPE) and ventilators. The spillover effects within a pandemic add complexity to managing these time-induced bottlenecks from resource dependencies. Normally firms can center attention on a small set of key dependencies by attempting to reduce them or at least increase their predictability. This remains true during most disruptions as well. As a result of the spillover effects brought on by a pandemic, however, firms find themselves fighting a multi-front assault by an ever-changing array of supply shortages and demand spikes. How can a firm juggle all of these interrelated dependencies to shape how well it fares during and after the pandemic? Although this question will need to be examined by multiple studies and methods, the answers they provide could offer a great deal of promising insights. Analytical research could provide important foundational insights by considering differences in scenarios wherein adjusting the parameters involved in one dependence relationship does or does not have a cascade effect on other dependencies.

Second, although deployed structures to manage dependencies may be effective within typical supply chain contexts, they may have little merit during pandemics as dependencies, themselves, may evolve. For example, the extreme shifts in supply and demand that accompany a pandemic can alter power dynamics

Table 1: Theories, insights into pandemics, and research questions.

Theories and Key Tenets	Key Insights for Supply Chain Research on Pandemics	Research Questions
<p><i>Resource dependence theory:</i> Firms depend on external entities for needed inputs and take actions to reduce this reliance.</p>	<p>Government efforts to alleviate the scope of a pandemic's impacts will indirectly enhance or restrict the flow of resources between firms, thus magnifying the extreme shifts in supply and demand.</p> <p>Extreme shifts in supply and demand will alter power dynamics within supply chains, as power advantages shift upstream.</p>	<p>Does a pandemic increase the prevalence of power "nonuse" within exchange relationships and, if so, to what extent?</p> <p>What "balancing operations" do firms use to manage dependencies during and after a pandemic?</p>
<p><i>Institutional theory:</i> Pressures from the environment lead firms to choose actions that help them gain or maintain legitimacy.</p>	<p>Efforts to deal with the scope of a pandemic's impacts will lead to mimicry in supply chain responses, as industry leaders' actions become readily accepted as legitimate.</p> <p>Widely accepted best practices will be set aside as firms desperately respond to extreme shifts in supply and demand.</p>	<p>What new sources of dependence emerge during a pandemic? For how long do these dependencies influence firm behavior following a pandemic?</p> <p>How does the drastic increase in the level and multiplicity of institutional pressures during a pandemic influence how firms respond?</p> <p>Under what conditions will a pandemic result in permanent transformations in supply chain processes versus reinstitutionalization of previous processes?</p> <p>To what extent, if any, does government's increased role as a source of institutional pressures persist postpandemic?</p>

Continued

Table 1: Continued.

Theories and Key Tenets	Key Insights for Supply Chain Research on Pandemics	Research Questions
<p><i>Resource orchestration theory:</i> Firms structure, bundle, and leverage strategic resources to achieve a sustained competitive advantage and superior performance.</p>	<p>Synchronization of structuring, bundling, and leveraging activities will be critical to prepare for future pandemics. Firms are more likely to restructure their resource portfolio in response to extreme shifts in supply and demand.</p>	<p>How much of a firm's resource portfolio should be outsourced versus built in-house to weather pandemic-induced shifts in supply and demand? What long-term effects do on-the-spot bundling activities have on firms' longstanding resource bundles? What determines a firm's level of versatility with reconfiguring resource bundles to generate different types of value during a pandemic?</p>
<p><i>Structural inertia theory:</i> Environmental conditions, not managers' decisions, are the main driver of why firms live or die.</p>	<p>Groups of firms who cooperate may be more likely to survive a pandemic than uncooperative ones. The scope of a pandemic's impacts may be particularly troublesome for small firms and old firms who are slow to adapt.</p>	<p>How should government mitigation efforts be structured to enhance the likelihood that small firms will survive a pandemic? To what extent, if any, do a pandemic's extreme impacts accelerate the process of extinction for firms who were slow to respond to prepandemic pivots (e.g., the transition to e-commerce)? To what extent, if any, do a firm's adaptation attempts during a pandemic influence its likelihood of survival following a pandemic?</p>

Continued

Table 1: Continued.

Theories and Key Tenets	Key Insights for Supply Chain Research on Pandemics	Research Questions
<p><i>Game theory:</i> Because firms strive to maximize payoffs, their actions can be predicted based on their interactions with other actors.</p>	<p>Government efforts to alleviate the scope of a pandemic's impacts will alter the "rules of the game" and thus how firms interact with one another.</p> <p>Extreme shifts in supply and demand will make upstream and downstream firms' moves more difficult to forecast and anticipate.</p>	<p>By what process and at what speed does cooperation between firms with competing objectives erode following a pandemic?</p> <p>How do the violations of the knowledge assumption brought on by a pandemic influence the sensitivity of game theoretic predictions?</p> <p>What mix of cooperation and competition helps firms achieve transiency during and after a pandemic?</p>
<p><i>Real options theory:</i> Managers delay decision-making under uncertain conditions by creating options, then exercising or not exercising those options.</p>	<p>Managers are more likely to exercise deferral, switch-use, and abandonment options in response to a pandemic.</p> <p>Staging options become more difficult to create and maintain during a pandemic, but they are potentially more useful under such conditions.</p>	<p>What types of options—new or existing—should managers create to foster transiency in preparation for the next pandemic?</p> <p>Under what conditions (i.e., when and how) should particular option types be exercised during a pandemic?</p> <p>What is the optimal design, mix, and deployment of options during a pandemic?</p>

Continued

Table 1: Continued.

Theories and Key Tenets	Key Insights for Supply Chain Research on Pandemics	Research Questions
<p><i>Event system theory:</i> Novel, disruptive, or critical events are more likely to shape firm behaviors, and their effects may disperse widely across firms.</p>	<p>Firms that experience huge swings in supply and demand during a pandemic are more likely to change their supply chain processes postpandemic.</p> <p>During a pandemic, firms that experience effects that cut across the entire end-to-end supply chain are more likely to foster transiliency.</p>	<p>How do event time and event space moderate the level of change triggered by a pandemic?</p> <p>How are supply chain managers and policymakers likely to respond to a pandemic given varying event characteristics (e.g., strength, time, and space)?</p> <p>What changes in supply chain processes should be maintained and discarded following a pandemic?</p>
<p><i>Awareness-motivation-capability framework:</i> The likelihood a firm will respond to an external threat is determined by its awareness of the threat, motivation to counter it, and capability to counter it.</p>	<p>Prior pandemic experience will increase firms' awareness of a pandemic's impact and thus the likelihood they will respond.</p> <p>Individual firms are motivated to counter a pandemic's extreme impacts but are unlikely to have the capabilities required, thus encouraging cooperation.</p>	<p>What level of awareness is required to elicit a proactive response from firms pre-pandemic?</p> <p>How does firm motivation enhance or attenuate the effect of awareness on the likelihood of a proactive response?</p> <p>What level of cooperation between supply chain actors is required to effectively counter a pandemic's extreme impacts?</p>

Continued

Table 1: Continued.

Theories and Key Tenets	Key Insights for Supply Chain Research on Pandemics	Research Questions
<p><i>Prospect theory</i>: The framing of alternatives in terms of potential gains or losses shapes managers' risk preferences and decisions.</p>	<p>Framing a pandemic's impact in terms of potential losses will increase the likelihood that managers will respond. Managers need to temper risk-seeking tendencies that the significant losses associated with a pandemic will encourage.</p>	<p>How can a pandemic's potential impacts be framed in order to improve supply chain managers' decisions? How does external framing (e.g., government and media) of a pandemic's potential impacts influence the likelihood supply chain managers will respond before versus during a pandemic? What "checks" and interventions can firms implement to adjust for supply chain managers' risk preferences during a pandemic?</p>
<p><i>Tournament theory</i>: How rewards are distributed among "winners" and "losers" shapes managers' decisions.</p>	<p>A firm will take more actions to maximize its chances of attaining pandemic-induced government bailouts when prize spreads are large. Pandemic-related uncertainty and the associated risks may require greater prize spreads to motivate firms to take actions that foster transiency.</p>	<p>Under what conditions do pandemic-induced tournaments foster collaboration versus competition in buyer-supplier exchanges? What level of prize spread optimizes the distribution of necessary goods during a pandemic? How do extreme losses during a pandemic influence firms' postpandemic actions to maintain or improve competitiveness?</p>

within supply chains, as firms become more or less dependent on external entities (Pfeffer & Salancik, 1978). As an illustration, consider the power dynamics in a traditional retailer–supplier relationship. Retailers are dependent on suppliers for access to brands and products, and suppliers are dependent on retailers for access to consumers. Under normal circumstances, retailers enjoy a power advantage and wield this power to extract concessions from suppliers (Huang, Li, & Mahajan, 2002). During a pandemic, however, the balance of power shifts in suppliers' favor. In the midst of consumer stockpiling and unprecedented increases in demand, retailers are increasingly dependent on suppliers to keep shelves stocked. For example, during the COVID-19 pandemic, Walmart gave suppliers exemptions on its notoriously tight on-time, in-full protocol (Souza, 2020). To what extent emergent power relationships persist versus return to normal could be an overarching question worth answering. The resultant line of inquiry would seem to be central to the examination of transiliency in postpandemic periods.

Institutional Theory

Institutional theory suggests that firms bow to environmental pressures in an effort to earn legitimacy (DiMaggio & Powell, 1983). Legitimacy in turn is believed to allow a firm to more easily attract support from external actors such as buyers, suppliers, and governments. As various firms all pursue legitimacy, they start to resemble each other—a process called isomorphism (Meyer & Rowan, 1977). Bank branches, for example, share similarities such as well-dressed employees, conservative décor, and drive-through windows. Within the supply chain context, researchers have examined how expectations of what constitutes legitimate behavior diffuse across supply chains and gradually become shared norms (e.g., Bhakoo & Choi, 2013; Reusen, Stouthuysen, Roodhooft, Van den Abbeele, & Slabbinck, 2020).

Institutional theory's emphasis on the creation and demise of legitimacy fuels its value as a lens for understanding supply chain behavior during and after a pandemic (Meyer & Rowan, 1977)—see Table 1. During a pandemic, firms are freed from a so-called “iron cage” of expectations (DiMaggio & Powell, 1983), and longstanding ideas of what is and is not legitimate are ignored as firms desperately respond to extreme shifts in supply and demand. For example, during the COVID-19 pandemic, the “lean” philosophy—a widely adopted, if not sacred, best practice since the 1980s—was called into question amidst rampant stockouts (Jin & Ellram, 2020). After a pandemic subsides, institutional theory suggests two potential paths forward: either new conceptions of legitimacy will emerge or reinstitutionalization will occur as firms fall back into “old habits” (Davis-Sramek et al., 2017). Because of the broad scope and dramatic shifts that accompany a pandemic, we expect that new conceptions of legitimate, successful behavior will emerge following a pandemic, resulting in some permanent transformations in supply chain processes. In the postpandemic institutional environment, time-honored traditions such as lean operations will rise or fall on their own merits rather than being assumed to be legitimate. As such, we believe that studying the postpandemic evolution—or revolution—of other mainstream supply chain strategies (e.g., global sourcing) would be a fruitful path to pursue.

Institutional theory also can shed light on changes in environmental complexity. Firms typically face formidable pressures from only a limited number of actors (Lu, Koufteros, Talluri, & Hult, 2019) even during most disruptions. During a pandemic, however, firms face a flurry of unpredictable pressures from numerous and diverse stakeholders, including government, supply chain partners, competitors, employees, consumers, and the media. For example, although Target always exerts tough pressure on suppliers to deliver goods to its warehouses within tight windows (Bose & Layne, 2016) to appease consumer pressure, governmental actors normally are uninterested in suppliers' delivery performance. During COVID-19, however, the pressure shifted as the U.S. government called for stable supplies and full shelves to counter consumer hysteria and prevent further stockpiling. Likewise, the U.S. government directed General Motors to produce ventilators (Rosevear, 2020). During pandemics, firms may be asked to do more, but government pressures can also manifest in other ways. For example, a court ruling triggered the closure of Amazon distribution centers in France due to the perspective that with "the punitive 1M euro per incident imposed by the court, the risk of accidentally shipping nonessential items was too high" (Forde, 2020).

To cope with heightened institutional pressures and unprecedented levels of uncertainty induced by a pandemic, firms will mimic the changes and processes implemented by other firms—particularly industry leaders. Such responses are mimicked not because of their efficiency or effectiveness but rather because they are viewed as "safe" ways to proceed (DiMaggio & Powell, 1983). Deephouse (1999, p. 147) insightfully recommended that "firms should be as different as legitimately possible" but, under pandemic conditions, it might be wiser to be as similar as possible until the crisis ends. Overall, pandemics appear to foster changes in the nature of mimetic, normative, and coercive pressures. As the General Motors and Amazon examples illustrate, studying whether and to what extent coercive pressures increase during a pandemic—as well as whether any increased pressures later persist or subside—would be enlightening.

Resource Orchestration Theory

In crafting resource orchestration theory, Sirmon, Hitt, and Ireland (2007) began by adopting Barney's (1991) contention that strategic resources—assets such as a sophisticated supply network or stellar brand name that are valuable, rare, and difficult to substitute for or imitate—can give rise to sustainable competitive advantages. Although Barney's (1991) emphasis was theorizing about what effects strategic resources can have, Sirmon et al. (2007) and Sirmon, Hitt, Ireland, and Gilbert (2011) dug deep into understanding the processes by which these effects unfold. Subsequently, performance management (Koufteros, Verghese, & Lucianetti, 2014) and product recalls (Ketchen, Wowak, & Craighead, 2014) have been examined from a resource orchestration perspective, but overall the theory remains underexplored within supply chain research. Given the orchestration problems organizations experienced during COVID-19, pandemic research would be a great place to build momentum for this theory within supply chain research (see Table 1).

Resource orchestration theory suggests that three types of actions—structuring, bundling, and leveraging—accompany strategic resources (Sirmon et al., 2011). First, structuring refers to the “management of the firm’s resource portfolio” (Sirmon et al., 2007, p. 277) by accumulating (i.e., building), acquiring (i.e., buying), and divesting (i.e., selling) assets and capabilities. Scholars should examine whether each of these actions plays a central role in creating transiliency during pandemics (e.g., what new resources are needed and how are they created?), but they may also be used to examine longer term implications of the crisis. For example, the make-or-buy decision is a key consideration here as firms determine how much of their resource portfolio is built in-house versus contracted out to supply chain partners. Owning the means of production offers control but also adds complexity, so many firms outsourced much of their resource portfolio in recent years. Rampant shortages during the COVID-19 pandemic may induce firms to rethink this approach in favor of increased self-sufficiency. Modeling the balance of make-or-buy decisions that would allow firms to weather the extreme shifts in supply and demand in future pandemics could help managers determine how much of their resource portfolio should be moved back in-house.

Bundling refers to actions that bring together and integrate resources by stabilizing, enriching, and pioneering processes, that tweak, extend, or develop capabilities, respectively (Sirmon et al., 2007). For example, FedEx became iconic by building a ruthlessly efficient supply chain alongside uniquely clever marketing and a culture centered on competitiveness that extended to its supply partners (Hult, Ketchen, & Nichols, 2002). Although resource bundles are usually developed slowly and deliberately over time, the dramatic shifts in supply and demand induced by a pandemic force firms to bundle resources quickly and in ad-hoc ways. During COVID-19, Amazon, for example, simultaneously altered its product mix toward essential items, onboarded tens of thousands of new employees, and abandoned its 2-day delivery capabilities. In other words, the resource bundle that had fueled much of Amazon’s previous success was completely reconfigured during the pandemic. Understanding on-the-spot bundling’s efficacy in responding to a pandemic as well as the effects of on-the-spot bundling on firms’ longstanding resource bundles is an important avenue for future research. In particular, scholars should examine whether the rapid bundling is driven by the flexibility of the underlying resources, adaptability of interfaces between resources, or both that create and enhance transiliency. In doing so, determining what (and how) firms stabilized, enriched, and pioneered capabilities would be valuable.

Leveraging refers to the actions taken to generate value from a firm’s resources, including mobilizing (i.e., recognizing needed capabilities), coordinating (i.e., integrating resources), and deploying (i.e., using capabilities to support strategy) (Sirmon et al., 2007). During a pandemic, firms must not only rethink *how* they can generate value from their current bundling of resources but also *what type* of value they can create. For example, Louis Vuitton reconfigured its fashion workshops and cosmetics factories to produce much-needed masks, hospital gowns, and hand sanitizer during the COVID-19 outbreak (Seipel, 2020). Leveraging its production capabilities and distribution networks in this way may not generate value in the sense that it leads to a sustained competitive advantage for Louis Vuitton, but it generates value for society by helping to neutralize threats in the environment

(Barney, 1991). After a pandemic, we expect that firms will restore some of their previous resource deployments, whereas others will be permanently transformed. Further, as the Louis Vuitton example illustrates, synchronizing how resources are structured, bundled, and leveraged will be crucial to prepare for future pandemics (cf. Sirmon et al., 2007, 2011).

Structural Inertia Theory

According to research on population ecology, types of organizations survive or perish based on a process of natural selection that is beyond their control (Hannan & Freeman, 1977); this lies in contrast to theories such as resource dependence that are centered on willful adaptation. As population ecology thinking evolved, it increasingly emphasized the concept of structural inertia in explaining why many organizations cannot adapt to changing conditions (Hannan & Freeman, 1984). Just as a population of penguins would perish if placed in a desert, some firms cannot change enough to survive when conditions shift. For example, once-dominant Blockbuster Video was unable to adjust as streaming video became popular, and the firm collapsed. Similarly, tens of thousands of restaurants were permanently closed due to COVID-19 (Maze, 2020). Within supply chain research, structural inertia has been used to explain why firms struggle to make major shifts, such as from mass production to customization (Rungtusanatham & Salvador, 2008), despite the presence of conditions conducive to the latter.

Structural inertia appears to hold promise as a lens to examine why some types of firms fare better than others during and after pandemics (see Table 1). Under normal conditions, small businesses fail more frequently than large firms due to resource constraints (Hannan & Freeman, 1984). During a pandemic, this hazard is magnified because small businesses may not have the resources necessary to realize the level of transiliency needed for survival. This is illustrated, in part, by the U.S. government's attempt to help small businesses weather the COVID-19 pandemic via a targeted loan program. Larger firms gobbled up much of the initial funding that was intended for small businesses, leaving many of the latter suffering. Indeed, an April 2020 survey found that 52% of small business owners expected to fail within 6 months (Society for Human Resource Management, 2020). Yet, during the Great Shutdown, larger businesses were not immune to financial woes (e.g., J.Crew filed for bankruptcy in May 2020) (Tucker, 2020). Assessing the degree to which these firms struggled due to structural inertia before, during, and after the pandemic would be an intriguing research task.

Examining firms' structural inertia during and after pandemics through the lens of supply ecosystems is an appealing path (Ketchen, Crook, & Craighead, 2014). Within an ecosystem, buyers and suppliers can become deeply intertwined, fostering a high level of interdependence. This interdependence can be a blessing, a curse, or both. For example, during the COVID-19 pandemic, Rise Bar saw a dramatic increase in sales as consumers stockpiled nonperishable items like protein bars (Dudley, 2020). In response, Amazon upped its suggested inventory levels, and Rise Bar began shipping the "lion's share" of its available products to Amazon (Dudley, 2020). Such actions deepened the relationship between Rise Bar and Amazon but gave short shrift to Rise Bar's other retail partners. This is just

one example of many whereby Amazon strengthened its “competitive position in ways that could outlast the pandemic” (Dudley, 2020). To the extent that Amazon now dominates the ecosystem, Rise Bar may become more vulnerable to the retail giant’s whims over time and regret reducing its ties with other grocery chains when they needed Rise Bar the most.

Game Theory

Game theory aims to predict, given a set of rules, the strategies actors will use when interacting with each other (von Neumann & Morgenstern, 1944). It assumes that actors are logical and will try to maximize their own payoffs. In one-time exchanges, selfish choices (i.e., “defections”) usually maximize outcomes. If actors interact repeatedly, however, game theory’s “shadow of the future” proposition suggests that each will act cooperatively because defections will attract future retaliation (Bó, 2005). Building on these notions, game theory has been applied to buyer–supplier relations in order to predict, for example, optimal pricing and production quantities (Cao & Fang, 2019), new technology adoption (Zhu & Weyant, 2003), and distribution channel decisions (Xia, Xiao, & Zhang, 2017).

Game theory suggests that cooperation between firms with competing objectives is more likely during a pandemic because the costs of defection are much greater (see Table 1). During the COVID-19 pandemic, for example, large grocery chains paid their suppliers faster to help suppliers stay solvent (Creditsafe, 2020). Cooperation between competitors may also be warranted and, in some cases, requested by governments to adequately address a pandemic’s impacts. During the COVID-19 pandemic, Norway temporarily suspended competition laws to allow rival airlines to coordinate routes in order to stay afloat and transport goods (Terloar, 2020). Following a pandemic, the “shadow of the future” proposition suggests that firms will be more likely to cooperate—or at least not act opportunistically—in order to prevent being “punished” by buyers and suppliers in future pandemics (Bó, 2005). Research is needed to understand the “stickiness” of different types of coordination mechanisms (Sahin & Robinson, 2002) before, during, and after pandemics, such as whether the inevitable erosion of cooperation postpandemic is linear or curvilinear and whether it is abrupt or gradual.

Although we expect greater cooperation, the scope, spillover, and shifts induced by a pandemic violate game theory’s fundamental assumption that each actor knows the structure of the game (Ross, 2019). Extreme shifts in supply and demand make it more difficult for firms to predict how buyers and suppliers will act and thereby place a premium on building transiliency. Outside of the supply chain, government efforts to alleviate the scope of a pandemic’s impacts continuously and unpredictably alter ground rules and thus disrupt how firms interact with one another. For example, during the COVID-19 pandemic, several grocery chains had orders canceled or postponed by suppliers who were required to prioritize the U.S. Federal Emergency Management Association’s (FEMA) orders (Phillips, 2020). This is in stark contrast to government’s typically passive role within game theory as a “third player” that enforces the rules and occasionally revisits them (Ross, 2019). Experiments and simulations alike may be important

tools for future research to test the sensitivity of game theoretic predictions to violations of the theory's assumptions brought on by a pandemic.

Real Options Theory

Real options theory focuses on how to make better decisions within uncertain situations. Managers are believed to manage uncertainty by creating real options for themselves wherein they have the opportunity, but not an obligation, to make a bolder move as uncertainty is resolved (Myers, 1977). Building a factory using a modular approach, for example, creates an option to expand the facility if demand requires it. Given the inherent uncertainties within supply chains (Flynn, Koufteros, & Lu, 2016), real options thinking has been applied to information technology initiatives (Tiwana, Keil, & Fichman, 2006; Tiwana, Wang, Keil, & Ahluwalia, 2007), outsourcing (Jiang, Yao, & Feng, 2008), and other supply chain projects (Hult, Craighead, & Ketchen, 2010).

Pandemics create uncertainty at warp speed due to their scope, spillover, and extreme shifts in supply and demand. In preparation for the next one, managers should consider developing an arsenal of real options for navigating the associated uncertainties (see Table 1). Real options theory offers six primary options—unlocking (aka growth), stage, deferral, scale, switch use, and abandonment (Hult et al., 2010)—all of which potentially could be used to cope with the pandemic-induced challenges. For example, as COVID-19 unfolded, companies attempted to use existing drugs (e.g., Hydroxychloroquine, Remdesivir) to treat virus symptoms (a switch-use option), expanded production of key medical supplies (a scale option), and terminated projects to allocate funds to address more pressing needs (an abandonment option). These actions appear to have been grounded in desperation rather than through the exercise of well-designed options, which may have limited their effectiveness. Helping managers figure out which options to create before the next pandemic and to determine when the options should be exercised as the next pandemic unfolds represents a clear opportunity for supply chain scholars to contribute to theory and practice. We believe that the value of such options will vary considerably across industries and firms—as such future research should consider designs that center on breadth as well as depth.

As scholars identify the best options to combat pandemics, they should not only consider each option's effectiveness in directly responding to the virus's threat but also the opportunities for transiliency each creates. For example, during COVID-19, many restaurants were forced to convert in-house dining operations to curbside and delivery operations (a switch-use option) because of government restrictions. As stay-at-home orders were relaxed, restaurants had to decide whether to maintain both types of operations or return to their original approach. Real options thinking could allow for future pivots to be smoother. For example, in preparation for the next pandemic, restaurants could create an overarching switch-use option (Hult et al., 2010) by investing in contingency plans (e.g., how to convert in-house to delivery processes), training employees, and maintaining inventory of ambidextrous supplies (i.e., those that could be used in normal or pandemic modes of operation). To enable this transiliency, analytical research could focus on the optimal design, mix, and deployment of options, whereas empirical research

could explore whether the existing set of six primary options is adequate to cope with a pandemic's extreme impacts or if new types of options are waiting to be discovered.

Event System Theory

Open systems theory's central premise is that organizations must obtain needed inputs from the environment and transform them into outputs that other actors will purchase (Von Bertalanffy, 1950). Organizations thus seek to establish and maintain an equilibrium between their inbound and outbound flows in order to achieve stability (Katz & Kahn, 1978). Dramatic happenings—the focus of event systems theory (EST)—threaten this stability, which triggers changes to an organization's behaviors and features (Morgeson, Mitchell, & Liu, 2015). For example, the 9/11 attacks disrupted airport security operations, which prompted changes such as passengers having to remove shoes when going through the screening process. Given its relative newness, EST has not taken a strong hold in supply chain research, but its potential has been highlighted for scholars examining invasive events that alter firms and their supply chains, such as supplier-induced disruptions (Reimann, Kosmol, & Kaufmann, 2017) and counterfeiting (Craighead, Ketchen, & Cheng, 2016).

Given its focus on events that are novel, disruptive, and critical (Morgeson et al., 2015) and the resultant organizational changes, EST is a natural fit for supply chain research on pandemics (see Table 1). In particular, scholars could embrace EST's key change catalysts: event strength, space, and time. Event strength centers on how salient the event is compared to the usual "happenings" in the environment. EST predicts, perhaps intuitively, that more salient events are more likely to trigger change. However, the level of change triggered by event strength is moderated by event space and time (Morgeson et al., 2015). Event space focuses on how the *effects* of the event (i.e., not the event itself) spread, whereas event time focuses on the event's temporal aspects, such as its duration and trajectory. Fortunately, the world has experienced only a few pandemics since the 1900s (Centers for Disease Control & Prevention, 2020a), but this infrequency has resulted in very few permutations of event space and time.

Although supply chain scholars should examine changes in response to previous pandemics to garner insights, EST suggests that it is also important to examine a pandemic's characteristics in a "forward looking" manner (Morgeson et al., 2015). For example, behavioral studies that center on decision-making in juxtaposition with a pandemic's key event characteristics could help uncover likely responses from managers and policymakers. Likewise, simulating pandemics with varying strength, time, and space characteristics could help managers vet current practices and make necessary preparations for the next pandemic. Finally, empirical research using longitudinal data is well-suited to examine pandemic-induced changes given its ability to capture effect sizes and provide at least indirect evidence of causality.

EST may be especially useful for understanding how organizations can foster supply chain transiliency. One of EST's key implications is that events "can beget new features...in addition to changing existing features" (Morgeson et al.,

2015, pp. 532–533). That is, new policies and procedures implemented during a pandemic may continue even as operations return to normal and, in turn, become routinized over time. For example, during the COVID-19 pandemic, “fast fashion” companies were forced to move their design and manufacturing activities online whereby designers used digital prototyping to sample garments, prospective factories used virtual showrooms to showcase capabilities, and buyers placed orders from virtual lookbooks and digital fashion shows (Roberts-Islam, 2020). Industry experts referred to COVID-19 as a “catalyst for change” and predicted such digitalization would continue into the future. A key opportunity for supply chain researchers is identifying which new features and changes to existing features should and should not endure following a pandemic. More broadly, should transiliency be a centerpiece of supply chain strategy postpandemic, is its inherent value limited to times of crisis, or is it somewhere in between? We speculate that the answer to this will vary considerably across the various supply chain designs and strategies, environmental uncertainties, and industry clockspeeds.

Awareness–Motivation–Capability Framework

Chen (1996) introduced the awareness–motivation–capability (AMC) framework to describe, explain, and predict whether a firm will respond to an external threat and, if so, how. The theory contends that the likelihood and nature of responses are shaped by the degree to which a firm is aware of a threat, motivated to combat it, and capable of effectively countering it. Most applications involve analyzing rivals’ competitive moves and countermoves (e.g., Chen, Su, & Tsai, 2007; Upson, Ketchen, Connelly, & Ranft, 2012), but the theory recently has been extended to investigate whether and how a firm will respond to the implicit threat created when activist investors (i.e., investors who may want to force executives to act differently) take an ownership stake in the firm (Shi, Connelly, Hoskisson, & Ketchen, 2019). Given the grave threat posed by pandemics, using the AMC framework to shed light on responses appears to be a natural extension of the theory (see Table 1).

Some threats are explicit, whereas others are implicit (Sinaceur & Neale, 2005). Firms are more likely to be aware of the former, but the latter are often the more insidious dangers. Past disease outbreaks involving SARS and Ebola had the potential to become pandemics, but early detection and preventative measures limited the scope of their effects. Unfortunately, it appears that many firms failed to learn from these pandemic “near misses” (e.g., Dillon & Tinsley, 2008). As one chief executive officer put it, “maybe the COVID-19 stuff caught everybody with their pants down” (Motley Fool, 2020). One research goal could be understanding why firms’ awareness of potential pandemics either was too low or, if awareness was adequate, why this awareness did not trigger stronger preparation and contingency plans (Goldschmidt, Kremer, Thomas, & Craighead, 2020).

A partial answer might lie in the second element of the framework. In the absence of strong motivation, a firm is less likely to respond to an implicit threat (Chen, 1996). Firms must monitor a variety of outside threats and not all of them receive full attention. A firm might ignore or downplay the potential for a pandemic under a belief that the pandemic’s effects would not spill over to its sector. Another firm might be consumed by more explicit and immediate threats such

as the bankruptcy of an important supplier, labor problems in a factory, untimely executive turnover, or an overseas competitor establishing a foothold in its home market. With so many risks to manage, perhaps a pandemic—a high impact, but low probability event—takes a back seat to more salient ones. Thus, awareness of the threat posed by a pandemic increases the likelihood of a proactive response, but low motivation to respond makes a “wait and see” approach more likely.

Looking to the future, firms are now keenly aware of pandemics and highly motivated to respond well if one emerges. Given the monumental supply and demand shifts brought on by COVID-19 as well as the scope of its effects and the spillover across regions and sectors, it is not surprising with the benefit of hindsight that firms’ preparation of their supply chains was universally inadequate. Chen (1996, p. 105) noted that “capability depends largely on strategic or resource endowments.” Because the normal ground rules are suspended under pandemic conditions, perhaps no type or amount of endowments is adequate to arm a firm with an arsenal of fully capable supply chain responses. This brings to the forefront the potential importance of cooperation (e.g., Wilhelm, 2011) in which competing firms cooperate to realize an important outcome. During pandemics, the plethora of volatile, diverse environmental issues overwhelms the internal capabilities of most firms (i.e., prevents the achievement of requisite variety (cf. Ashby, 1961)), suggesting that cooperation becomes a necessity rather than an option. For example, in the spring of 2020, Apple and Google announced a plan to combine forces and develop contact tracing capabilities (Sherr, 2020). This initiative highlights the possibility that examining cooperation, particularly in terms of its ability to foster transiliency, would be a fruitful avenue.

Prospect Theory

Prospect theory’s focus is decision-making under uncertainty (Tversky & Kahneman, 1986), which makes the theory well-suited for explaining supply chain decisions during and after pandemics (see Table 1). Fundamental to prospect theory is the premise that how a problem is framed influences actors’ decisions. In particular, describing a situation in negative terms will lead to riskier choices than if the same scenario is described in positive terms. In a highly relevant experiment, Tversky and Kahneman (1986) asked subjects to choose between alternative policies to combat a new epidemic. When likely outcomes were framed in terms of “lives saved,” participants chose conservative options, but when the same outcomes were framed in terms of “lives lost,” participants preferred aggressive, risky options.

Consistent with prospect theory, experimental findings suggest that supply chain managers will be risk-seeking and order more than the optimal amount when all possible outcomes involve losses (e.g., Schweitzer & Cachon, 2000). To adjust for these risk preferences, firms normally implement various “checks” and interventions in their ordering, replenishment, and inventory management processes (Tokar, Aloysius, & Waller, 2012). During a pandemic, however, we expect that supply chain managers’ risk-seeking behaviors will not only be magnified but actually encouraged because of the enormity of the potential losses. Knowing that positive and negative framing will nudge supply chain managers toward conservative and risky choices respectively, we expect that the best course of action is to

consider both frames when making a decision. For example, under shortage conditions, pondering alternatives for distributing what is available both in terms of customers served and customers disappointed can help ensure logical choices are made. Examining to what extent assigning a formal devil's advocate within discussions of these alternatives improves outcomes could be a useful research pursuit. In particular, research examining these frames in light of transiliency may shed light on why some processes are restored and others adapted. More generally, behavioral research using experiments (e.g., economics based, vignette based) appears well-suited to examining how framing as well as other behavioral influences/biases shape important pandemic-related decisions.

How prominent outsiders frame situations appears to be particularly important during a pandemic—such conditions offer extreme variation in potential outcomes and the presentation of these outcomes by government and media outlets varies greatly as well. For example, during the SARS pandemic, the media was criticized for creating additional uncertainty (Siegel, 2005). Similarly, during the COVID-19 pandemic, media coverage varied significantly across countries and news outlets; some were accused of using “sensationalist” or “inflammatory” frames, whereas others were criticized for downplaying potential risks (Radu, 2020). Framing alternatives in terms of potential gains may promote prevention behaviors (Gallagher & Updegraff, 2012), but such behaviors will be more conservative (Tversky & Kahneman, 1986). During a pandemic, the use of loss frames may be warranted to galvanize managers to take the aggressive actions necessary to combat a pandemic's extreme effects. Prospect theory is thus useful in understanding why supply chain managers are likely to underreact prior to the pandemic but overreact (e.g., hoarding behaviors) during the pandemic when “losses loom larger than gains” (Kahneman & Tversky, 1979, p. 279).

Tournament Theory

Competition generally involves incremental accomplishments (e.g., poaching one supplier or customer from a rival) generating incremental gains (reductions in costs or increases in revenues, respectively). Sometimes, however, competition takes the form of a tournament wherein there are large disparities in gains between winners and losers (Connelly, Tihanyi, Crook, & Gangloff, 2014). For example, in the mid-2000s, two supply networks headed by Raytheon and Lockheed Martin competed for a 10-year, \$11.2 billion contract to supply the U.S. Army with training support (Ketchen, Ireland, & Snow, 2007). Raytheon's team won and collected all the money; Lockheed was left to absorb the cost of preparing its bid and lick its proverbial wounds. Firms entering such “winner-take-all” tournaments must decide how much effort to devote to contending for the prize knowing that their investments will disappear if they lose.

Tournament theory is well suited for analyzing buyer–supplier dynamics during a pandemic (Table 1). On the supply side, extreme scarcity raises the stakes associated with acquiring needed items. Rather than rationing goods across their customer base during the COVID-19 crisis, some suppliers provided all available stock to preferred customers and left others empty handed. Tournament theory suggests that the costs associated with losing (i.e., empty shelves and unhappy customers)

will incentivize firms to improve their competitiveness in future tournaments (Connelly et al., 2014). Postpandemic, firms that were winners will need to figure out how to ensure they remain a preferred customer, whereas losers will need to figure out how to improve their standing. Whether pandemic-induced tournaments foster collaboration or competition in postpandemic buyer–supplier exchanges is an open question, but past evidence that major losses can induce aggressive behavior (e.g., Harder, 1992; Pfeffer & Langton, 1993) points to the latter.

Prize spread is key to understanding behavior through a tournament theory lens (Connelly et al., 2014). Some tournaments are winner-take-all as in the Raytheon versus Lockheed Martin example above, but others are structured more like a professional golf tournament or an automobile race wherein the first-place performer takes the proverbial lion's share of the rewards and others win logarithmically descending rewards. If the prize spread is too small (i.e., payoffs are distributed too broadly), firms' incentives to excel are low. If the prize spread is too large, firms may hold back effort because the costs of competing outweigh the likelihood of winning. A key challenge in designing tournaments is thus identifying prize spreads that maximize competitors' efforts (e.g., Wen & Lin, 2016). During a pandemic, this challenge is even greater because the extreme uncertainty and associated risks make firms more sensitive to prize spreads (Bloom & Michel, 2002).

An added twist that can redefine winning and losing during a pandemic is public shaming of winners. When almost a third of the initial relief funds intended for U.S. small businesses during the COVID-19 pandemic was quickly gobbled up by large, publicly traded companies (Sun, 2020), the tournament made losers out of thousands of small businesses that received no funds. In an unprecedented move, large companies such as Ruth's Chris Steak House, Potbelly, and Shake Shack returned their funds for redistribution to small businesses after being harshly criticized. Analytical research could be extremely useful in identifying prize spreads that are optimized to get goods in the hands of the actors who need them during a pandemic, as well as estimating the effects of criticism on tournament winners' behavior. For example, how should the various governments distribute medical supplies across competing cities and states? During COVID-19, some states adopted a more selfish posture and hoarded certain resources. This leads us to wonder to what extent authorities should intervene when states are competing for scarce but valuable resources.

Sharpening the Theoretical Tools

Confucius wisely observed that “the mechanic that would perfect his work must first sharpen his tools.” In looking at our toolbox, and with acknowledgment that today's mechanics of theories—that is, researchers—include both women and men, we suggest that the theories can be sharpened to the degree they are applied to phenomena unique to pandemics. Craighead et al. (2016, p. 245) argued for the importance of *theoretical contextualization*, defined as the “adaptation of the theory to the underlying industry situation,” when using general theories (such as the ten theories in our proposed toolbox). We believe this is especially important for supply chain management research related to pandemics. Without a strong pandemic

context in the theorizing, scholars run the risk of merely tweaking extant supply chain management research when greater change is needed.

We thus call for research constructed around the realization that pandemic phenomena are qualitatively different from typical supply chain situations—whether in a normal or disrupted state. For example, in a typical disruption, companies quickly assess employees' physical wellbeing and the status of facilities and then move on to recovery. In a pandemic, employee safety needs to be monitored continuously. A lagged and unexpected downturn in employee health can shut a facility down, as Smithfield experienced with its pork processing plants. In this case, an embedded switch-use option (enabling resource redeployment (cf. Hult et al., 2010)) such as the ability to transfer unique tooling to another plant would allow health assessment and recovery to coexist side-by-side on an ongoing basis. Contextualizing a theory such as real options to account for the unique aspects of pandemics offers an added bonus—by examining rare and unique phenomena, scholars put themselves in a prime position to find a theory's boundaries, an important but elusive aspect of theory building (Bacharach, 1989).

Theoretical contextualization, and consequent sharpening of the tools, can be bolstered by capturing temporal and spatial aspects of pandemics. Ketchen, Craighead, and Cheng (2018) stressed the importance of *temporal capturing* in supply chain management research wherein the theorizing captures the “when” of examined phenomena. Temporal capturing is an intuitive fit with pandemics—which evolve over time (Centers for Disease Control and Prevention, 2020b)—thus enhancing the potential theory-driven insights for both scholars and managers (Craighead, Ketchen, & Darby, 2019). For example, researchers interested in resource orchestration theory could examine how companies bundled, structured, and leveraged their resources before, during, and after pandemics and thereby build understanding of how these resource shifts could be improved in the future. We described how Amazon orchestrated its resources in response to COVID-19 by altering its product mix toward essential items, onboarding tens of thousands of new employees, and abandoning its 2-day delivery capabilities. As a pandemic subsides, when, how, and to what extent should a company return to the resource bundle that fueled much of its previous success? The spatial aspects of pandemics provide an additional interesting twist to this question. For example, because COVID-19 unfolded differently across the U.S. and around the world, to what extent did its geographic distribution play a role in Amazon's orchestration shifts? Although we recognize that theoretical contextualization, including temporal and spatial aspects, may come at the expense of generalizability (Craighead et al., 2016), so be it—pandemics are important enough to warrant deep diving research.

The sharpening of the tools to foster a greater level of insight can also be accomplished by synergizing the focal theory with (a) complementary theories and (b) calibrated research designs. In many instances, master mechanics may find situations where the simultaneous use of multiple tools may be required to get the job done. Likewise, scholars may find that a theory's effectiveness can be sharpened by another theory. For example, scholars embracing institutional theory to examine how companies deal with pandemic-induced shifts in government pressures to act (or not) may find that real options could play a role in dealing with the uncertainty surrounding those contexts. Finally, Ketchen et al. (2018) stressed the importance

of *theoretical calibration* (i.e., the degree that the research design captures the theory's key tenets), which is an effective approach to hone the revealed insights. For example, EST centers on event-induced change so research designs capturing the before–after of key supply chain phenomenon would appear to be quite productive.

CONCLUSION

In the aftermath of a monumental crisis, attention naturally turns to preparing for the “next one,” along with a profound universal hope that such preparations will never be needed. Even if there were a guarantee that no more pandemics would arise in the foreseeable future, however, the COVID-19 experience would still be worthy of attention from scholars and managers alike. For scholars, we outlined a series of theories that we believe are powerful tools for making sense of what happened, how organizations responded, and how supply chain structures and processes can be adjusted in case another pandemic arrives. Meanwhile, managers can look to a timeless truth offered by the ancient Greek philosopher Plato: “necessity is the mother of invention.” Organizations experimented with new ideas and approaches—many used out of desperation—and some of these on-the-spot inventions can improve their transiliency regardless of what the future does or does not bring. Thus, we end with a broad call for scholars to flesh out the transiliency concept, both theoretically and empirically, and examine its explanatory value and boundaries within pandemic and interpandemic contexts. In thinking beyond the context of pandemics, one valuable facet of this inquiry could be examining how transiliency can help firms avert a crisis and quantify whether the benefits of crisis avoidance outweigh the costs of building transiliency.

REFERENCES

- Ashby, W. R. (1961). *An introduction to cybernetics*. London, UK: Chapman & Hall Ltd.
- Azadegan, A., Mellat Parast, M., Lucianetti, L., Nishant, R., & Blackhurst, J. (2020). Supply chain disruptions and business continuity: An empirical assessment. *Decision Sciences, 51*(1), 38–73.
- Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. *Academy of Management Review, 14*(4), 496–515.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120.
- Bhakoo, V., & Choi, T. (2013). The iron cage exposed: Institutional pressures and heterogeneity across the healthcare supply chain. *Journal of Operations Management, 31*(6), 432–449.
- Bloom, M., & Michel, J. G. (2002). The relationships among organizational context, pay dispersion, and among managerial turnover. *Academy of Management Journal, 45*(1), 33–42.

- Bo, P. D. (2005). Cooperation under the shadow of the future: Experimental evidence from infinitely repeated games. *The American Economic Review*, 95(5), 1591–1604.
- Bode, C., Wagner, S. M., Petersen, K. J., & Ellram, L. M. (2011). Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, 54(4), 833–856.
- Bose, N., & Layne, N. (2016). Target gets tough with vendors to speed up supply chain, accessed May 7, 2020, available at <https://www.reuters.com/article/us-target-suppliers-exclusive/exclusive-target-gets-tough-with-vendors-to-speed-up-supply-chain-idUSKCN0XV096>.
- Cao, X., & Fang, X. (2019). Component procurement for an assembly supply chain with random capacities and random demand. *Decision Sciences*, 50(6), 1259–1280.
- Centers for Disease Control and Prevention. (2020a). Past pandemics, accessed May 7, 2020, available at <https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html>.
- Centers for Disease Control and Prevention. (2020b). The continuum of pandemic phases, accessed May 7, 2020, available at <https://www.cdc.gov/flu/pandemic-resources/planning-preparedness/global-planning-508.html>.
- Chen, M. J. (1996). Competitor analysis and interfirm rivalry: Toward a theoretical integration. *Academy of Management Review*, 21(1), 100–134.
- Chen, M. J., Su, K. H., & Tsai, W. (2007). Competitive tension: The awareness-motivation-capability perspective. *Academy of Management Journal*, 50(1), 101–118.
- Connelly, B. L., Ketchen, D. J., & Slater, S. (2011). Toward a “theoretical toolbox” for sustainability research in marketing. *Journal of the Academy of Marketing Science*, 39, 86–100.
- Connelly, B. L., Tihanyi, L., Crook, T. R., & Gangloff, K. A. (2014). Tournament theory: Thirty years of contests and competitions. *Journal of Management*, 40(1), 16–47.
- Craighead, C. W., Blackhurst, J., Rungtusanatham, M. J., & Handfield, R. B. (2007). The severity of supply chain disruptions: Design characteristics and mitigation capabilities. *Decision Sciences*, 38(1), 131–156.
- Craighead, C. W., Ketchen, D. J., Jr., & Cheng, L. (2016). “Goldilocks” theorizing in supply chain research: Balancing scientific and practical utility via middle-range theory. *Transportation Journal*, 55(3), 241–257.
- Craighead, C. W., Ketchen, D. J., Jr., & Darby, J. L. (2019). Taking AIM at theoretical and pragmatic impact: A call for actionable, insightful, and measurable research. *Journal of Business Logistics*, 40(4), 289–298.
- Creditsafe. (2020). Creditsafe data shows grocery chains paying suppliers faster during COVID-19 pandemic, accessed May 7, 2020, available at <https://www.groceryretailonline.com/doc/creditsafe-data-grocery-chains-paying-suppliers-faster-during-covid-pandemic-0001>.

- Davis-Sramek, B., Fugate, B. S., Miller, J., Germain, R., Izyumov, A., & Krotov, K. (2017). Understanding the present by examining the past: Imprinting effects on supply chain outsourcing in a transition economy. *Journal of Supply Chain Management*, 53(1), 65–86.
- Deephouse, D. L. (1999). To be different, or to be the same? It's a question (and theory) of strategic balance. *Strategic Management Journal*, 20(2), 147–166.
- Dillon, R. L., & Tinsley, C. H. (2008). How near-misses influence decision making under risk: A missed opportunity for learning. *Management Science*, 54(8), 1425–1440.
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160.
- Dudley, R. (2020). The Amazon lockdown: How an unforgiving algorithm drives suppliers to favor the e-commerce giant over other retailers, accessed May 7, 2020, available at <https://www.nextgov.com/emerging-tech/2020/04/amazon-lockdown-how-unforgiving-algorithm-drives-suppliers-favor-e-commerce-giant-over-other-retailers/164926/>.
- Flynn, B. B., Koufteros, X., & Lu, G. (2016). On theory in supply chain uncertainty and its implications for supply chain integration. *Journal of Supply Chain Management*, 52(3), 3–27.
- Forde, M. (2020). Amazon extends distribution center shutdowns in France after losing appeal case, accessed May 9, 2020, available at <https://www.supplychaindive.com/news/coronavirus-amazon-shuts-distribution-centers-france-worker-safety/576179/>.
- Gallagher, K. M., & Updegraff, J. A. (2012). Health message framing effects on attitudes, intentions, and behavior: A meta-analytic review. *Annals of Behavioral Medicine*, 43(1), 101–116.
- Goldschmidt, K., Kremer, M., Thomas, D., & Craighead, C. W. (2020). Strategic sourcing under severe disruption risk: Learning failures and underdiversification bias. *Manufacturing and Service Operations Management*. <http://doi.org/10.2139/ssrn.2481099>
- Hannan, M. T., & Freeman, J. (1977). The population ecology of organizations. *American Journal of Sociology*, 82(5), 929–964.
- Hannan, M. T., & Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, 49(2), 149–164.
- Harder, J. W. (1992). Play for pay: Effects of inequity in a pay-for-performance context. *Administrative Science Quarterly*, 37(2), 321–335.
- Huang, Z., Li, S. X., & Mahajan, V. (2002). An analysis of manufacturer-retailer supply chain coordination in cooperative advertising. *Decision Sciences*, 33(3), 469–494.
- Hult, G. T., Craighead, C. W., & Ketchen, D. J. (2010). Risk uncertainty and supply chain decisions: A real options perspective. *Decision Sciences*, 41(3), 435–458.

- Hult, G. T., Ketchen, D. J., & Nichols, E. (2002). An examination of cultural competitiveness and order fulfillment cycle time within supply chains. *Academy of Management Journal*, 45(3), 577–586.
- International Monetary Fund. (2020). The great lockdown: Worst economic downturn since the Great Depression, accessed May 7, 2020, available at <https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/>.
- Jean, R., Kim, D., & Sinkovics, R. R. (2012). Drivers and performance outcomes of supplier innovation generation in customer–supplier relationships: The role of power-dependence. *Decision Sciences*, 43(6), 1003–1038.
- Jiang, B., Yao, T., & Feng, B. (2008). Valuate outsourcing contracts from vendors' perspective: A real options approach. *Decision Sciences*, 39(3), 383–405.
- Jin, Y., & Ellram, L. (2020). To prepare for the next 'black swan' event, supply chains should rethink 'lean.', accessed May 7, 2020, available at <https://www.supplychaindive.com/news/coronavirus-preparing-supply-chains-next-black-swan-event/576004/>.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47, 263–291.
- Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations* (Vol. 2). New York, NY: Wiley.
- Ketchen, D. J., Craighead, C. W., & Cheng, L. (2018). Achieving research design excellence through the pursuit of perfection: Toward strong theoretical calibration. *Journal of Supply Chain Management*, 54(1), 16–22.
- Ketchen, D. J., Crook, T. R., & Craighead, C. W. (2014). From supply chains to supply ecosystems: Implications for strategic sourcing research and practice. *Journal of Business Logistics*, 35(3), 165–171.
- Ketchen, D. J., & Hult, G. T. (2007). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management*, 25, 573–580.
- Ketchen, D. J., Ireland, R. D., & Snow, C. (2007). Strategic entrepreneurship, collaborative innovation, and wealth creation. *Strategic Entrepreneurship Journal*, 1, 371–385.
- Ketchen, D. J., Wowak, K., & Craighead, C. W. (2014). Resource gaps and resource orchestration shortfalls in supply chain management: The case of product recalls. *Journal of Supply Chain Management*, 50(3), 6–15.
- Koufteros, X., Verghese, A. J., & Lucianetti, L. (2014). The effect of performance measurement systems on firm performance: A cross-sectional and a longitudinal study. *Journal of Operations Management*, 32(6), 313–336.
- Lu, G., Koufteros, X., Talluri, S., & Hult, G. T. (2019). Deployment of supply chain security practices: Antecedents and consequences. *Decision Sciences*, 50(3), 459–497.

- Maze, J. (2020). A lot of restaurants are already permanently closed, accessed May 12, 2020, available at <https://www.restaurantbusinessonline.com/financing/lot-restaurants-are-already-permanently-closed>.
- Mena, C., Melnyk, S. A., Baghersad, M., & Zobel, C. W. (2019). Sourcing decisions under conditions of risk and resilience: A behavioral study. *Decision Sciences*. <https://doi.org/10.1111/deci.12403>
- Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340–363.
- Morgeson, F. P., Mitchell, T. R., & Liu, D. (2015). Event system theory: An event-oriented approach to the organizational sciences. *Academy of Management Review*, 40(4), 515–537.
- Motley Fool. (2020). WWE Q1 earnings call, accessed May 7, 2020, available at <https://www.fool.com/premium/coverage/earnings/call-transcripts/2020/04/24/world-wrestling-entertainment-inc-wwe-q1-2020-earn.aspx>.
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147–175.
- Pfeffer, J., & Langton, N. (1993). The effect of wage dispersion on satisfaction, productivity, and working collaboratively: Evidence from college and university faculty. *Administrative Science Quarterly*, 38(3), 382–407.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations*. New York, NY: Harper & Row.
- Phillips, A. (2020). Grocery stores seeking masks for ‘essential’ workers confront shortages, federal interference, accessed May 7, 2020, available at <https://www.latimes.com/politics/story/2020-04-26/grocery-stores-masks-essential-workers-shortages-federal-interference>.
- Radu, S. (2020). How global media covers the coronavirus, accessed May 7, 2020, available at <https://www.usnews.com/news/best-countries/articles/2020-02-07/how-the-global-media-covered-stories-about-the-coronavirus-outbreak>.
- Reimann, F., Kosmol, T., & Kaufmann, L. (2017). Responses to supplier-induced disruptions: A fuzzy-set analysis. *Journal of Supply Chain Management*, 53(4), 37–66.
- Reusen, E., Stouthuysen, K., Roodhooft, F., Van den Abbeele, A., & Slabbinck, H. (2020). Imitation of management practices in supply networks: Relational and environmental effects. *Journal of Supply Chain Management*, 56(1), 54–72.
- Roberts-Islam, B. (2020). Designer and supply chain digital revolution: How COVID-19 is changing the fashion industry, accessed May 7, 2020, available at <https://www.forbes.com/sites/brookerobertislam/2020/04/13/designer-and-supply-chain-digital-revolution-how-covid-19-is-changing-the-fashion-industry/#465e4d07ccc1>.
- Rosevear, J. (2020). General Motors will help manufacture hospital ventilators to fight coronavirus, accessed May 9, 2020, available at <https://www.fool.com/investing/2020/03/21/general-motors-will-help-manufacture-hospital-vent.aspx>.

- Ross, D. (2019). Game theory, accessed May 7, 2020, available at <https://plato.stanford.edu/archives/win2019/entries/game-theory/>.
- Rungtusanatham, M. J., & Salvador, F. (2008). From mass production to mass customization: Hindrance factors, structural inertia, and transition hazard. *Production and Operations Management*, 17(3), 385–396.
- Sahin, F., & Robinson, E. P. (2002). Flow coordination and information sharing in supply chains: Review, implications, and directions for future research. *Decision Sciences*, 33(4), 505–536.
- Schweitzer, M. E., & Cachon, G. P. (2000). Decision bias in the newsvendor problem with a known demand distribution: Experimental evidence. *Management Science*, 46(3), 404–420.
- Seipel, B. (2020). Designer brand Louis Vuitton starts making masks, hospital gowns for coronavirus outbreak, accessed May 7, 2020, available at <https://thehill.com/business-a-lobbying/business-a-lobbying/493440-designer-brand-louis-vuitton-starts-making-masks>.
- Sherr, I. (2020). Apple, Google give a look at coronavirus tracking tech, promise more privacy protections, accessed May 11, 2020, available at <https://www.cnet.com/news/apple-google-give-a-look-at-coronavirus-tracking-tech-promise-more-privacy-protections/>.
- Shi, W., Connelly, B. L., Hoskisson, R. E., & Ketchen, D. J. (2019). Portfolio spillover of institutional investor activism: An awareness-motivation-capability perspective. *Academy of Management Journal*. <https://doi.org/10.5465/amj.2018.0074>
- Siegel, M. (2005). *False alarm: The truth about the epidemic of fear*. Hoboken, NJ: John Wiley & Sons.
- Sinaceur, M., & Neale, M. A. (2005). Not all threats are created equal: How implicitness and timing affect the effectiveness of threats in negotiations. *Group Decision and Negotiation*, 14(1), 63–85.
- Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, 32, 273–292.
- Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage breadth, depth, and life cycle effects. *Journal of Management*, 37, 1390–1412.
- Society for Human Resource Management. (2020). Survey: COVID-19 could shutter most small businesses, accessed May 7, 2020, available at <https://www.shrm.org/about-shrm/press-room/press-releases/pages/survey-covid-19-could-shutter-most-small-businesses.aspx>.
- Souza, K. (2020). The supply side: Delays, product scarcity challenge retailers, manufacturers, accessed May 7, 2020, available at <https://talkbusiness.net/2020/04/the-supply-side-delays-product-scarcity-challenge-retailers-manufacturers/>.
- Sun, H. (2020). Public companies took far more small business loans than first thought – here’s the latest tally, accessed May 7, 2020, available

- at <https://plato.stanford.edu/cgi-bin/encyclopedia/archinfo.cgi?entry=game-theory&archive=win2019>.
- Terloar, S. (2020). Norway temporarily suspends competition regulation for airlines, accessed May 7, 2020, available at <https://news.bloomberglaw.com/mergers-and-antitrust/norway-temporarily-suspends-competition-regulation-for-airlines>.
- Tiwana, A., Keil, M., & Fichman, R. G. (2006). Information systems project continuation in escalation situations: A real options model. *Decision Sciences*, 37(3), 357–391.
- Tiwana, A., Wang, J., Keil, M., & Ahluwalia, P. (2007). The bounded rationality bias in managerial valuation of real options: Theory and evidence from IT projects. *Decision Sciences*, 38(1), 157–181.
- Tokar, T., Aloysius, J. A., & Waller, M. A. (2012). Supply chain inventory replenishment: The debiasing effect of declarative knowledge. *Decision Sciences*, 43(3), 525–546.
- Touboulic, A., Chicksand, D., & Walker, H. (2014). Managing imbalanced supply chain relationships for sustainability: A power perspective. *Decision Sciences*, 45(4), 577–619.
- Tucker, H. (2020). Coronavirus bankruptcy tracker: These major companies are failing amid the shutdown, accessed May 11, 2020, available at <https://www.forbes.com/sites/hanktucker/2020/05/03/coronavirus-bankruptcy-tracker-these-major-companies-are-failing-amid-the-shutdown/#f7a49223425a>.
- Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *The Journal of Business*, 59(4), 251–278.
- Upson, J. W., Ketchen, D. J., Connelly, B. L., & Ranft, A. L. (2012). Competitor analysis and foothold moves. *Academy of Management Journal*, 55(1), 93–110.
- von Bertalanffy, L. (1950). An outline of general system theory. *British Journal for the Philosophy of science*, 1, 134–165.
- von Neumann, J., & Morgenstern, O. (1944). *The theory of games and economic behavior*. Princeton, NJ: Princeton University Press.
- Wen, Z., & Lin, L. (2016). Optimal fee structures of crowdsourcing platforms. *Decision Sciences*, 47(5), 820–850.
- Wilhelm, M. M. (2011). Managing cooperation through horizontal supply chain relations: Linking dyadic and network levels of analysis. *Journal of Operations Management*, 29(7-8), 663–676.
- Wowak, K., Craighead, C. W., Ketchen, D. J., & Hult, G. T. (2016). Toward a “theoretical toolbox” for the supplier-enabled fuzzy front end of the new product development process. *Journal of Supply Chain Management*, 52(1), 66–81.
- Xia, Y., Xiao, T., & Zhang, G. P. (2017). The impact of product returns and retailer’s service investment on manufacturer’s channel strategies. *Decision Sciences*, 48(5), 918–955.

Zhu, K., & Weyant, J. P. (2003). Strategic decisions of new technology adoption under asymmetric information: A game-theoretic model. *Decision Sciences*, 34(4), 643–675.

Christopher W. Craighead serves as the Dove Professor of Supply Chain Management in the Department of Supply Chain Management, Haslam College of Business, University of Tennessee. His articles have been published in *Journal of Business Logistics*, *Journal of Operations Management*, *Production and Operations Management*, *Journal of Supply Chain Management*, *Transportation Science*, *Manufacturing & Service Operations Management*, and other journals. He is the inaugural editor of the Logistics Department at *Decision Sciences* and has served as an associate editor and editorial board member for several top journals. In doing so, he has received multiple awards for reviewing and editing excellence, including Best Associate Editor Awards from *Decision Sciences*, *Journal of Operations Management*, and *Journal of Supply Chain Management*.

David J. Ketchen, Jr. serves as Harbert Eminent Scholar and Professor of Management in Auburn University's Harbert College of Business. His research interests include entrepreneurship and franchising, methodological issues in organizational research, strategic supply chain management, and the determinants of superior organizational performance. His research has appeared in *Academy of Management Journal*, *Administrative Science Quarterly*, *Journal of Business Logistics*, *Journal of Operations Management*, *Journal of Supply Chain Management*, *Manufacturing & Service Operations Management*, *Strategic Management Journal*, and other journals. He currently serves as a department editor for *Decision Sciences* and as an associate editor for *Journal of Supply Chain Management*. He has completed editorial terms for *Academy of Management Journal*, *Journal of Operations Management*, *Organizational Research Methods*, *Journal of International Business Studies*, and *Journal of Management*.

Jessica L. Darby serves as an assistant professor of supply chain management in Auburn University's Harbert College of Business. Her research focuses primarily on the role of markets and institutions, such as governments, regulatory agencies, and financial markets, in supply chain operations and decision-making. Her research has appeared in several journals, including *Journal of Supply Chain Management*, *Journal of Business Logistics*, *International Journal of Logistics Management*, and *International Journal of Production Economics*.