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Citation:

Smith, C and Fatorachian, H (2025) Strengthening supply chain risk management: Unveiling opportunities through the lens of behavioral economics and organizational culture. In: ISM 2024: International Conference on Industry 4.0 and Smart Manufacturing, 20-22 November 2024, Prague, Czech Republic. DOI: <https://doi.org/10.1016/j.procs.2025.01.076>

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Document Version:

Conference or Workshop Item (Published Version)

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6th International Conference on Industry 4.0 and Smart Manufacturing

Strengthening supply chain risk management: Unveiling opportunities through the lens of behavioral economics and organizational culture

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Abstract

In recent decades, the growing awareness that supply chains are increasingly vulnerable to unexpected disruptions has led to the development of the field of Supply Chain Disruption Management (SCDM). While significant progress has been made, particularly during the COVID-19 pandemic, there is still a notable gap in understanding the human-centred rationale behind SCDM decisions beyond traditional supply chain factors like cost and asset availability. Current literature effectively addresses the empirical reasons for specific SCDM strategies but falls short in exploring the cognitive, social, and cultural factors influencing these choices, such as cognitive biases, group dynamics, and organizational culture. This work aims to assess the existing knowledge in SCDM, highlight the lack of research linking behavioural economic theories and organizational culture to SCDM, and identify where these connections exist and their significance, thereby proposing future research directions. Our study suggests that advancing SCDM requires investigating how behavioural economics and organizational culture influence decision-making and outcomes, with a focus on leadership styles, risk management, Industry 4.0 technologies, and inter-organizational collaboration, especially during crises.

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Peer-review under responsibility of the scientific committee of the 6th International Conference on Industry 4.0 and Smart Manufacturing

Keywords: Behavioural economics; organisational culture; supply chain disruption management

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1. Introduction

In recent decades, practitioners and academics alike have observed that supply chains are increasingly susceptible to unexpected crises; this has led to the emergence of the field of Supply Chain Disruption Management (SCDM),

which aims to assist practitioners through the differentiation between certain types of disruptive events, as well as the provision of management strategies that can assist in their management [1,2,3]. Although numerous strides have been, and continue to be, made in this field, particularly as COVID-19 became prevalent, there is a noticeable lack of work exploring foundational concepts regarding why organizations made certain decisions, and the timings of said decisions, outside of typical supply chain parameters. Although the current literature, particularly in relation to SCDM, is adept at explaining the empirical reasoning behind business-centric decisions (i.e., costs, asset availability, forecasting, rules and regulations, internal documentation), the current state of knowledge is miserably lacking in its ability to explain the human rationale behind these decisions (i.e., cognitive shortcuts, group dynamics, organizational culture).

Ultimately, it is the proposition of this work that because SCDM decisions are made by groups and the individuals that compose them (and they are unable to make rational decisions, even when not experiencing a disruption), these human elements must be acknowledged, both from the perspective of individuals and groups. These explanations, alongside the outcomes of said decisions, could allow practitioners to be more cognizant of the decisions made by themselves and their teams, and the possible impacts of them, be they positive or negative. In this way, improving our understanding of how these fields relate to each other, would not only allow SCDM decisions to be better understood, but also allow them to be more accurately predicted, leading to improved decision-making models alongside the development of supplier and customer relationships; improving these critical areas of supply chain management would enable firms to make better decisions, both under and free from disruptive conditions. Thus, the purpose of this paper is to explore the current state of knowledge in the area, acknowledge the lack of academic works linking behavioral economic theories and organizational culture to various elements SCDM, while also highlighting where these linkages lie and their importance, resulting in the generation of future research directions for academicians. The ultimate aim to create a report outlining the current gaps and future research directions.

The next sections of the paper will outline the research methodology employed in this study, detailing the approach and techniques used to gather and analyse data. Following this, the findings from the data analysis will be presented and discussed, providing insights into the key themes and implications for Supply Chain Disruption Management (SCDM).

2. Methodology

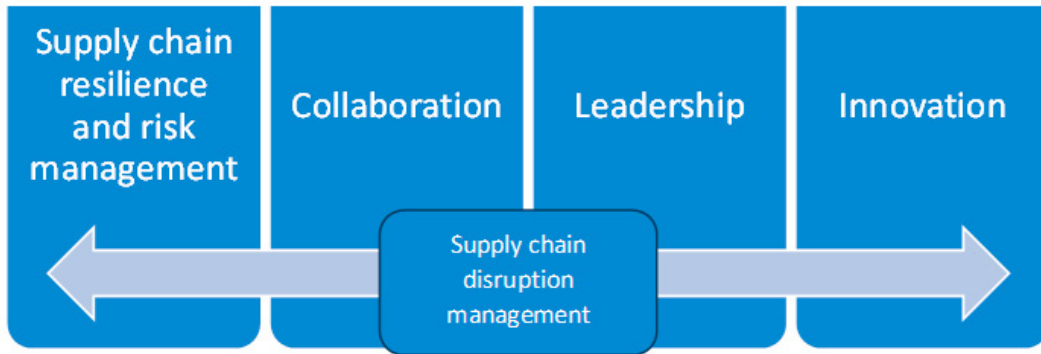
This piece is based on an integrative literature review, with the works selected via the purposive sampling method. An integrative literature review allows for the synthesis of diverse research findings, providing a comprehensive understanding of how various theoretical perspectives intersect and contribute to the topic. Although the quality of the works being mentioned has been assessed (by their SNIP score, timeliness, and quantity of public citations), no specific restrictions have been applied because there isn't much research in this field. This inclusive approach is necessary given the limited existing research, as it enables the incorporation of a wide range of studies and perspectives, thereby offering a more holistic view of the subject matter. This might have some implications for this particular work, but this is also highly indicative of the current state of knowledge bridging these academic disciplines. It is recognized that further primary research is required to validate and close any research gaps identified below, and that the connections which define the gaps must also be empirically validated. However, in order to define such empirical research, it is first necessary to understand and establish the connections between the three core theories (Behavioural Economics, Organizational Culture, and Supply Chain Disruption Management).

2.1. Literature Review

Due to the fundamental lack of work in this area, it is useful to note how the topics discussed are related to each other, and how each area contributes to the over-arching thesis statement, that the decisions underlying Supply Chain Disruption Management strategies can be explained through the theoretical lenses of behavioral economics and organizational culture; thus, more research is needed to empirically establish these connections and the practical impact of them. In this way, it is important to outline the tenuous linkages that presently exist, where gaps in knowledge lie, and the importance of exploring these gaps. This will enable the creation of a robust plan for future research endeavors that possess both theoretical and practical value, both on large and specific scales. We first have

the field of SCDM, which utilizes a number of theoretical concepts as responses to Supply Chain Disruptions (SDCs). In particular, this work will focus on crisis/ risk management, supply chain agility/ resilience, information sharing/ collaboration, Industry 4.0/ technological innovations, and leadership. The linkages between each of these areas and behavioral economics and organizational culture are then explored, leading to the definition of inter-disciplinary relationships between the three core theories. This is visually represented in Figure 1.

Figure 1. Interdisciplinary linkages discussed in this work.



3. Current State of Knowledge

3.1. Supply Chain Disruption Management

As mentioned, literature has paid considerable attention to SCDM with many works being published in the area in recent decades [4,5,6,7,8]. When examining the literature that considers the context of COVID-19, much of the work lied within the practical application of the concepts, rather than its underlying theories, such as examples of actions that particular organizations have taken, and how those actions factor into supply chain management, both micro and macro scales [9,10].

3.2. Crisis/ Risk Management

The literature has discussed the risks and crises imposed by Supply Chain Disruptions, risk analysis methods appropriate for SCDs, as well as the formulation of effective SCDM tools, such as postponement, dual sourcing, and planning [1,11,12,13,14]. All risk management strategies are considered by individual firms, and supply chains as a whole, through the lenses of risk appetite and risk culture [15,16,17], which describe “an organization’s willingness to accept a given risk in pursuit of their organizational objectives”, and “the values, attitudes, understanding, etc. of risks that a group of individuals share within organizations”, respectively [18].

3.3. Supply Chain Agility/ Resilience

Due to the prevalence of globalized, lengthy, and lean supply chains, particularly within certain industries, such as the food retailing sector, academicians have also paid special attention to building resilient and agile supply chains, and how these approaches to supply chain management have benefited organizational performance throughout SCDs [19]. Numerous authors have discussed contextual factors that may impact not only operational/ supply chain performance, but also the implementation of agile/ resilient supply chains, such as uncertainty, supply chain integration, macro-environmental factors, and the supply chain’s industry/sector, among many others [5,7,20,21,22,23,24].

3.4. Information Sharing/ Collaboration

Information sharing and collaboration across the supply chain has been a topic of much discussion, with a number of works suggesting that supply chain collaboration necessitates effective communication and information sharing between echelons, with collaboration acting as the antecedent to the management of risks induced by SCDs [11,25,26,27].

3.5. Industry 4.0/ Technological Innovations

Over the last decade, Industry 4.0 technologies, and other technological innovations, have been developed to aid organizations with various components of supply chain and operations management, including SCDM [15,28]. Some examples of Industry 4.0 technologies include blockchain, the Internet of Things, Cyber-Physical systems, smart factories and sensors, artificial intelligence, and cloud computing [29,30,31]. The existing literature has also discussed the risks of implementing such technologies, with two primary examples being upfront and long-term costs and implementation difficulties leading to extrapolated risks (i.e., production slowdown/ stoppage and reduced operational efficiency during implementation [32,33].

3.6. Leadership

Appropriate leadership is commonly regarded as an antecedent to operational performance, particularly when experiencing SCDs, due to its ability to link workers, and their goals, to organizational objectives and day-to-day operations. However, much of the work in this area has primarily discussed surface-level components of the topic, such as the cruciality of leadership, reflections on the actions of leaders, and how leadership impacted the firm-level responses, throughout the SCD. Such superficial and minimal coverage creates challenges for company seniors, as the literature essentially states that “appropriate leadership is important” but does not elaborate on how to be a successful leader under disruptive circumstances [29].

4. Inter-Disciplinary Research Gaps

It is worth noting that there exist some work discussing SCDs and organizational culture [35], as well as SCDs and behavioral economics [37], however, these are from the perspective of consumers/ the individual, rather than from the perspective of business-centric decisions [38]. Additionally, while works do exist exploring the relationship of certain aspects of behavioral economics and organizational culture to supply chain management in general [39], these applications are generally limited to specific theories (i.e., Transaction Cost Economics) or are limited to certain components of supply chain management (i.e., supplier relationship management [40,41,42], or enterprise management more broadly (i.e., risk management) [43,44]. One exception to this is a piece by Sarkar and Kumar (2015), who utilized an experimental design among students, to explore inventory decisions under SCDs [45]. Meaning that further work remains to fully bridge the concepts of SCDM and behavioral economics/ organizational culture.

4.1. Behavioral Economics

The literature has largely engaged with SCDM strategies through the lens of neo-classical economics (including articles that purport to assist in decision making under SCDs, such as Kumar and Sharma, 2021 [46]), when, in reality, humans, particularly under times of disruption (i.e., stress), are not able to make rational decisions, making the behavioral model of decision-making (that acknowledges heuristics, prospect theory, risk aversion, and loss aversion) far more appropriate [47,48,49,50]. In this regard, further investigation is warranted to ascertain the role of behavioral economic concepts (i.e., risk and loss aversion) in SCDM decisions, and vice versa (how SCDM impacted behavioral economic concepts). For instance, the concept of risk appetite highlights the link between behavioral economics and Crisis/ Risk Management, as which risks are to be avoided or engaged with are decided by individuals and groups; concepts such as risk appetite and risk culture aim to explain why such decisions are made, and guide organizations

towards making better decisions under risk [15,18]. However, the connections between these concepts have been largely unexplored; this is fascinating due to how the concepts of loss and risk aversion could easily be applied to how organizations formulate their risk appetite plans, and how those plans are enacted in real time. This leads us to obvious questions regarding the role of behavioral economics in the formulation of risk appetite plans, including under times of severe disruption.

This logic can also be applied to the other SCDM strategies discussed above, namely, Supply Chain Agility/ Resilience and Industry 4.0/ Technological Innovations; when considering such approaches, the utilization of concepts from the behavioral economics literature could introduce nuance to the discussion of when, why, and how organizations chose to implement these approaches, which is, in the current literature, limited to tangible benefits, such as fund availability [21]. Similarly, regarding Collaboration/ Information Sharing, organizations must be careful in deciding what and how much information to share, which supply chain members they are sharing with, and when to make this information available to the relevant parties, as it could lead to a competitive disadvantage [27]; the careful decision making required for this will most certainly be impacted by behavioral economic concepts, however, again, the literature has neglected this connection. For each of these theories, questions then are raised as to the role of behavioral economics in the decision to implement each of these SCDM strategies, including under times of severe disruption; for Industry 4.0, the vice versa is another interesting question- how did implementing these technologies affect decision making, from the perspective of behavioral economics.

4.2. Organizational Culture

Change within organizations, particularly under times of disruption, is innate, and this includes changes to organizational culture [35]; when contemplating the general impacts of SCDs, the literature has paid minimal attention to how disruptive events cause organizational cultures to change, and, in turn, how these cultural shifts affect organizational decision-making processes; meaning, further investigation is required to understand how SCDs affect organizational culture, and vice versa (how organizational culture affects SCDM responses). For instance, when considering large-scale endeavors (such as Industry 4.0/ Technological Innovations and Agile/ Resilient Supply Chains), the role of organizational/ inter-organizational cultures could play a role in how the SCDM strategy is viewed, how much it is accepted, and, in turn, how it is implemented in practice [39,40]; this leaves us with the obvious questions regarding the role of organizational culture in implementing these SCDM strategies. Consequently, there is minimal work exploring the vice versa, i.e., the impact of implementing these SCDM strategies on organizational culture; this demands further attention, particularly as it relates to the implementation of technologies associated with Industry 4.0.

Additionally, regarding Crisis/ Risk Management, the literature discusses how risk culture and risk governance impact organizational performance, and how organizational culture informs risk-laden decisions, but there is minimal work exploring how organizational culture informs risk culture, specifically; another area that warrants further investigation, including under periods of disruption [44,50]. This is also true when considering Information Sharing/ Collaboration, and how the quantity and quality of the information informs organizational culture, or how organizational culture enables/ disadvantages collaborative efforts, particularly under times of disruption [42]. Lastly, all of the above discussions (and their lack of empirical research) also apply to the decisions made by groups of individuals, and the effects of organizational culture and group dynamics on said choices, particularly in the context of SCDs and SCDM.

4.3. Leadership: A Note

Despite leadership being more widely discussed than organizational culture, there is still more work to be done as it relates to SCDM [34]. Work-based heuristics are certainly developed based on the organization's culture and leadership, but the literature has not verified such a relationship; therefore, further study is warranted on how leadership affects organizational culture, how leadership affects individual decision-making, as well as how these components impact the implementation of SCDM strategies. On the other hand, more research is warranted as to the rationale behind the adoption of certain leadership styles, and the timing of said adoptions. Lastly, like most discussions of leadership, the discussion has been largely limited to leadership within the context of a singular focal

firm; further work is needed to explore the effects of leadership on an inter-organizational basis. This leaves us with some interesting questions as to how leadership affects people and their decision making (through the lenses of behavioral economics and organizational culture), on the levels of intra-organizational individuals and groups, as well as inter-organizational individuals and groups, including under times of severe disruption; further investigation is also warranted in terms of why leaders adopted certain leadership styles and how effective these style changes were, especially under disruptive conditions.

5. Conclusions

5.1. Importance of Research Gaps

Organizations are constantly faced with decisions, to be made both as groups and individuals; these decisions are far-reaching, covering many areas (i.e., how to immediately respond to a disruption, how to manage risks and crises in the long-term, how agile/ resilient to make the supply chain, decisions surrounding information sharing and collaboration (i.e., what, how much, who with, when, and why), technological implementation decisions, and how to lead during a time of crisis). Although the current literature is adept at explaining the empirical rationale behind these decisions, its ability to explain the human factors is very lacking; as people are unable to engage with rational decisions as defined by neo-classical economics, the underlying concepts of how and why people make decisions (i.e., behavioral economics and organizational culture), as well as how the implementation of SCDM strategies (in turn) affect organizational decision-making, are highly important to engage with. However, these elements have been largely neglected by the literature, when it comes to explaining the reasons behind choosing and implementing changes regarding SCDM strategies.

Exploring these elements in relation to SCDM strategies would enable academicians to explain supply chain decisions more completely, as well as allow practitioners to understand how these dynamics would impact their own SCDM strategy implementations, from both mathematical and human standpoints. Additionally, works discussing the effects of SCDs on businesses could benefit from how these components change under times of severe disruption/stress. These explanations, considered in tandem with the outcomes of these SCDM decisions, could provide examples of success stories and cautionary tales to practitioners, allowing them to be more cognizant of their decisions and their possible impacts, be they positive or negative. These would not only allow for developments in the field of SCDM, but also further the disciplines of behavioral economics and organizational culture, in terms of both theory and practice. Although some work has been done to consider the human elements of decision-making within the context of the firm, with the Behavioral Theory of the Firm being present for many decades, and the discipline of behavioral operations emerging in recent years. However, the current state of knowledge regarding this discipline has barely expanded the literature review stage and has not yet been considered within the context of SCDs. With these events becoming more frequent and severe in nature, the more it becomes necessary to understand the full rationale behind these decisions, so that they may be improved in the future.

5.2. Future Research Directions

There are numerous future research directions proposed by this piece, some are rather specific, and others will require further development from those researchers wanting to engage with them. These have been summarized below; for an in-depth exploration of the research avenues uncovered by our analysis, please see Table 1.

Table 1. Table Summarizing Proposed Research Directions (developed by the researcher)

Categorical Subject Area	Inter-Disciplinary Linkage	Research Directions/ Questions
Supply Chain Disruption Management	Behavioural Economics	How did theories of behavioural economics (i.e., loss/ risk aversion) affect supply chain disruption management throughout the disruption; what were the outcomes of these decisions?

	Organisational Culture	<p>How did supply chain disruption management impact professionals through the lens of theories of behavioural economics (i.e., loss/ risk aversion) throughout the disruption?</p> <p>How did organisational culture affect supply chain disruption management throughout the disruption; what were the outcomes of these decisions?</p> <p>How did supply chain disruption management affect organisational culture throughout the disruption?</p>
Crisis and Risk Management	Behavioural Economics	What role do theories of behavioural economics (i.e., loss/ risk aversion) play in the formulation and implementation of risk appetite plans, including under times of severe disruption?
	Organisational Culture	How does organisational culture inform risk culture, including under times of severe disruption?
Supply Chain Agility/ Resilience	Behavioural Economics	Why/How did organisations decide to implement agile/ resilient supply chains/ other supply chain management strategies, through the lens of theories of behavioural economics (i.e., loss/ risk aversion), including under times of severe disruption; what were the outcomes of these decisions?
	Organisational Culture	What role did organisational culture play in the decision to implement agile/ resilient supply chains/ other supply chain management strategies, including under times of severe disruption; what were the outcomes of these decisions?
Information Sharing and Collaboration	Behavioural Economics	How did theories of behavioural economics (i.e., loss/ risk aversion) affect information sharing decisions, including under times of severe disruption; what were the outcomes of these decisions?
	Organisational Culture	How did organisational culture affect information sharing decisions, including under times of severe disruption; what were the outcomes of these decisions?
Industry 4.0/ Technological Innovations	Behavioural Economics	<p>How did theories of behavioural economics (i.e., loss/ risk aversion) affect decisions to implement technological innovations, including under times of severe disruption; what were the outcomes of these decisions?</p> <p>How did the implementation of technological innovations affect theories of behavioural economics (i.e., loss/ risk aversion) within individuals in business contexts, including under times of severe disruption; what were the outcomes of these decisions?</p>
	Organisational Culture	<p>How did organisational culture affect decisions to implement technological innovations, including under times of severe disruption; what were the outcomes of these decisions?</p> <p>How did the implementation of technological innovations affect organisational culture, including under times of severe disruption; what were the outcomes of these decisions?</p>

Leadership	Behavioural Economics	<p>Why did leaders adopt certain styles throughout different phases of the disruption; how effective were the chosen styles for each stage at positively influencing theories of behavioural economics (i.e., loss/risk aversion) in individuals' decision faculties?</p> <p>How did leadership impact theories of behavioural economics (i.e., loss/risk aversion) in individuals' decision faculties, including under times of severe disruption; what were the outcomes of these decisions?</p> <p>How did leadership impact theories of behavioural economics (i.e., loss/risk aversion) in individuals' decision faculties, on an inter-organisational basis, including under times of severe disruption; what were the outcomes of these decisions?</p>
	Organisational Culture	<p>Why did leaders adopt certain styles throughout different phases of the disruption; how effective were the chosen styles for each stage at positively influencing organisational culture and group decision faculties?</p> <p>How did leadership impact organisational culture and group decision faculties, including under times of severe disruption; what were the outcomes of these decisions?</p> <p>How did leadership impact organisational culture and group decision faculties, on an inter-organisational basis, including under times of severe disruption; what were the outcomes of these decisions?</p>

When considering SCDM as a whole, the field can be advanced by considering how theories of behavioral economics, such as loss and risk aversion, affect SCDM throughout the disruption, and the outcomes of those decisions; this is also true of the vice versa scenario, where the SCDM actions selected, and how they affected decision making (again through the lens of behavioral economics) throughout the disruption, are explored. These research directions are also mirrored when considering organizational culture and SCDM, where it would be pertinent to explore how organizational culture impacted the SCDM decisions made, and vice versa, where SCDM affects organizational culture. In this vein, Industry 4.0 technologies, how their implementations are affected by behavioral economics/ organizational culture, and vice versa, also mandate further attention.

Both within and outside disruption contexts, crisis/risk management could be bolstered through the discussion of the role of behavioral economic concepts in the formulation and implementation of risk appetite plans. Similarly, exploring the relationship between organizational culture and risk culture would be invaluable, to both theory and practice, particularly under times of severe disruption. Additionally, we currently don't understand the role of both organizational culture and behavioral economics in the decision to implement agile/resilient supply chains, as well as how these elements would affect the eventual outcomes of implementation, both within and outside disruption contexts. These research directions also apply when considering the role of information sharing and collaboration, and the outcomes of such actions, in SCDM.

Moreover, regarding leadership and SCDM, it would be useful to understand why leaders adopted certain styles throughout a disruption, how effective the chosen styles were. In this vein, how these adopted leadership styles impacted the organization's culture and the decision-making capabilities of individuals and groups (from the perspective of behavioral economics), as well as the outcomes of these decisions, would be invaluable for practitioners. Lastly, theories of leadership are often only discussed in the context of one focal organization, and discussions of inter-organizational leadership could benefit both theory and practice, particularly under disruptive conditions.

5.3. Limitations

This work is based largely on the already-existing body of literature in these areas, which, as previously discussed, is remarkably lacking. The lack of directly relevant primary research has been noted, however, for the overall purpose of this paper (that being to outline future research directions to support inter-disciplinary linkages, between disciplines that have not been bridged before), a literature review was more appropriate.

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