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Inherently irrational: exploring the role of behavioural economics and organisational culture in food supply chain disruption management decisions

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ABSTRACT

Understanding human behaviour in supply chain disruption management (SCDM) requires moving beyond purely rational models. While traditional decision-making frameworks focus on empirical factors, they often overlook the role of behavioural economics and organizational culture in shaping responses to crises. This study examines how supply chain managers navigated risks and cultural shifts during the COVID-19 pandemic, offering insights into the interplay between personal risk values, cultural cohesion, and SCDM risk levels. Using a retrospective approach, the study gathered data from 21 supply chain managers in the fast-moving consumer goods (FMCG) and food supply chains. Questionnaires captured their attitudes towards risk, decision-making patterns, and organizational cultural shifts before, during, and after the pandemic. Descriptive statistical analyses revealed that SCDM risk levels peaked at the height of the crisis, while cultural cohesion and personal risk values declined. Interestingly, the relationship between cultural cohesion and personal risk value intensified during the pandemic and continued to strengthen post-pandemic. A similar trend was observed between personal risk value and SCDM risk levels, which became more pronounced over time. However, the link between cultural cohesion and SCDM risk level was strongest during the crisis but faded in pre- and post-pandemic periods. These findings contribute to the growing field of behavioural operations by demonstrating the significance of psychological and cultural factors in crisis decision-making. They underscore the need for supply chain strategies that integrate behavioural insights, recognizing that human responses to disruption are shaped by more than just rational calculations. By acknowledging the evolving dynamics of risk perception and cultural adaptation, organizations can develop more resilient and human-centric approaches to supply chain management in times of crisis.

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1. Introduction

The field of Supply Chain Disruption Management (SCDM) has gained increasing importance in recent years, primarily due to the rising frequency and severity of supply chain disruptions; large-scale crises can have significant economic and operational consequences for businesses and organizations, making the management of the disruption paramount. The COVID-19 pandemic was one of the most severe disruptions experienced by supply chains worldwide in recent history. Consequently, much literature has been written to explain (1) how the pandemic affected different societal components (such as businesses, individuals, and governments), (2) how each of these elements responded to the pandemic, and (3) the theoretical and managerial implications of their responses through a myriad of perspectives. While there has been substantial progress in understanding the empirical factors that influence SCDM decisions, such as costs, asset availability, forecasting, internal rules, and external regulations, there has

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been a noticeable gap in exploring the human-centric rationale behind these decisions (Asafo-Adjei et al., 2023; Canwat, 2024; Mawonde et al., 2023; Moyo et al., 2023; Xiao & Khan, 2024).

Behavioural economics provides valuable insights into how individuals make decisions, often deviating from purely rational economic models (Thaler, 2016). Understanding how cognitive biases, emotions, and social factors influence decision-making can shed light on why certain choices are made in the context of supply chain disruptions. Moreover, organizational culture, which encompasses the shared values, beliefs, and norms within a company, can have a profound impact on how decisions are made (Schein, 2010). It can shape the way employees respond to disruptions, their risk tolerance, and their willingness to adapt. Incorporating behavioural economics and organizational culture into the realm of SCDM could offer a more comprehensive understanding of the factors that influence decisions during disruptions. By doing so, organizations can develop more effective strategies and responses to mitigate the impact of disruptions on their supply chains, ultimately improving resilience and adaptability in an increasingly turbulent business environment.

While prior research has extensively explored the role of digitalization and Industry 4.0 technologies in supply chain efficiency and sustainability (Verdouw et al., 2016; Zhong et al., 2017), more recent studies highlight the significance of Industry 5.0 in advancing supply chain globalization through human-centric approaches and enhanced resilience (Fatorachian, 2023). However, there remains a significant gap in understanding their application in cold supply chains, particularly concerning waste reduction and sustainability goals. Existing studies often focus on generalized supply chain benefits without delving into the specific mechanisms through which digital technologies can address inefficiencies in cold chains (Maroli et al., 2021; Sadeghi et al., 2022). Moreover, the behavioural and organizational dynamics influencing the adoption of these technologies in cold supply chains have received limited attention.

This study advances the field by providing a targeted analysis of how Industry 4.0-enabled solutions, such as IoT and predictive analytics, can be strategically employed to enhance waste efficiency in cold supply chains. It also contributes to understanding the enablers and barriers to technology adoption, offering actionable insights into the intersection of digitalization and sustainability in this niche but critical area. Unlike previous studies, this research employs empirical data from industry professionals, ensuring its findings are grounded in practical realities. Furthermore, the study aligns its outcomes with global sustainability objectives, such as the United Nations Sustainable Development Goals (SDGs), providing both academic and practical relevance.

This paper, ultimately, advocates for further investigation into the relationships between behavioural economics, organisational culture, and SCDM; this is on the basis that decisions, in the contexts of firms, are made by groups and the individuals that compose them, and these actors are not able to be fully rational, even when not experiencing a widespread disruption. It is worth noting that there do exist works that have applied behavioural economics and organizational culture theories to various aspects of business decision-making, such as innovation, sustainability initiatives, and supplier management. However, the application of these concepts to SCDM remains underexplored. This research seeks to bridge this gap by investigating the connections between behavioural economic concepts, organizational culture, and decision-making in the context of supply chain disruptions. Therefore, the purpose of this work is to explore the role of behavioural economic concepts and organisational culture in Supply Chain Disruption Management (SCDM) decisions, utilising the COVID-19 pandemic as the focal example.

Given this premise, and the novelty of the research concept, the research objectives and sub-questions showcased in Table 1 emerged. The explorative nature of this work dictated that a quantitative approach would be most appropriate; thus, the below questions will be answered utilising the questionnaire method. Of special interest to this paper is the FMCG/food supply chains, due to their criticality to (human and economic) survival throughout the COVID-19 pandemic; responses from 21 supply chain and operations managers from this sector will be analysed utilising descriptive statistics and covariance. The major contribution of this work is the uncovering of the relationships between these three, currently disparate theories.

2. Research background and literature review

Behavioural economics is a field that acknowledges how human decision-making is influenced by cognitive biases and emotions, often leading to deviations from purely rational models. These factors can

Table 1. Research objectives, questions, and sub-questions.

Research objective	Research question	Sub-question
Understand the Relationship Between Behavioural Economics and SCDM	What levels of Risk did SC Members Perceive in their SCDM Strategies?	What SCDM strategies were implemented and when?
		How much risk was perceived in each of these strategies when they were implemented?
	How did their Risk and Loss Aversion Change throughout the Pandemic?	How willing were they to take personal risks throughout the pandemic?
		How willing were they to take work-related 'gambles' throughout the pandemic?
Understand the Relationship Between Organisational Culture and SCDM	How did the organisation's culture and decision-making change from a quantitative point of view?	From an individual, quantitative perspective, how has the organisation's culture and decision making changed throughout COVID-19?

significantly impact supply chain management (SCM) decisions, particularly under disruptive conditions. Although behavioural economics has recently been applied to business-centric decision-making, much of the current understanding remains focused on empirical factors, such as cost, asset availability, and other supply chain parameters. Consequently, the full rationale behind SCM decisions, especially in the context of disruptions, remains underexplored. Gaining a deeper understanding of the human rationale behind supply chain disruption management (SCDM) decisions would enable academics to provide more comprehensive explanations of these decisions. This, in turn, could lead to the development of new decision-making models that practitioners can adopt, ultimately enhancing supply chain performance during disruptive events (Tokar, 2010). For instance, empirical evidence from UK manufacturing SMEs illustrates how internet-enabled integration supports decision-making and performance improvement under such conditions (Fatorachian et al., 2013).

Organizational culture, on the other hand, encompasses the shared values, norms, and beliefs that guide decision-making within a company (Schein, 2010). Cultural factors not only influence how an organization responds to supply chain disruptions but also shape interactions between employees, managers, and the organization as a whole. These interactions establish the attitudes, beliefs, and behaviours deemed acceptable within the organization, which, in turn, impact business-centric decision-making processes at both individual and group levels. Understanding the interplay between organizational culture and SCDM decisions is crucial, as it provides insights into the reasoning behind specific decisions made during disruptions, including those related to inventory management, sourcing strategies, and risk mitigation. As emphasized earlier, incorporating these human components into decision-making frameworks has the potential to improve supply chain performance, particularly in response to large-scale disruptions such as the COVID-19 pandemic.

The next section of the literature review explores the current state of knowledge surrounding the concepts related to the research questions.

2.1. Supply chain disruption management- current state of knowledge

The COVID-19 pandemic had a profound impact on both the demand and supply sides of supply chains, and extensive literature has explored these effects (Aday & Aday, 2020; Alexander et al., 2022; Al-Mansour & Al-Ajmi, 2020; de Souza et al., 2022; El Baz & Ruel, 2021; Graham et al., 2020; Kähkönen et al., 2023; Liu et al., 2021; Moosavi et al., 2022; Nikolopoulos et al., 2021; Novoszel & Wakolbinger, 2022; Plaisance, 2024; Rejeb et al., 2022; Roscoe et al., 2022; Sharma et al., 2022; Singh et al., 2021). COVID-19 was regarded as a 'black swan event', or a 'super disruption' due to three defining characteristics: it was a long-term, unpredictable disruption that exists, simultaneously, internally and externally, both up- and down-stream. Additionally, COVID-19 was unprecedented in terms of its scale, scope, and pace of propagation, with swift changes at the macro-level creating more complex interactions between supply chain members; this made the necessary function of avoiding food scarcity much more difficult within the food supply chain (Ambrogio et al., 2022; Arunprasad et al., 2022; de Souza et al., 2022; El Baz & Ruel, 2021; Hohenstein, 2022; Ivanov, 2021; Kähkönen et al., 2023; Moosavi et al., 2022; Novoszel & Wakolbinger, 2022; Remko, 2020; Roscoe et al., 2022; Sharma et al., 2022; Singh et al., 2021).

On the demand side, three significant shifts emerged during the pandemic. Firstly, stockpiling, panic buying, and hoarding became prevalent as consumers rushed to secure essential items like toilet paper,

soap, and non-perishables, resulting in demand volatility and supply chain disruptions. Secondly, increased customer anxiety due to factors such as rising unemployment, economic recession, and fears of food supply disruptions led to unpredictable demand patterns. Thirdly, the pandemic accelerated the shift to online and omni-channel shopping, altering consumer behaviour and challenging traditional supply chain models (Aday & Aday, 2020; Al-Mansour & Al-Ajmi, 2020; Ambrogio et al., 2022; El Baz & Ruel, 2021; Hobbs, 2020; Ivanov, 2022; Ivanov & Das, 2020; Končar et al., 2020; Liu et al., 2021; Nekmahmud, 2024; Novoszel & Wakolbinger, 2022; Remko, 2020; Roni et al., 2022; Roscoe et al., 2022; Sarkis, 2020; Sharma et al., 2022; Singh et al., 2021). On the supply side, lockdowns and travel restrictions disrupted supply chains in two critical ways. The UK, heavily reliant on foreign suppliers for its food supply, experienced the consequences of global travel and trade restrictions. This dependence made it particularly vulnerable to disruptions in its grocery supply chain. Additionally, labour shortages were widespread due to isolation measures and illness, impacting the operational capabilities of the value chain, from harvesting and processing to manufacturing and distribution (Abdullah et al., 2021; Aday & Aday, 2020; Al-Mansour & Al-Ajmi, 2020; Ambrogio et al., 2022; Atkinson et al., 2020; Baghersad & Zobel, 2021; Donthu & Gustafsson, 2020; Food and Agricultural Organization of the United Nations [FAOUN], 2020; Han et al., 2021; Ivanov, 2022; Khan et al., 2022; Kumar et al., 2021; Liu et al., 2021; Love et al., 2021; Lowe et al., 2021; Mollenkopf et al., 2021; Nikolopoulos et al., 2021; Novoszel & Wakolbinger, 2022; Rahman et al., 2021; Roscoe et al., 2022; Sarkis, 2020; Sharma et al., 2022; Singh et al., 2021; Xu et al., 2020; Yang & Han, 2021). Separately, communication breakdowns between public and private entities further exacerbated the supply chain challenges. Inaccurate, inconsistent, and overly reassuring information led to price increases, resource wastage, and uncoordinated responses to the pandemic, hindering effective crisis management (Altig et al., 2020; Atkinson et al., 2020; Chang et al., 2020; Donthu & Gustafsson, 2020; Eklund, 2021; Remko, 2020; Tomlin & Wang, 2011; Yang & Han, 2021; Yoon et al., 2020). Table 2 provides a summary of these risks.

To address these supply chain disruptions, researchers and practitioners have emphasized the importance of robust risk management strategies, supply chain resilience, and improved communication and collaboration between government bodies, private enterprises, and the public. Lessons learned from the COVID-19 pandemic have underscored the need for adaptable and agile supply chains capable of responding to unexpected shocks, fostering greater collaboration and information sharing among stakeholders, and implementing technology-driven solutions to enhance supply chain visibility and efficiency.

Of special interest to this work is the grocery/FMCG supply chain, due to its general importance and contribution to the economy and the stability of daily life for the everyday person. Aside from its criticality, the grocery and FMCG sectors were among the few industries allowed to operate 'as normal' throughout the pandemic. Considering this, the literature has highlighted a few critical contradicting priorities that negatively impacted firms' responses to the pandemic (Bode & MacDonald, 2017; de Souza et al., 2022; Hobbs, 2020; Kumar et al., 2021; Mollenkopf et al., 2021; Rejeb et al., 2022; Remko, 2020; Saleheen & Habib, 2022; Sharma et al., 2022 ; Singh et al., 2021). (1) Cost Efficiencies Versus Supply Chain Agility- the UK grocery supply chain primarily competes on costs; however, the pandemic (and other SCDs) mandate that the supply chain be more agile in order to cope with variations in demand and supply (de Souza et al., 2022; Graham et al., 2020; Hobbs, 2020; Hong & Kochar, 2020; Ivanov, 2021; Jabbarzadeh et al., 2018; Kumar et al., 2021; Rejeb et al., 2022; Sarkis, 2020; Sharma et al., 2022). (2) Globalisation Versus Localisation- the UK food supply chain is heavily dependent on foreign merchants to bolster food security, particularly in terms of fruit and vegetables, meaning that globalised supply

Table 2. Different risks induced by COVID-19.

Demand-side risks	Supply-side risks	Miscellaneous
• Stockpiling, panic buying, hoarding (i.e. toilet paper, soap, baking items, non-perishables, frozen foods) • Increased volatility in demand due to customer anxieties (i.e. increasing unemployment, economic recession, and feared disruptions to food supply) • Sudden shift to online and omni-channel shopping (although ongoing for the last 10 years, accelerated during pandemic)	• Lockdowns caused many issues. • Travel/trade restrictions (heavily impacted the UK grocery supply chain, due to high reliance on foreign merchants to bolster supply) • Labour shortages due to isolation measures/ illness leading to absenteeism (impacted value chain's capabilities- particularly at the harvesting, processing/ manufacturing, and distribution stages)	• Significant communication errors between public and private entities- in terms of inaccuracy, inconsistency, and over-reassurance. • Led to price increases, wasted resources, and uncoordinated responses to the pandemic.

chains are very common. This mandates increasing the length and complexity of the supply chain, which makes it more susceptible to blockages and deadlocks. Firms are also facing pressure to 'localise' their supply chains as it promotes urban-rural linkages, self-reliance, environmental conditions, and food quality; however, others indicate that this could reduce reliability, increase prices, and wouldn't be beneficial towards improving self-reliance due to seasonality, crop cycles, and other concerns (Aday & Aday, 2020; de Souza et al., 2022; Graham et al., 2020; Hobbs, 2020; Hohenstein, 2022; Hong & Kochar, 2020; Ivanov & Das, 2020; Kumar et al., 2021; Mollenkopf et al., 2021; Nikolopoulos et al., 2021; Remko, 2020; Sarkis, 2020; Sharma et al., 2022).

(3) Food Safety Versus Human Safety- despite minimal concerns of the virus being propagated through food, product recalls were abundant during the pandemic; government regulations are more focused on pathogen-related food safety, leaving firms to their own devices regarding pathogen-related human safety. However, high value commodities are highly labour-intensive and are heavily impacted by absenteeism; this made the balancing of food and worker safety a core activity throughout the pandemic (Aday & Aday, 2020; de Souza et al., 2022; Hobbs, 2020 (B); Kumar et al., 2021; Mollenkopf et al., 2021; Sharma et al., 2022). (4) Political Instability Versus Environmental Sustainability- Brexit and other situations involving political and civil unrest resulted in a reduced ability to acquire labour as well as import and export goods, which had severe consequences for the stability of the food supply. Sarkis (2020) relate such instabilities to sustainability, arguing that COVID-19 is further evidence of the three pillars of sustainability- economic conditions, environmental sustainability, and social climate; they expand on this by stating that the economic conditions have been severe, while the social environment was turbulent, subsequently producing mixed results concerning the physical environment (Sarkis, 2020). Holistically, this mandates the balancing of political/ social instability, whilst also maintaining a steady food supply, and avoiding the causation of undue environmental harm (Aday & Aday, 2020; Al-Mansour & Al-Ajmi, 2020; de Souza et al., 2022; Jabbarzadeh et al., 2018; Kumar et al., 2023; Moosavi et al., 2022; Rejeb et al., 2022; Sarkis, 2020; Sharma et al., 2022).

2.2. Behavioural economics- current state of knowledge

Much of the current literature explores behavioural economics concepts in relation to specific aspects of SCM, such as prospect theory, risk/ loss aversion, heuristics/ bounded rationality, emotion/ ambiguity/ other factors, transaction cost economics, behavioural operations/ theory of the firm, and miscellaneous concepts. For instance, Wu et al. (2010) explored the role risk aversion plays in decisions related to supply contracts, where they found that the optimal strategy was dependent on supply chain system parameters, such as costs and selling/ option prices, as well as risk aversion, which is still seldom reported on in the literature today, where risk aversion was negatively correlated with the number of options exercised (Wu et al., 2010). Similarly, others argue that the interrelationships between risk aversion levels and risk attitudes of lenders heavily impacted the terms and agreements of their business arrangements (i.e. contracts) (Fahimnia et al., 2019). Moreover, Shen et al., 2011 explored these concepts in the context of manufacturing firms, where they found that loss-averse manufacturers behave differently, and in a more complex way than risk-neutral or risk-averse ones; loss-averse manufacturers order larger quantities in advance when demand or supply prices become more uncertain) (Shen et al., 2011). Furthermore, Xu et al. (2019) found that loss averse retailers don't normally purchase options under uncertainty, in favour of replenishing stock; when shortage costs aren't considered, loss averse retailers that become more loss averse under uncertain circumstances should purchase fewer options to reduce potential losses, which can vary among loss averse retailers when shortage costs are accounted for (Xu et al., 2019).

On the topic of bounded rationality and bipolarity in operational decision-making, Yang et al. (2021), utilised the COVID-19 pandemic to explore behavioural causes of the bullwhip effect, finding that risk aversion, loss aversion, prospect theory, among other concepts all play a considerable role in its occurrence (Goudarzi et al., 2023; Yang et al., 2021). Adding to this discussion, some authors have explored the role of bounded rationality, decoupling, and other behavioural economics concepts (i.e. heuristics, biases, and decision-maker characteristics) in the implementation of Big Data Analytics, Predictive Maintenance Work Systems, and other Industry 4.0- supported technologies, finding that all behavioural concepts significantly impacted implementation efforts (Kalaitzi & Tsolakis, 2022; Taqi et al., 2023; van

Oudenhoven et al., 2023). ; On the other hand, Bitsch and Hanf (2022) explore the impact of behavioural factors on supplier relations, highlighting the importance of non-empirical factors in relation to business-centric decisions generally, supply chain management, and supplier relationship management (Bitsch and Hanf, 2022). Finally, the literature points out a heuristic applicable to the COVID-19 pandemic- that the disruption would occur 'somewhere else' and not affect them; when optimism is taken to an extreme, it can be detrimental to the organisation, which was observed among practitioners throughout the pandemic (Altig et al., 2020; Atkinson et al., 2020; Chang et al., 2020; Donthu & Gustafsson, 2020; Eklund, 2021; Yang & Han, 2021).

Regarding the topics of emotions, ambiguity, and other factors, it has been widely acknowledged that humans behave wildly differently based on their emotional state, and that any form of crisis will be highly influential in this regard, particularly within the context of a disruption on the scale and scope of COVID-19. For instance, Campos-Vazquez and Cuilty (2014) among others, studied the role of emotions on risk aversion, finding that sadder people are more risk averse, and that angry people are less sensitive to loss aversion (Campos-Vazquez & Cuilty, 2014; Savage, 2019; Wang et al., 2017). Similarly, Petrocchi et al. (2022) found that distress, ambiguity, and risk aversion increased the perceived utility of the lockdowns, and that, in contrast to much of the literature, worry wasn't associated with increased risk aversion (Petrocchi et al., 2022). Wang et al. (2017) add to this through their discussion of the impact of national culture on how loss aversion is experienced, finding that loss aversion is experienced differently due to differences in emotional regulation and expression (Wang et al., 2017). On the other hand, Young et al. (2012) identified time pressures as a factor towards the making of poor decisions (Young et al., 2012). Of more direct interest to this paper is the work by Roscoe et al. (2022), who found that managerial decision-making rationales are impacted by the mobility of SC assets and managerial perceptions of risk, and that multiple logics are likely to be utilised simultaneously (Roscoe et al., 2022). Otherwise, much of the literature discusses the role of these and other factors, and their impact on the loss/ risk aversion of the general population, both within and outside the context of COVID-19 (Kluwe-Schiavon et al., 2021).

In the current state of knowledge, much of the focus regarding Transaction Cost Economics is on different 'views' of TCE (i.e. responsiveness versus efficiency views), and control mechanisms that manage cost efficiencies (Emery & Marques, 2011; Wang & Wei, 2007). However, TCE is criticised for a number of reasons, such as inaccurate predictions of actual SC behaviours (i.e. TCE assumes adversarial relationships between SC partners that leads to the accumulation of inventory, whereas most SC partners rely on collaboration to keep inventory buffers low and to maintain efficiency), not going far enough to explain human elements of SC decision making (i.e. reference prices are highly predictive of loss averse and risk averse behaviour; personal aspirations and psychological adoption levels, based on the sellers' initial price offering, are not considered under TCE), and the lack of general applicability of the concept as a whole (with only a small subset of the theory's principles being practically adopted) (Emery & Marques, 2011; Ketokivi & Mahoney, 2020; Richey et al., 2022; Wong et al., 2021).

Numerous authors have produced overarching literature reviews concerning behavioural operations/ behavioural theory of the firm, in several contexts (i.e. inventory management, operations management, information sharing, and supply chain management); literature reviews were the most commonly utilised method on this topic, with very little in the way of empirical research, particularly as it relates to COVID-19. The majority of these reviews consolidate findings surrounding three core areas: (1) cognitive limitations, bounded rationality, risk attitudes, and bipolarity in operational decision-making; (2) buyer-supplier relationships, through the lenses of power, trust, and both; (3) diverse supply chain management topics (i.e. green supply chain management, SC integration, strategic alliances) (Fahimnia et al., 2019; Goudarzi et al., 2023; Liu et al., 2019; Nunes et al., 2021; Paul et al., 2021; Perera et al., 2020; White, 2016).

Regarding the role of cognitive limitations and perceptions of risk-laden decisions, Zona (2012), examined corporate expenditure through the lens of executive decision making, where they found that executives are risk averse under times of crisis, and that their decision making is also affected by the level of available slack resources, in addition to prospect theory, and other such concepts (Zona, 2012). There are also other works exploring bounded rationality, risk attitudes, and bipolarity in decision-making from the perspective of the firm, with their findings being related to subjects from the bullwhip effect to

supply chain viability (de Vries et al., 2022; Lusiantoro et al., 2022; Sawik & Sawik, 2024; Yamini & Gajanand, 2022; Yang et al., 2021) Concerning buyer-supplier relationships, Tsanos et al. (2014), argue that trust enables collaborators to worry less about shortcomings induced by their bounded rationality (Sahu et al., 2022, Tsanos et al., 2014). Additionally, within the context of a demand-side supply chain disruption, Zhai et al. (2022) highlighted the importance/ influence of the disruption itself and the power structures that compose the supply chain on service level, production, and optimal pricing decisions (Zhai et al., 2022). Other works in this area explore the roles of justice and power in supplier relationships (Alghababsheh et al., 2023), and highlight the complexity of supplier segmentation decisions (Shiralkar et al., 2023). Miscellaneous articles concerning behavioural operations encompass discussions of sustainable SCM and corporate social responsibility (Kumar et al., 2023; Nunes et al., 2021; Zheng et al., 2021), the support of NGOs (Asogwa et al., 2023), the development of the 'new normal' post-COVID-19 (Alexander et al., 2022), and the implementation of green practices and smart technologies as a recovery strategy (Khan et al., 2022).

Table 3 provides a summary of the behavioural economics concepts and their connections to SCDM, as outlined by the current state of knowledge, and discussed above.

2.3. Organisational culture—current state of knowledge

Organisational culture has been studied in innumerable contexts, with much work in recent years discussing the role of organisational culture in (1) risk management (including risk cultures and appetites), (2) COVID-19 and organisational survival (including work-from-home practices, organisational change and learning, OCB and organisational empathy, and Industry 4.0/ digitalisation), (3) organisational/ operations management (including innovation, strategy/practices/ effectiveness, and total quality management), and (4) supply chain management (including sustainable SCM), and (5) behavioural economics. Despite the work done in these areas, applications to remain rather scant (Permatasari & Mahyuni, 2022).

Firstly, on the topic of enterprise risk management, Kimbrough and Componation (2009) associated 'organic cultures' with successful implementation of the concept (Kimbrough & Componation, 2009). On the other hand, Stephens et al. (2022) uncovered a positive and significant relationship between market performance and supply chain disruption orientation, pointing out the importance of organisational culture in developing a disruption orientation (Stephens et al., 2022). Whereas Azizi and Rowlands (2018), particularly in the context of IT risk management, discuss how culture acts as a contextual factor that either hinders or supports knowledge and sharing and capture mechanisms (Azizi & Rowlands, 2018). While Griffith et al. (2010) explored safety cultures through the linking of definitions of organisational culture to definitions of enterprise risk management, Neal et al. (2012) assessed factors that contribute to the development of a food safety culture, finding that the interview process can be used to identify individual employees' commitment to food safety (Griffith et al., 2010; Neal et al., 2012). Aside from these general applications, many authors have discussed the role of organisational culture in developing a risk culture, the importance of having a well-developed risk culture, and the impact of risk cultures and appetites on supply chain performance (Alrobaish et al., 2022; Chen et al., 2019; COSO, 2020; Kumar & Anbanandam, 2020; Schulman, 2020; Som & Anyigba, 2022; Whiteside & Dani, 2020).

Secondly, the topic of COVID-19 and organisational survival, numerous authors explored the impact of work-from-home, organisational change and learning, organisational citizenship behaviour and organisational empathy, and Industry 4.0/ digitalisation. Regarding work-from-home adoption during the pandemic, numerous authors have discussed (1) culture's impact on the adoption of work-from-home practices (Singh & Kumar, 2020), (2) the nature of trust disruption and preservation under these new conditions (Panteli et al., 2023) the nature of changes induced by the pandemic and work-from-home practices (where most changes were transformational and necessary in nature) (Nyamunda, 2022), (3) the impact of remote work on behavioural patterns and organisational commitment (Machaczka & Stopa, 2022), (4) the complexity of leading remotely, different approaches to supporting employees, and antecedents to crisis leadership (Balasubramanian & Fernandes, 2022; Krehl & Buttgen, 2022; Yue & Walden, 2023). Past works on the topic of organisational change and learning primarily focus on planned organisational change and the development of sub-cultural clusters (Ogbonna & Harris, 2002, 2015), whereas the recent literature tends to focus more on unplanned cultural changes (or changes induced

Table 3. Explorations of behavioural economics concepts in relation to SC(D)M.

Behavioural economics concepts	Areas of discussion	Citations
Prospect Theory, Risk/ Loss Aversion	• Contract Management-SC parameters and risk aversion found to both play roles in the options exercised. • Loss averse manufacturing firms behave differently and in more complex ways than risk neutral and risk averse ones. • Loss averse retailers don't purchase options under uncertainty; loss averse retailers become more loss averse under uncertainty. • Miscellaneous- CEO productivity, HR utilisation of nudges, farmer's financing decisions • Non-Commercial Applications → Customer's risk aversion impact on SCM, how behavioural economic concepts impacted compliance with lockdowns, online food shopping motivations, how nudges can be utilised by governments to control consumer and business behaviour, how loss aversion can be utilised by governments to influence economic performance	COSO (2020); Fahimnia et al. (2019); McDonald (2017); Roni et al. (2022); Shen et al. (2011); Wang and Wang (2018); Wang et al. (2022); Wu et al. (2010); Xu et al. (2019); Yan et al. (2020)
Heuristics and Bounded Rationality	• SC relationships- bullwhip effect is an example of bounded rationality manifesting itself. • Implementation of Industry 4.0 technologies and Predictive Maintenance Work Systems • Example of Heuristics applicable to COVID	Altig et al. (2020); Atkinson et al. (2020); Bitsch and Hanf (2022); Chang et al. (2020); Donthu and Gustafsson (2020); Eklund (2021); Goudarzi et al. (2023); Kalaitzi and Tsolakis (2022); Taqi et al. (2023); van Oudenhoven et al. (2023); Yang and Han (2021); Yang et al. (2021
Emotion, Ambiguity, and Other Factors	• Sadder people are more risk averse, angry people are less sensitive to loss aversion. • Risk aversion increased the perceived utility of the lockdowns, worry was not associated with increased risk aversion. • National culture impacts loss aversion, due to differences in emotional regulation and expression. • Time pressures result in hastily made decisions; Managerial decision-making rationales are influenced by SC parameters and perceptions of risk; multiple decision-making logics are being utilised at the same time. • Non-Commercial Applications → Likelihood of compliance with social distancing guidelines, risk aversion levels are variable dependent on proximity to COVID-19, risk and loss aversion are subject to change given negative changes/ experiences, Loss aversion did not replicate under pandemic conditions	Campos-Vazquez and Cuilty (2014); Kluwe-Schiavon et al. (2021); Petrocchi et al. (2022); Roscoe et al. (2022); Savage (2019); Wang et al. (2017); Young et al. (2012)
Transaction Cost Economics	• Different views of TCE • TCE is criticised due to its inability to accurately predict decisions under various circumstances, it does not go far enough in explaining the human elements of decision making, and it hasn't been adequately adopted on a practical level.	Emery and Marques (2011); Ketokivi and Mahoney (2020); Richey et al. (2022); Wang and Wei (2007); Wong et al. (2021)
Behavioural Operations/ Theory of the Firm	• Literature reviews dominated this area- historical analyses, focal points, and differentiation of focus over time. • Cognitive shortcomings, bounded rationality, risk attitudes, and bipolarity in operational decision-making • Buyer-Supplier relationships- trust and power • Misc SCM topics- Green SCM, SC integration, strategic alliances	Alexander et al. (2022); Alghababsheh et al. (2023); de Vries et al. (2022); Fahimnia et al. (2019); Goudarzi et al. (2023); Khan et al. (2022); Kumar et al. (2023); Liu et al. (2019); Lusiantoro et al. (2022); Nunes et al. (2021); Paul et al. (2021); Perera et al. (2020); Sahu et al. (2022); Sawik and Sawik (2024); Shiralkar et al. (2023); Tsanos et al. (2014); White (2016); Yamini and Gajanand (2022); Yang et al. (2021); Zhai et al. (2022); Zheng et al. (2021); Zona (2012)
Miscellaneous	• Inductive research exploring roles of human factors in decision making. • Operational, behavioural, disruption, and technological factors all impacted the perishable food supply chain- but behavioural and disruption factors were most relevant to COVID-19. • Historical analyses of the discipline • Examination of responses to financial crisis through the lens of behavioural economics. • Examination of financial market under COVID and Brexit- utilised behavioural economic concepts to explain risk-taking behaviour among investors- all concepts used were determined to be significant.	Burd (2010); Kirchoff et al. (2016); McDonald (2009); Paterson et al. (2024); Sharma et al. (2022)

by external circumstances) (Spicer, 2020), the impact of organisational learning on employee resilience (Blaique et al., 2023), the development of new cultures based on changes to training methodologies (Mikolajczyk, 2022), and the development of a risk management culture based on current knowledge management practices (Ali et al., 2023).

A smaller subset of the literature focused on the development of Organisational Citizenship Behaviours (OCBs) among employees, the influence of OCBs on performance (Widarko & Anwarodin, 2022), the role of organisational gratitude in crisis self-efficacy (Ni et al., 2022), and culture's effects on the levels of organisational empathy experienced during times of crisis (Yim & Park, 2021). On the other hand, a larger portion of the literature has discussed organisational culture in the context of digitalisation, particularly in relation to Industry 4.0-enabling technologies. For instance, Ajmal et al. (2022) explored practical changes made due to COVID-19, with digitalisation being discussed in depth (Ajmal et al., 2022). Spieske and Birkel (2021) explored how risk management cultures can be supported by Industry 4.0, whereas Gupta et al. (2022) discussed the development of human resources to support digitalisation efforts, as well as organisational factors, behavioural factors, and technical factors, that contribute to the supply chain's capacity for digitalisation (Gupta et al., 2022; Spieske & Birkel, 2021). Similarly, Alamsjah and Yunus (2022) identified ambidexterity (in terms of organisational culture and supply chain agility) as the most critical success factor underlying digitalisation (Alamsjah & Yunus, 2022). Other authors explored specific technologies that would be useful adopt, given disruptive supply chain conditions (given either new collaborative efforts (Dubey et al., 2019), or COVID-19 (Galanakis et al., 2021)). Lastly, two authors explored factors impacting the adoption of eSCM technologies, with Liu et al. (2010) identifying institutional pressures and flexibility-versus-control orientation as impacting adoption intentions (Liu et al., 2010), and Kalaitzi and Tsolakis (2022) identified the organisation's strategic goals, structure, and culture as impacting their ability to adopt supply chain analytics (Kalaitzi & Tsolakis, 2022).

On the other hand, operations and organisational management generally has also been a common topic of conversation in the literature, with innovation, general organisational management, and Total Quality Management (TQM) being discussed. Regarding innovation, most of the focus has been on identifying how culture, and specific factors within the organisation, support innovative practices. For instance, Hamdan and Alheet (2020) argue that organisational cultures that are supportive of new and creative ideas, encourage employee participation in decision making, which supports the generation of innovativeness at every level of the organisation (Hamdan & Alheet, 2020). Alternatively, Riivari et al. (2012) found that behavioural innovativeness established by the organisation encourages the development of an innovative culture; Scaliza et al. (2022) found that 'adhocracy cultures' are conducive to improving innovative performance (Riivari et al., 2012; Scaliza et al., 2022). Furthermore, Wiewiora et al. (2014) found that market-type characteristics were associated with decreased trust in employees and explicit forms of knowledge-sharing (and thus, were a detriment to innovation) (Wiewiora et al., 2014). Other authors have explored the relationship between culture and organisational management more generally, finding that corporate strategies (Hughes, 1999), management practices (Braunscheidel et al., 2010), performance, and organisational effectiveness (Naveed et al., 2022), are all related to organisational culture. Similarly, the TQM literature also seeks to answer how different types of organisational culture, and the alignment of culture with TQM principles, support the firms' ability/ willingness to engage in TQM (Tomic et al., 2017).

Concerning SCM, several authors have discussed the antecedents of supply chain performance and resilience, finding that organisational culture, and more specifically changes to organisational culture, played a significant role (Ali et al., 2021; Braunscheidel et al., 2010; Eriksson & Hallberg, 2022; Nikookar & Yanadori, 2022; Zanon et al., 2021). Cadden et al. (2010), among others, further the application of organisational culture to supply chain management, through an exploration of the literature, where they find that, at the supplier selection, development, and evaluation stages of collaboration, ensuring cultural fit between the participating organisations, such that trust, commitment, adaptability, and communication are aligned (i.e. a strong culture of shared beliefs, values, and norms), is a crucial component of ensuring enhanced supply chain performance (Belhadi et al., 2021; Cadden et al., 2010; Konstantinou et al., 2021; Lu et al., 2016; Rees, 1994; Wang & Dyball, 2019; Wiewiora et al., 2014; Winklhofer et al., 2006). These ideas are clarified by Cadden et al. (2013), who find that in situations involving just two firms, cultural fit is a stronger predictor of supply chain performance; overall, cultural fit is significant, but might not be indicative of successful outcomes being achieved when a multitude of suppliers and cultures are involved (Cadden et al., 2013). Separately, Hult et al. (2007) and Hardcopf et al. (2021) argue that supply chains are leaner and more flexible, and also show more readiness and capability to adapt to the external environment when they adopt developmental cultures that encourage knowledge development and competitiveness (Hardcopf et al., 2021; Hult et al., 2007). The topic of sustainable SCM was

also widely discussed in the literature, with many authors exploring how culture impacts implementation efforts (Hong et al., 2022; Lazar et al., 2022; Rizzi et al., 2023). Others discuss the roles of 'green human resource management' (Al-Swidi et al., 2021; Roscoe et al., 2019), normative commitment (Lazar et al., 2022), and managerial effectiveness in communicating sustainability awareness (Ketprapakorn & Kantabutra, 2022; Negi & Dangwal, 2019).

Manetje and Martins (2009) explain how the organisation's culture influences (and is influenced by) the behaviour and attitudes of its members, highlighting that practitioners do not behave in a vacuum; they further propose that employees' commitment to the organisation, how leaders influence the organisation's culture/how culture is instilled throughout the organisation, and the assumptions that are developed, as problems are encountered and resolved, all result in employees developing new adaptive behaviours. These will then result in the generation of new values and beliefs throughout the firm (Manetje & Martins, 2009). Goudarzi et al. (2023), also briefly discuss how more attention is being paid to the role of organisational and national culture in Behavioural Operations, particularly as it relates to contract performance and utilising behavioural approaches to reduce the bullwhip effect (Goudarzi et al., 2023). Furthermore, Yang et al. (2021) and Permatasari and Mahyuni (2022) argue that it is highly important for large organisations (where most operations occur), to consider learning, communication, and culture alongside the cognitive shortcuts of the human mind, due to the negative implications for operational performance associated with limitations in these areas, particularly under Supply Chain Disruptions (Permatasari & Mahyuni, 2022; Yang et al., 2021). Similarly, Behavioural Theory of the Firm has also been examined, where it was found that culture has an influential role in the development of work-based heuristics and reference points, as well as how loss and risk aversion are experienced and viewed within the firm, from both the perspectives of groups and the individuals that compose them (Augier & March, 2008; Pennings & Leuthold, 2001; Savage, 2019)

Table 4 provides a summary of the organisational culture and its connections to SCDM, as outlined by the current state of knowledge, and discussed above.

2.4. Criticisms of current state of knowledge

Behavioural Economics has long been applied to consumers and the general population, with the aim being to guide their decisions (Fahimnia et al., 2019; Nekmahmud, 2024; Paterson et al., 2024; Roni et al., 2022). Despite recent strides in the application of behavioural economic concepts to supply chain management decisions, research regarding behavioural operations tends to focus on particular areas of operations management (AlMazrouei & Zacca, 2022; Augier, 2004), with limited extension to supply chain management, and even less application to SCDM, with Fahimnia et al. (2019) only citing 3 articles related to SCDM in their extensive literature review regarding behavioural operations (Fahimnia et al., 2019). There has been some application of bounded rationality to SCM, but the authors often portray the concept as having limits, such as Li et al. (2020) implying that managers are less boundedly rational than their subordinates, and thus, can manage 'other people's irrational decisions' to exploit them for commercial growth (Li et al., 2020). While TCE does begin to link behavioural concepts to supply-chain-centric decision-making, it is more focused on external contingencies impacting costs, as opposed to explaining internal decision-making processes, which limits is applicability (Liu et al., 2010). TCE also faces issues of not being able to predict firm behaviour in terms of willingness to combine resources and collaborate to achieve external effectiveness, and the utilisation of buffer inventories, certain governance structures, and networks (Richey et al., 2022; Wang & Wei, 2007). Additionally, the field of behavioural economics/operations is dominated by experimental approaches, equation modelling, and literature reviews; while these methods have provided solid foundations, they encounter issues of incomplete explanations of real-world behaviour, particularly when compared with the rich findings of ethnographic/ other forms of observations of real-world settings (Pendleton et al., 2019). Furthermore, the topic of inventory decisions is an over-represented area of supply chain decision making, when compared with the diverse range of decisions supply chain practitioners face; Supply Chain Disruptions are not commonly managed solely through inventory management, and other SCDM decisions deserve examination (Yamini & Gajanand, 2022).

Similarly, much of the literature is beginning to apply organisational culture to some aspects of SCM; however, national culture greatly overshadows discussions of organisational culture in all aspects

Table 4. Explorations of organisational culture in relation to SC(D)M.

Topic	Sub-topic	Areas of discussion	Citations
Risk Management, Culture, Appetite	Risk Management	• Organic organisational cultures result in successful implementation of enterprise risk management. • Culture is a contextual factor that impacts knowledge sharing and risk management mechanisms. • Top management facilitates organisational culture and thus risk management activities.	Azizi and Rowlands (2018); Kimbrough and Componation (2009)
	Safety/ Risk Cultures and SCD Orientation	• Exploration of 'safety cultures' and factors that contribute to their development. • Risk cultures are shaped by organisational culture and greatly influence SC risk management. • Supply chain disruption orientation had a positive impact on SC risk management performance.	Alrobaish et al. (2022); Chen et al. (2019); Griffith et al. (2010); Kumar and Anbanandam (2020); Schulman (2020); Som and Anyigba (2022); Neal et al. (2012); Stephens et al. (2022); Whiteside and Dani (2020)
COVID-19 and Organisational Survival	Work From Home	• Workers found they were happier when working from home, but new concerns of cybersecurity were encountered; work-life balance was a benefit or a concern to different workers. • Work from home practices decrease creativity, innovativeness, motivation, etc. • Work-home tensions, privacy/ security issues, shared workspaces, and the presence of others (or lack thereof) contributed to trust disruptions. • Cultures supportive of work-from-home assisted with its adoption. • Leading and supporting employees was highlighted as being more complex due to the pandemic.	Balasubramanian and Fernandes (2022); Krehl and Buttgen (2022); Machaczka and Stopa (2022); Nyamunda (2022); Panteli et al. (2023); Singh and Kumar (2020); Spicer (2020); Yue and Walden (2023)
	Organisational Change and Learning	• Organisational changes induced by the pandemic was mostly transformational, made out of necessity, and organisations are not likely to regress after making these changes. • Organisational learning positively impacted employee resilience, psychological empowerment, and work engagement in the context of COVID-19. • Role of cultural sub-clusters in planned organisational change. • Knowledge-based activities are a precursor to the development of a 'risk management culture'.	Ali et al. (2023); Blaique et al. (2023); Mikolajczyk (2022); Ogbonna and Harris (2002); Ogbonna and Harris (2015)
	OCB and Organisational Empathy	• The use of High-Performance Work Systems positively impacted worker morale, performance, and overall, created a culture that was conducive to the building of Organisational Citizenship Behaviour (OCB). • Motivation increases OCB, organisational culture doesn't directly affect OCB, and that OCB has a direct impact on work performance. • Encouraging 'helping behaviour' and emotional support encourages a 'gratitude culture', which improves crisis self-efficacy and employee wellbeing. • Organisational culture has a significant effect on the levels of organisational empathy experienced during times of crisis.	Ni et al. (2022); Widarko and Anwarodin (2022); Yim and Park (2021)
	Industry 4.0 and Digitalisation	• How organisational culture changed as a result of practical changes, such as I4.0 implementation. • How risk cultures can be supported by I4.0 • Readiness Index Framework to assist HR with the digitalisation of logistics. • Ambidexterity (in terms of organisational culture and supply chain agility) as the most critical success factor underlying digitalisation. • Collaborative efforts could be supported by Big Data Analytics due to their ability to account for differences in culture. • Food safety culture combined with innovations could be beneficial for farmers and processors under COVID-19. • Differing organisational cultures have different moderating effects on eSCM adoption. • Supply Chain Analytics needs careful consideration of how it will fit with the organisation's goals, structure, and culture.	Ajmal et al. (2022); Alamsjah and Yunus (2022); Asamoah et al. (2021); Dubey et al. (2019); Galanakis et al. (2021); Gupta et al. (2022); Kalaitzi and Tsolakis (2022); Spieske and Birkel (2021)

(*Continued*)

Table 4. Continued.

Topic	Sub-topic	Areas of discussion	Citations
Organisational/ Operations Management	Innovation	• Cultures that support new and creative ideas supports the innovativeness of the organisation through the encouragement of employee engagement. • Behavioural innovativeness encourages the development of an innovative culture; ethical standards and practices can boost behavioural, strategic, and process innovativeness. • 'Adhocracy' organisational cultures are more conducive to improving innovation performance. • Organisational culture plays a significant role in knowledge sharing and trustworthiness in terms of project management between organisations	Hamdan and Alheet (2020); Riivari et al. (2012); Scaliza et al. (2022); Wiewiora et al. (2014)
	Strategy, Practices, and Effectiveness	• Strategic decisions are directly influenced by culture. • Cultural values directly determine the practices adopted by firms; this results in different cultures performing differently. • Establishing the link between culture and performance- culture must be known and adjustments need to be made in both areas continuously. • Organisational culture positively impacts organisational effectiveness through enhanced perceptions of innovation.	Braunscheidel et al. (2010); Hughes (1999); Naveed et al. (2022)
	Total Quality Management	• TQM programme and organisational culture need to be aligned. • Organisational culture impacts firm willingness to make changes to enhance performance. • Adhocratic cultures had a positive relationship with TQM.	Tomic et al. (2017)
	General SCM	• Cultural changes that encourage the prioritisation of SC performance under COVID-19 are critical. • Social capital, human capital, and managers' cognitive abilities, all influenced supply chain visibility, responsiveness, flexibility, and thus SC resilience. • At various stages of collaboration, ensuring cultural fit is a crucial component of ensuring enhanced SCM performance. • Cultural fit is a stronger predictor of supply chain performance when only two firms are involved. • Cultures of competitiveness and knowledge development are better able to offset the effects of the external environment. • Lean SCM is most compatible with a 'developmental' culture that values flexibility/ readiness.	Ali et al. (2021); Belhadi et al. (2021); Braunscheidel et al. (2010); Cadden et al. (2010); Cadden et al. (2013); Eriksson and Hallberg (2022); Hardcopf et al. (2021); Hult et al. (2007); Konstantinou et al. (2021); Lu et al. (2016); Nikookar and Yanadori (2022); Rees (1994); Wang and Dyball (2019); Wiewiora et al. (2014); Winklhofer et al. (2006); Zanon et al. (2021)
	Sustainable SCM	• National and organisational cultures impact SSCM adoption through impact on strategic choices, employee behaviours, and organisational effectiveness. • Significant relationship between active organisational cultures and SSCM adoption. • Strong positive correlations between SSCM adoption and cultures that encourage employee empowerment, bottom-up initiatives, and flexibility. • Hierarchical cultures have a negative effect on successful SSCM implementation efforts, due to the people-centric nature of SSCM. • Green human resource management is crucial to create a sustainability culture that encourages employee involvement and behaviour adjustments. • Normative commitment and organisational culture have a positive impact on the SC's ability to adopt more sustainable practices. • Culture plays a mediating role in the relationship between managerial effectiveness and sustainability. • Sustainability awareness should be integrated into the culture so that meaningful progress towards sustainability can be achieved. • Leaders need to share and promote the values of the sustainability vision.	Al-Swidi et al. (2021); Rizzi et al. (2023); Hong et al. (2022); Ketprapakorn and Kantabutra (2022); Lazar et al. (2022); Negi and Dangwal (2019); Roscoe et al. (2019)

(*Continued*)

Table 4. Continued.

Topic	Sub-topic	Areas of discussion	Citations
Behavioural Economics		• Practitioners don't behave in a vacuum; commitment, leadership, and culture all result in different behaviours and new values/ beliefs throughout the firm. • Increased attention on organisational and national culture's impact on contract performance and utilising behavioural approaches to reduce the bullwhip effect. • Learning, communication, and culture are all crucial to consider alongside the cognitive shortcuts of the human mind, particularly under SCDs. • BTOF is influenced by organisational culture. • Preferences and risk aversion are highly influenced by behaviours manifested due to organisational culture. • Organisational culture affected managerial decision making. • Organisational culture has an influential role in the development of work-based heuristics and reference points, as well as how loss and risk aversion are experienced and viewed within the firm. • Decision making attitudes, national cultures, and organisational culture all play significant roles in R&D investment decisions.	Augier and March (2008); Goudarzi et al. (2023); Manetje and Martins (2009); Pennings and Leuthold (2001); Savage (2019); Yang et al. (2021)

of application to SCDM decisions and SCM in general (Alipour & Yaprak, 2022; El Baz et al., 2022; Gupta & Gupta, 2019; Kitayama et al., 2022; Li et al., 2013; Perera et al., 2020; Wang et al., 2017; Wiewiora et al., 2014; Yang et al., 2021). Separately, leadership is another widely discussed topic in this theoretical realm; the initial discussions of leadership within the COVID-context were composed of reflections on leadership and the importance of appropriate leadership (Antonakis, 2021). Within the work-from-home context, several authors explored the impact of different leadership styles on employee wellbeing and performance (Kloutsiniotis et al., 2022; Koh et al., 2022), and difficulties with showcasing leadership during the crisis (Stoker et al., 2022). Alternatively, authors have explored crisis leadership in more depth, with Stern (2013) highlighting preparation, Forster et al. (2020) highlighting transparency, and Boin et al. (2013) highlighting sensemaking, the orchestration of coordination, communication, rendering accountability, and enhancing resilience as crucial components and activities of crisis leadership (Boin et al., 2013; Forster et al., 2020; Stern, 2013). Chingwena and Scheepers (2022), on the other hand, found that dramatic social change acts a meaningful mediator between various leadership styles and organisational adaptability; they also highlight the importance of intangible assets, such as an ability to learn or adapt, at the organisational and managerial levels (Chingwena & Scheepers, 2022). Moreover, a minority of the work has also focused on gendered leadership, with Eichenauer et al. (2022) finding that women need to display higher levels of communality than their male counterparts in order to score similarly on competence reports, and Wilson and Newstead (2022) highlighting lessons that could be learned from female heads of state, highlighting virtues that are crucial components of crisis leadership, such as humanity, justice, courage, wisdom, and transcendence (Eichenauer et al., 2022; Wilson & Newstead, 2022). Otherwise, operations management within the focal firm, supplier selection, and supplier relationship management are the primary focal points, meaning that applications to SCDM specifically are scant (El Baz et al., 2022; Gupta & Gupta, 2019; Permatasari & Mahyuni, 2022; Wiewiora et al., 2014).

2.5. Positioning the current study within the literature

While significant progress has been made in understanding the impact of digitalization and Industry 4.0 technologies on supply chains, much of the existing research remains generalized and does not specifically address the unique challenges of cold supply chains. Studies often focus on broad supply chain benefits, such as efficiency and sustainability, but overlook the behavioural and organizational dynamics influencing decision-making, particularly during disruptions (Verdouw et al., 2016; Zhong et al., 2017). Similarly, while behavioural economics and organizational culture have been explored in various business

contexts, their application to Supply Chain Disruption Management (SCDM) is underexplored. Recent advances, such as the integration of Industry 5.0 principles into sustainable supply chain management, offer new perspectives on enhancing resilience and achieving sustainability goals in disruption-prone environments (Fatorachian, 2024).

To clarify how this study builds on prior work while addressing these gaps, Table 5 contrasts key elements of previous research with the unique contributions of the current study. This comparison highlights the novelty and relevance of the study, particularly in its focus on cold supply chains, empirical approach, and integration of behavioural and organizational theories.

Table 5 provides a detailed comparison between prior studies and the current research, showcasing how this work bridges gaps in the literature. Unlike previous research, which often relied on theoretical or qualitative methods and generalized supply chain contexts, this study focuses specifically on cold supply chains, employs empirical data from FMCG/food supply chain professionals, and integrates behavioural economics and organizational culture theories to enhance understanding of SCDM. The table underscores the study's contributions to both academic and practical fields, particularly in addressing waste reduction and resilience in cold supply chains during disruptions like COVID-19.

3. Case study insights supporting behavioural economics and organizational culture in SCDM

To complement the study's findings, this section presents detailed real-world case studies illustrating the interplay between behavioural economics, organizational culture, and supply chain disruption management (SCDM). These cases provide empirical evidence to validate key principles such as risk aversion, bounded rationality, and cultural cohesion in decision-making during disruptions.

3.1. Tesco's supply chain response to COVID-19

Tesco, the UK's leading grocery retailer, effectively managed supply chain disruptions during the COVID-19 pandemic by fostering cultural cohesion and employing behavioural economics principles. Tesco prioritized collaborative risk-sharing with suppliers, ensuring continuity in the supply of essential goods despite widespread disruptions. The retailer implemented transparent communication strategies, reducing panic buying by providing regular updates to customers and stakeholders. This approach reflects trust-building and loss aversion, core principles of behavioural economics, which helped mitigate the perceived risks of shortages among customers and suppliers (Tesco PLC, 2020).

Moreover, Tesco leveraged its organizational culture to address workforce challenges, such as safety concerns and absenteeism. By reallocating staff and introducing flexible working arrangements, Tesco maintained operational efficiency. These actions align with the study's findings on how cultural cohesion influences risk-taking and decision-making during crises (Tesco PLC, 2020).

Table 5. Comparison between previous work and current study.

Aspect	Previous Work	Current Study
Focus Area	General supply chain efficiency and sustainability (Verdouw et al., 2016; Zhong et al., 2017).	Cold supply chains with an emphasis on waste reduction and sustainability.
Technological Emphasis	Broad digitalization benefits, without specific mechanisms (Maroli et al., 2021; Sadeghi et al., 2022).	Strategic application of Industry 4.0 technologies, such as IoT and predictive analytics.
Behavioral/Organizational	Limited exploration of human-centric and organizational dynamics (Schein, 2010; Thaler, 2016).	Incorporates behavioral economics and organizational culture to explore decision-making dynamics.
Methodology	Theoretical or qualitative case-based studies (Moyo et al., 2023; Xiao & Khan, 2024).	Empirical analysis using responses from 21 supply chain managers in the FMCG/food sector.
Application Context	Diverse supply chain sectors (Asafo-Adjei et al., 2023; Sadeghi et al., 2022).	Focused on critical FMCG/food supply chains during COVID-19.
Contribution to Theory	Generic recommendations for supply chain improvement.	Bridging gaps between behavioral economics, organizational culture, and SCDM.

3.2. Amazon's behavioural approach to risk and disruption

Amazon's ability to adapt during the COVID-19 pandemic showcases the application of bounded rationality and data-driven decision-making. As demand for essential goods surged, Amazon analyzed customer purchasing behaviour to prioritize essential items and reprioritized its logistics network accordingly. This decision, informed by real-time customer behaviour analysis, exemplifies how Amazon used heuristics and simplified decision-making processes to address complex disruptions (Amazon, 2020).

Amazon's organizational culture, emphasizing agility and innovation, played a critical role in its response. The company rapidly scaled its workforce, hiring over 175,000 temporary employees in 2020 to meet increased demand. This cultural adaptability, combined with technological investments in supply chain visibility, underscores the synergy between behavioural economics and organizational culture in enhancing resilience during disruptions (Amazon, 2020).

3.3. Healthcare supply chains during COVID-19

The global healthcare supply chain faced severe disruptions during the pandemic, particularly in sourcing and distributing personal protective equipment (PPE). Johnson & Johnson responded by embedding a culture of proactive risk management, employing strategies such as supplier diversification and scenario planning. These measures ensured the continued availability of critical medical supplies (Johnson & Johnson, 2020).

Johnson & Johnson also utilized behavioural insights to address overconfidence in supply chain resilience. By conducting stress tests and engaging cross-functional teams, the company identified vulnerabilities and implemented corrective actions. This approach mirrors the study's emphasis on integrating cultural and behavioural insights into risk-based decision-making frameworks (Johnson & Johnson, 2020).

3.4. Toyota's recovery from the 2011 earthquake and tsunami

Toyota's response to the 2011 earthquake and tsunami highlights the critical role of cultural cohesion in managing supply chain disruptions. The company's organizational culture, built on principles of collective responsibility and continuous improvement (Kaizen), facilitated a faster recovery than its competitors. Toyota's incremental approach to risk-taking and its investment in local suppliers ensured that production resumed quickly (Toyota Motor Corporation, 2012).

Toyota's case underscores the importance of knowledge-sharing and collaboration in enhancing organizational resilience. These strategies align closely with the study's findings on how cultural cohesion shapes risk-taking behaviour and decision-making under crisis conditions (Toyota Motor Corporation, 2012).

3.5. FMCG industry in India

Hindustan Unilever, a major FMCG company in India, effectively navigated supply chain disruptions during COVID-19 lockdowns by fostering cultural cohesion and leveraging local sourcing strategies. The company maintained frequent communication with its workforce, ensuring alignment and shared decision-making. This approach mitigated uncertainty aversion among employees and strengthened trust within the organization (Hindustan Unilever, 2020).

Hindustan Unilever also adapted its supply chain operations by sourcing raw materials locally, reducing reliance on global supply chains that were severely disrupted. This practical application of adaptive risk management illustrates the study's findings on the interplay between personal risk values and cultural cohesion in decision-making under uncertainty (Hindustan Unilever, 2020).

3.6. Pfizer's cold chain logistics for COVID-19 vaccine distribution

Pfizer's global distribution of COVID-19 vaccines demonstrated the importance of cultural cohesion and proactive risk management in cold chain logistics. To maintain the integrity of temperature-sensitive vaccines, Pfizer implemented advanced temperature monitoring technologies and collaborated closely with

logistics partners and governments. Scenario planning and risk assessments allowed Pfizer to anticipate and address challenges such as transportation delays and storage limitations (Pfizer, 2021).

The company's organizational culture, emphasizing accountability and precision, supported its ability to navigate these complexities. Pfizer's approach highlights the interplay between bounded rationality and cultural alignment, illustrating how behavioural economics principles can inform effective cold chain management (Pfizer, 2021).

3.7. Nestlé's adaptation in the food and beverage industry

Nestlé, a global leader in the food and beverage industry, adapted its supply chain operations during the pandemic by focusing on employee welfare and supply chain resilience. The company introduced flexible working arrangements and enhanced workplace safety measures to address workforce stability concerns. These actions mitigated loss aversion and ensured business continuity (Nestlé, 2020).

Nestlé also diversified its supplier base and invested in digital technologies to monitor and optimize its supply chain in real-time. This adaptive approach highlights the role of cultural cohesion and data-driven decision-making in mitigating disruptions and maintaining operational efficiency (Nestlé, 2020).

4. Methodology

4.1. Methodological approach and variable definition

The study commenced with an exploratory literature review, which is a fundamental step in academic research (Boote & Beile, 2005). This review involved an in-depth examination of existing scholarly publications, encompassing 529 academic articles, grey literature, and industry reports. The primary objective was to establish a solid foundational understanding of the subject matter, including the key concepts, theoretical frameworks, and empirical studies relevant to the role of behavioural economics and organizational culture in supply chain disruption management decisions. This comprehensive review not only acquainted the research team with the state of the field but also helped identify gaps, discrepancies, and critical themes within the existing literature. The benefits of this approach are manifold. Firstly, it provides researchers with a rigorous theoretical basis for their investigation. It ensures that their study is well-informed and grounded in the latest insights in the field, thereby enhancing the credibility and validity of the research findings. Moreover, the literature review serves as a vital preparatory stage for the development of research questions and hypotheses, refining the research focus and scope (Boote & Beile, 2005). By synthesizing existing knowledge, the exploratory literature review facilitates the formulation of research questions and hypotheses, and ultimately contributes to a well-informed research design. This methodological approach enriches the research process, equipping researchers with the necessary contextual understanding to conduct meaningful empirical investigations.

Following the exploratory research and in line with the pragmatist philosophy, this study adopted the mix of methods that are most aligned with answering the research questions. Questionnaires were chosen, as, aside from experimental designs, it was the most widely used and discussed research method in the field of behavioural economics, and in the context of organisational culture they were the most common methodology. The explorative nature of this research also indicates that the quantitative approach is more appropriate.

Written informed consent was obtained from all participants prior to their involvement in the study. They were thoroughly briefed on the research purpose, procedures, potential risks and benefits, measures to ensure confidentiality, and their right to withdraw at any time without consequences. Participants provided their consent voluntarily by signing a consent form.

In order to encapsulate the three disciplines, three variables were defined: (1) 'SCDM Risk Level'- the level of risk perceived in SCDM strategies employed to manage the pandemic, (2) 'Personal Risk Value'- the participants' willingness to take risks (of various types) throughout the pandemic, and (3) 'Cultural Cohesion'- the level of cultural cohesiveness experienced by participants throughout the pandemic. The authors propose the following conceptual model (Figure 1) for how the three variables

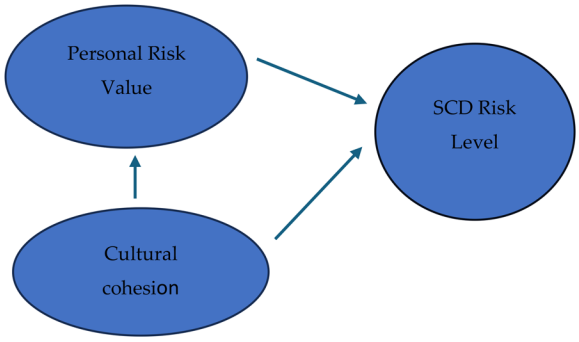

Figure 1. Conceptual model.

relate to one another. The relationship between Cultural Cohesion and Personal Risk Value has been established by the literature, whereas the other relationships (Personal Risk Value/ Cultural Cohesion and SCDM Risk Level) are of particular interest to this work, as this is where the originality of this study lies.

As the research was conducted after the pandemic concluded, the questions require the participants to recall how they would have acted 'before', 'during', and 'after' the pandemic; this means that, although the surveys are not longitudinal in the traditional sense (where responses would have been collected as the pandemic progressed), they are *retrospectively longitudinal* in that that each period is being explored with hindsight. The questions were framed through the lens of Likert scales, so that uniform data could be captured, and to establish minimum and maximum levels for each variable; further information discussing the questions asked has been provided below.

4.2. Questions asked to participants

Correspondingly, the below table (Table 6) shows the specific questions asked of the participants, as well as their relation to the variables and theories being explored, and further information surrounding the nature of the questions/ justification for the questions where relevant. The questions asked in relation to behavioural economics were based on the more experimentally oriented approaches adopted by many authors, such as the fathers of the discipline, Kahneman et al. (1991); a few of the questions were lifted from these sources (and modified slightly for purpose). The questions surrounding organisational culture mirror those asked within the Organisational Culture Questionnaire (as per Manetje & Martins, 2009); these were also combined, shortened, and slightly modified to be fit for purpose. The questions asked in relation to SCDM were self-created.

4.3. Data analysis process

Following the collection of the data, the answers provided by the participants were fed into an Excel document, which was then imported into SPSS, to facilitate the initial calculations that produced the mean and median values for each variable (utilising the 'descriptive statistics' feature), during each time period, for each participant. The responses for each observed variable were averaged together to formulate a mean and median value for each latent variable per participant. Ultimately, this resulted in the generation of the following variables for comparison via the conceptual model previously described; these variables are defined in Table 7 below.

These mean and median values were then imported into SPSS for further analysis via covariance. Utilising SPSS's 'Chart Builder' feature, scatter plots were generated to compare all three theories to one another (SCDM Risk Level and Personal Risk Value; SCDM Risk Level and Cultural Cohesion; Personal Risk Value and Cultural Cohesion). These comparisons were conducted for each time period (before, during, and after the pandemic), and these analyses were duplicated to be calculated using both the mean and median values. These findings were then applied to the conceptual model outlined above, to simplify the comparison across time periods.

Table 6. Questions asked of participants.

Theory Association	Variable Association	Question	Further Information
SCDM	N/A	During each period, what actions did your organization take to address the risks imposed by COVID-19/ pandemic-like disruptions? (Can be related to purchasing, logistics, operations, or general working life)	Asked solely to provide context for the upcoming question. 2 examples for 'before', 'during', and 'after' the pandemic were requested through this open question.
SCDM	SCDM Risk Level	How much risk did you perceive in each of these management strategies, when you found out that they would be implemented? (In terms of cost, feasibility, applicability etc.)	Question framed through Likert Scales, 1 rating per SCDM strategy employed. The scale was- Very Low Risk, Low Risk, Moderate Risk, High Risk, Very High Risk.
Behavioural Economics	Personal Risk Value	During each period, how willing would you be to take personal health risks? (Can be related or unrelated to COVID-19- i.e. not wearing a mask, working in the office, not testing, unhealthy food, not exercising, smoking, etc.)	Question framed through Likert Scales, 1 rating per time period (before, during, after). The scale was- Very Unwilling, Somewhat Unwilling, Neither Willing nor Unwilling, Somewhat Willing, Very Willing
Behavioural Economics	Personal Risk Value	During each period, how willing would you be to take personal financial risks? (i.e. investments, not saving, overspending)	
Behavioural Economics	Personal Risk Value	Consider the following scenario as if you were 'playing' with company funds. There is a lottery that has a 50% chance to lose £100 and a 50% chance of losing nothing. How willing would you be to participate in this gamble?	
Behavioural Economics	Personal Risk Value	Consider the following scenario as if you were 'playing' with company funds. There is a lottery that has a 50% chance to earn £100 and a 50% chance of earning nothing. How willing would you be to participate in this gamble?	
Behavioural Economics	Personal Risk Value	Consider the following scenario as if you 'played' with company funds. You participated in both previous lotteries, avoiding a loss of £100 in the first lottery, and gaining £100 in the second lottery. Which scenario makes you happier and by how much?	Question framed through Likert Scales, 1 rating per time period (before, during, after). The scale was- Avoiding the Loss of £100 makes me Much Happier, Avoiding the Loss of £100 makes me Somewhat Happier, Neither Makes me Happier, Gaining £100 makes me Somewhat Happier, Gaining £100 Makes me Much Happier
Organisational Culture	Cultural Cohesion	Emphasis is placed on results and meeting customer needs, with customer satisfaction being regularly measured and reported on- rather than following procedures prescribed by a manager, dedicating tasks to specific employees, or observing the history of the organisation.	Question framed through Likert Scales, 1 rating per time period (before, during, after). 'During each period, how much would you have agreed or disagreed with the following statement?'
Organisational Culture	Cultural Cohesion	My manager(s) are active participants in decision making and collaboration; they ensure I am happy in my role, help resolve work problems, and take a personal interest when I am celebrating personal events or experiencing personal issues.	The scale was- Strongly Disagree, Somewhat Disagree, Neither Agree nor Disagree, Somewhat Agree
Organisational Culture	Cultural Cohesion	I am an active participant in decision making and collaboration; I am encouraged to have a say in matters involving me and to engage in personal development; I am complimented for a job well done.	
Organisational Culture	Cultural Cohesion	Managers openly discuss constructive criticisms and mistakes of an employee directly with them, and vice versa.	
Organisational Culture	Cultural Cohesion	I am actively involved in decision making that is consequential for, and/or aligned with the views of, my department/organisation; I encounter few barriers to these decisions, as I am trusted with the decisions I make.	

4.4. Sampling considerations

Due to this work's relation to Supply Chain Management, supply chain practitioners and managers that worked at their company (within the FMCG and food supply chains) during COVID-19 were the target population. Procurement professionals within these chains were the primary targets, however, other roles within supply chain management, operations management, and those adopting leadership positions

Table 7. Variable definition.

Variable label	Latent variable	Mean/ median	Time period	Observed variables included
RLB-M	SCDM Risk Level	Mean	Before	SCDM Risk Level 1, SCDM Risk Level 2
RVB-M	Personal Risk Value	Mean	Before	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCB-M	Cultural Cohesion	Mean	Before	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust
RLD-M	SCDM Risk Level	Mean	During	SCDM Risk Level 1, SCDM Risk Level 2
RVD-M	Personal Risk Value	Mean	During	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCD-M	Cultural Cohesion	Mean	During	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust
RLA-M	SCDM Risk Level	Mean	After	SCDM Risk Level 1, SCDM Risk Level 2
RVA-M	Personal Risk Value	Mean	After	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCA-M	Cultural Cohesion	Mean	After	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust
RLB-MD	SCDM Risk Level	Median	Before	SCDM Risk Level 1, SCDM Risk Level 2
RVB-MD	Personal Risk Value	Median	Before	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCB-MD	Cultural Cohesion	Median	Before	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust
RLD-MD	SCDM Risk Level	Median	During	SCDM Risk Level 1, SCDM Risk Level 2
RVD-MD	Personal Risk Value	Median	During	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCD-MD	Cultural Cohesion	Median	During	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust
RLA-MD	SCDM Risk Level	Median	After	SCDM Risk Level 1, SCDM Risk Level 2
RVA-MD	Personal Risk Value	Median	After	Personal Health Risks, Personal Financial Risks, Risk Aversion- Loss Domain, Risk Aversion- Gains Domain, Loss Aversion
CCA-MD	Cultural Cohesion	Median	After	Customer Focus, Managerial Engagement, Employee Engagement, Criticisms Discussion, Decision Quality and Trust

were accepted, due to the inaccessibility of this population. Initially, the study was limited to the UK context; however, this was expanded to include international companies, again due to the hard-to-access nature of this population. This also mandated the use of convenience sampling, with the snowball sampling method being employed to gather further participants; both approaches are associated with hard-to-access populations and limited sample sizes, and where some degree of expertise within the participants is required. Despite the implementation of sampling methodologies that cast a rather wide net of possible candidates, it is noteworthy that the survey has only yielded twenty-one responses. It is crucial to acknowledge that such constraints can potentially affect the generalizability of the findings. However, this pilot study serves as an initial step in shedding light on the subject matter, paving the way for more comprehensive analysis and evaluation through subsequent primary research endeavours; further research conducted by the authors will be sure to improve upon this.

4.5. Data capture

The data was obtained through the distribution of online questionnaires amongst supply chain professionals who worked throughout the COVID-19 pandemic. The target population was composed of UK supply chain practitioners in FMCG/ food supply chains, but this was expanded to practitioners in other industries (as well as in other geographical regions) due to low participation rates. These participants were gathered via online means, such as LinkedIn, for the sake of accessibility; this was in line with the pragmatist philosophy and the snowball-convenience sampling methods (the full questionnaire can be found in part one of the Supplementary Materials section at the end of this document). This research was approved by the Leeds Beckett ethics committee; data was collected from participants who were informed about the purpose of the research and what it would entail, and they provided their written consent for their data to be utilised for the purpose of academic research. Naturally, due to the chosen methodology being questionnaires, the data output was quantitative in nature; because all questions utilised Likert scales, uniform data was captured for each observed variable, allowing for justified comparisons between participants and latent constructs. The full datasets utilised in this study are accessible via parts two and three of the Supplementary Materials section at the end of this document; there are no rights and permissions required to utilise these datasets.

5. Data analysis

5.1. Descriptive statistics

Before delving into the covariance analysis, it's useful to understand the means and standard deviations observed amongst the observed constructs. Firstly, we'll discuss the observed variables related to the latent variable of SCDM Risk Level; this will be followed by discussions of the observed variables related to the latent variables of Personal Risk Value and Cultural Cohesion. The descriptive statistical analysis has been summarised and applied to the proposed conceptual model in Figure 2.

SCDM Risk Level was measured through 2 observations per time period (i.e. two examples of SCDM strategies used before, during, and after the pandemic). The first observed variable started at 2.81, before increasing to 3.19, and then levelling out at 2.95 (mean values); this was complemented by a steady decrease in standard deviation as the pandemic progressed. On the other hand, the other SCDM Risk Level variable started out at 3.10, which lowered to 3.05 during the pandemic, before decreasing further to 2.71 once the 'new normal' after the pandemic was established; the standard deviations for this cluster decreased as the pandemic came into effect, but then increased as the pandemic ended.

In order to formulate a mean result and standard deviation for the latent variable, these findings were then averaged together to produce the following results. SCDM Risk Levels before the pandemic sat at 2.96, before increasing to 3.12 during the pandemic, before lowering to below pre-pandemic levels at 2.83; the averaged standard deviations saw a decrease between the 'before' and 'during' stages, before increasing at the 'after' stage. Overall, this can be interpreted as the SCDM Risk Level generally increasing in value as the pandemic progressed, before lowering to below pre-pandemic levels, after the 'new normal' was established in the post-COVID era. This implies that organisations were willing to take more extreme risks during the pandemic, and that the establishment of the new normal encouraged decision-makers to be more cautious in their approach. The standard deviations are also interesting to note, as preference towards the mean values were strongest during the pandemic, meaning that most decision makers agreed on their levels of SCDM Risk while the crisis was at its peak.

Next, we will discuss the observed variables related to the latent construct of Personal Risk Value. Firstly, 'willingness to take personal health risks' peaked during the pre-pandemic period at 3.33, before decreasing to 2.62 during the pandemic, and then, finally, increasing to 2.90; the standard deviations mirror these results, with the standard deviation decreasing in the 'during' phase of the disruption, before decreasing slightly after the 'new normal' was established. Similarly, 'willingness to take personal financial risks' started with 3.24, before decreasing to 2.43, which was followed by an increase to 2.67; the standard deviations saw a relatively stable decrease as the pandemic progressed. Furthermore, this pattern

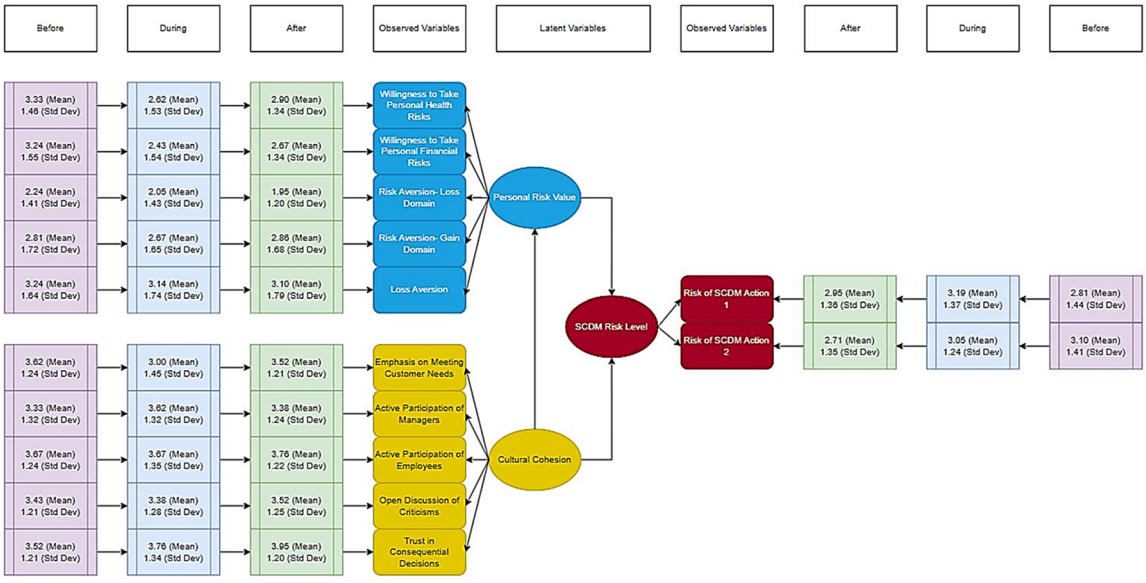

Figure 2. Means and Standard Deviations applied to the conceptual model.

is also mirrored in the measurement of the 'risk aversion- gains domain' variable, which started at 2.81, before it lowered to 2.67 during the pandemic, and this was followed by the exceeding of pre-pandemic levels, with a mean value of 2.86; unlike the previous observed variables, however, the standard deviations do not mirror the results, as they increased very slightly as the pandemic ramped up, before decreasing dramatically after the pandemic. Conversely, 'risk aversion- losses domain' saw a steady decline as the pandemic progressed, starting at 2.24, before decreasing to 2.05, and further decreasing to 1.95; this is mirrored in steady decreases of standard deviation. Analogously, 'loss aversion' steadily decreased from 3.24 to 3.14, and then again to 3.10 as the pandemic evolved; conversely to this, the standard deviations for this variable gradually increased as the pandemic proceeded.

Once more, to formulate a mean result and standard deviation for the latent variable, these observed variables were averaged together. The latent variable of Personal Risk Value started with a mean value 2.97, which decreased to 2.58 during the pandemic, before increasing to 2.70 after the pandemic. This had an inverse relationship with the standard deviations, as they increased slightly during the pandemic, before decreasing after the pandemic. Overall, this can be interpreted as Personal Risk Value decreasing during the pandemic, before increasing slightly after the pandemic; the mean, however, didn't return to pre-pandemic levels. This implies that the pandemic encouraged careful consideration of risks on a personal level, and that the 'new normal' (established after the disruption) encourages people to engage with risky decisions with more caution than they would have before the pandemic. The standard deviations are also interesting to note, as Personal Risk Value was most skewed towards the mean after the pandemic, which further validates the above proposition.

Lastly, we'll cover the observed variables related to the latent variable of Cultural Cohesion. Firstly, regarding the prioritisation of meeting customer needs, the mean value started at 3.62, before decreasing to 3.00 during the pandemic, and mildly increasing to 3.52 in the post-pandemic era; the standard deviations increased during the pandemic and lowered to below pandemic levels after the pandemic. Similarly, the open discussion of criticisms started at 3.43, before decreasing to 3.38 in the pandemic era, and exceeding pre-pandemic levels after the pandemic with a mean value of 3.52; the standard deviations for this observed variable had an inverse relationship with its means, as they increased during the pandemic, before decreasing after the pandemic. Conversely, the active participation of managers began at 3.33, which increased to 3.62 during the pandemic, and this was then followed by a decrease to 3.38 after the pandemic; the standard deviations for this variable maintained at their pre-pandemic levels before decreasing after the pandemic. Similarly, the active participation of employees before the pandemic had a mean value of 3.67, which was maintained during the pandemic, before seeing an increase to 3.76 after the pandemic; the standard deviations increased alongside the severity of the pandemic, before decreasing to below pre-pandemic levels. On the other hand, trust in consequential decisions gradually increased from 3.52 to 3.76 to 3.95 as the pandemic progressed; the standard deviations increased during the pandemic and fell to below pre-pandemic levels afterwards.

Finally, these observed variables were averaged together, in order to formulate the latent construct of Cultural Cohesion. This variable started with a mean value of 3.52 before the pandemic, which then decreased slightly to 3.49 during the pandemic, and this was followed by an exceeding of pre-pandemic levels with a mean value of 3.63. The standard deviations for the Cultural Cohesion variable increased during the pandemic period and fell below the pre-pandemic levels of deviation, meaning that answers skewed most towards the mean after the pandemic. Holistically, this can be interpreted as Cultural Cohesion decreasing slightly whilst experiencing a massive disruption, before the establishment of the 'new normal' facilitated the development of a more cohesive culture; the standard deviations being their lowest in the post-pandemic period also support this proposition.

5.2. Covariance analysis

Now that the descriptive statistics for each observed variable have been discussed, we can now explore the covariance between the latent variables. As discussed previously, the mean and median values were produced for each latent variable, for each time period, for each participant; these values were analysed using SPSS, and then the results were transposed onto the below conceptual model for simplified comparisons. The relationship between Cultural Cohesion and Personal Risk Value will be discussed prior to

the discussion of the relationship between SCDM Risk Level and Personal Risk Value, which will then be followed by an exploration of the relationship between SCDM Risk Level and Cultural Cohesion. For the sake of completeness, the Y-Intercept has been included in the below diagram; however, no statistically significant meaning can be extrapolated from these results, so they will not be discussed further. The covariance analysis has been summarised and applied to the proposed conceptual model in Figure 3.

When considering the mean values for Cultural Cohesion and Personal Risk Value, the *R*-Squared before the pandemic was .000, which increased to .045 during the pandemic, and decreased to .024 after the pandemic; this indicates that the relationship between Cultural Cohesion and Personal Risk Value was at its strongest during the pandemic, and that this enhanced relationship was adopted as a part of the 'new normal' established after the pandemic. On the other hand, the median values indicated a different, but more statistically significant, relationship between these latent variables, as the R-Squared before the pandemic was .037, which increased slightly to .048 during the pandemic, and then increased dramatically to .253 after the pandemic. This is very interesting to note, as all three variables had more statistically significant results, and the most covariance was observed in the 'after the pandemic' time frame. These results indicate that the median values are controlling for outliers to a notable degree. Aside from this, the general trend can be understood as the relationship increasing in strength as the pandemic progressed, reaching new heights in the post-pandemic era.

Additionally, there was a negative correlation throughout all three measured periods of the pandemic, when utilising both the mean and median values, meaning that as Cultural Cohesion increases, Personal Risk Value decreases. The lack of change in correlation direction indicates the universality of this relationship, in that it doesn't seem to be affected by the presence of disruptive conditions, such as those imposed by the pandemic. Finally, the mean values resulted in a slope of .03 before the pandemic, which increased to .20 during the pandemic, before decreasing to .024 in the post-pandemic period; the median values produced a slope of .22 before the pandemic, which increased slightly to .24 during the pandemic, before increasing dramatically to .59 after the pandemic. This mirrors the R-Squared results, in terms of the strength of the relationship between Cultural Cohesion and Risk Value, where the mean values portrayed a peak in correlation during the pandemic, and the median values strengthened throughout the pandemic and peaked as the 'new normal' was established.

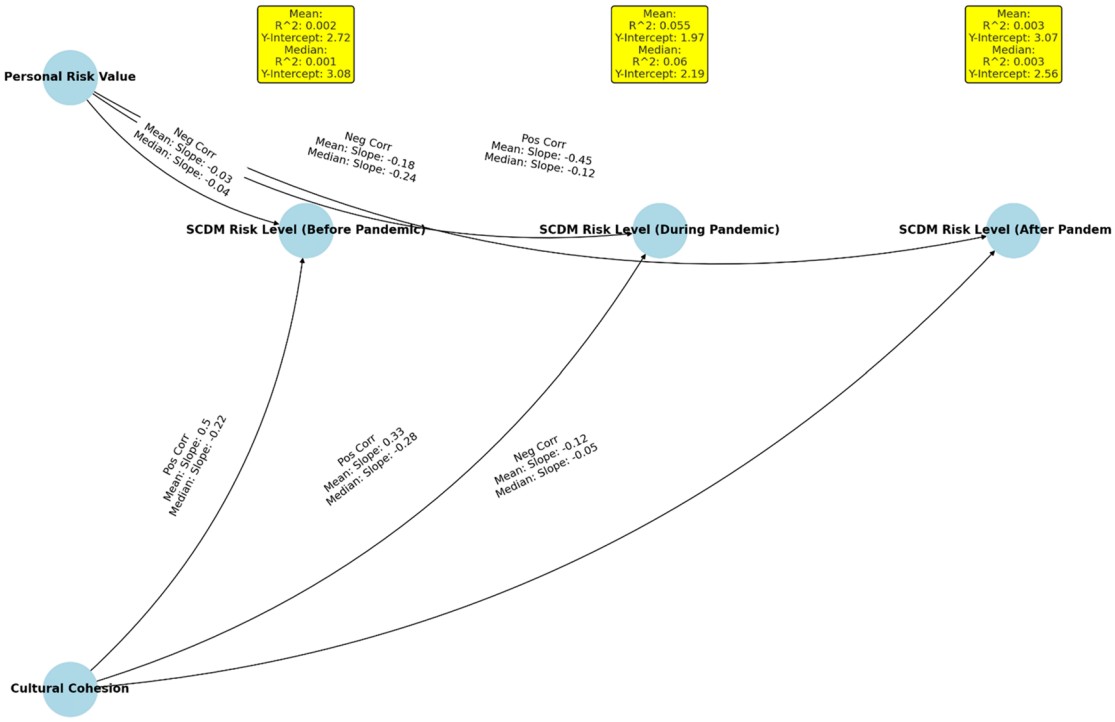

Figure 3. Covariance analysis applied to conceptual model.

Moving on, the mean values for Personal Risk Value and SCDM Risk Level produced an R-Squared value of .001 in the pre-pandemic period, which increased slightly to .011, before increasing dramatically to .103 after the pandemic. This relationship is mirrored in the results produced by the median values, which began at .002, before increasing to .010, and finally increasing further to .019 in the post-pandemic era. This increase is not as statistically significant as with the mean values; however, this was anticipated due to the extent to which the median values are controlling for outliers. Overall, these results show a general trend for the relationship between these variables increasing in strength as the pandemic progressed, and, as the 'new normal' was internalised, the relationship continued to strengthen.

Furthermore, the correlation direction for both the mean and median values indicated that there was a negative relationship between Personal Risk Value and SCDM Risk Level before the pandemic; during and after the pandemic, the relationship between these variables was positive, meaning that as Personal Risk Value increased SCDM Risk Level also increased. The change in the direction of the correlation implies that the pandemic, and the new normal established after the fact, induced a change in the relationship direction; however, the lack of a significant R-Squared for before the pandemic means that the correlation is also not very strong, lessening the significance of the change in correlation direction. The slopes also mirror the R-Squared values for both the mean and median values, beginning at .05, increasing to .16, before increasing further to .45 after the pandemic, while the median values increased from .04 to .09, before finally reaching .12; this mirrors the R-Squared values in terms of the general trend of increasing in strength as the pandemic progressed, as well as the degree to which the median values are controlling for outliers.

Finally, regarding the relationship between Cultural Cohesion and SCDM Risk Level, the R-Squared for the mean values started at .002, increased to its peak during the pandemic at .055, before returning to pre-pandemic levels at .003. This is mirrored in the median results, where the R-Squared began at .001, increased to .060 during the pandemic, and returned to .003 after the pandemic. It is interesting to note that the median values produced more statistically significant results, particularly in terms of the 'during value'. Overall, this implies that the relationship between Cultural Cohesion and SCDM Risk Level was at its strongest during the pandemic; after the pandemic, this relationship returned to pre-pandemic levels, where the relationship was almost non-existent.

Moreover, the correlation direction varied between time periods, and varied depending on whether the mean or median values were utilised. For the means, the correlation direction was positive before and during the pandemic, and was negative for the post-pandemic period, whereas for the medians, the correlation was negative before the pandemic, positive during the pandemic, and negative after the pandemic. Generally, this, when considered alongside the R-Squared values, indicates that the relationship between these variables is so minimal that the correlation direction could swing either way for the 'before' and 'after' values; however, the relationship between these variables during the pandemic are still quite notable, and the positive relationship for this era indicates that as Cultural Cohesion increases, so too does SCDM Risk Levels. This is also mirrored in the slope values for this comparison of variables, which began at .07, before increasing to .33 during the pandemic, and then decreasing to pre-pandemic levels at .07; for the median values, the slope began at .04, increased to .26, and then decreased to .05. This mirrors the R-Squared values in terms of the general trend of increasing in strength as the pandemic progressed, before decreasing to pre-pandemic levels, as well as the degree to which the median values are controlling for outliers, in that more significant results were achieved with the median values.

6. Results and discussion

6.1. Discussion of results-descriptive statistics

Firstly, the descriptive statistics for SCDM Risk Level indicated that more risks were taken during the pandemic era, and that these levels of risk taking lowered to below pre-pandemic levels in the post-pandemic era. This, although anticipated, is still interesting to note and verify, as it validates the general assumption within the literature that more risks were taken during the pandemic, due to the unprecedented scale and scope of the disruption. Additionally, the standard deviations were at their lowest during the pandemic, meaning that most participants agreed on the SCDM Risk Level

experienced during this period, in that it was much greater during the pandemic, and hovered around 3.12. The decrease in SCDM Risk Level to below pre-pandemic levels is also indicative that the 'new normal' established encouraged practitioners to engage with risky decisions more carefully than they would under the pandemic itself. It might also be suggestive of the level of disruption introduced by the pandemic, in that 'drastic times call for drastic measures', so the level of risk engaged with to overcome disruptive conditions increased in line with this philosophy; the levels of risk indicated a willingness to engage with these 'drastic measures'.

On the other hand, the descriptive statistics for Personal Risk Value illustrated that they were at their lowest during the pandemic, and increased in the post-pandemic era, however, not to pre-pandemic levels. This implies that, on a personal level, the pandemic encouraged participants to engage with risks in a more measured and careful manner, and, that this sense of caution has maintained itself, albeit to a lesser extent after the pandemic ended and the 'new normal' was established. The standard deviations for this variable were at their lowest after the pandemic period, meaning that most participants concurred on the level of risk engaged with after the pandemic, which was around 2.70; again, this is indicative of the establishment of the new normal, where people are encouraged to engage with risky decisions in a more considered manner. This is in direct contrast to the SCDM Risk Level identified, meaning that the levels of risk individuals were willing to take during the pandemic, may not be directly aligned with the level of risk adopted by the supply chain, possibly due to things such as power differentials and group-based decision making. It's also possible that the participants were engaging with risks at the supply chain level that they were not entirely comfortable with. These suppositions are supported by the business-centric decision-making literature, where it is commonly acknowledged that group and power dynamics strongly dictate the decisions adopted by firms.

Similarly, the descriptive statistics for the latent variable indicated that Cultural Cohesion was at its lowest during the pandemic, and after the pandemic it exceeded pre-pandemic levels. The fact that Cultural Cohesion was at its lowest during the pandemic is interesting to note, as the literature indicates that SCDs result in changes to organisational culture, that may not be necessarily positive, and may result in the making of non-optimal decisions. The standard deviation for these results indicated that the establishment of a more cohesive culture after the pandemic ended (and the new normal was established) was most commonly agreed upon by the participants. When considering the decrease in Cultural Cohesion during the pandemic, it makes the seemingly contradictory relationship between SCDM Risk Level and Personal Risk Value make more sense; if individuals were less willing to take risks under the disruption, but their organisational culture is experiencing a period of delamination, it would make sense that their organisation may be going against their personal willingness to take risks, and increase the level of SCDM risk adopted in response to the pandemic. The mediatory relationship between these variables is interesting to note, and future research on this topic needs to examine this relationship in more depth.

6.2. Discussion of results- covariance analysis

The literature has already established a relationship between Cultural Cohesion and Personal Risk Value, so this relationship is of less importance to this work, and more serves as a point of comparison between this work and the literature. Due to the extent to which the median values controlled for outliers for this variable, and the difference in statistical significance between the two, the median values will be utilised for the following discussion. Overall, it was discovered that as Cultural Cohesion increases, Personal Risk Value decreases; this was the case for each phase of the pandemic, and the general trend for this relationship was to become stronger as the pandemic progressed, as indicated both by the R-Squared and slope values. The peak R-Squared value of .253 is the most statistically significant result produced by the analysis of the primary data; although this was to be expected, due to the literature's pre-existing connections between these two theories, it serves as a positive indicator of the fitness for purpose of the adopted methodology. Holistically speaking, the relationship between these latent constructs as proposed by the literature has been confirmed; this means that increased Cultural Cohesion encourages decision-makers to engage with their decisions more carefully, making them less willing to take risks. This relationship could then have an impact on the decisions made in response to a disruption, with organisations experiencing cultural dissolution onboarding more risk and more cohesive cultures taking less risk.

Of more direct interest to this work is the relationship between Personal Risk Value and SCDM Risk Level. Due to the statistical significance of the results produced by the mean values, these will be discussed in the following section. During and after the pandemic, a notable positive relationship between these two constructs was uncovered; the pre-pandemic era showcased a negative relationship between the variables, however, the almost-non-existent correlation between them during this time means lessens the significance of the change in relational direction. Therefore, overall, it can be determined that as Personal Risk Value increases, so too does SCDM Risk Level; this relationship only strengthened (in terms of R-Squared and slope) as the pandemic progressed, with the peak value originating from the post-pandemic era, at .103. This is of great importance to the central thesis of this work, as it indicates a relationship between behavioural economic concepts and SCDM decision-making. The strength of the relationship increasing as time goes on indicates that the disruption encouraged this relationship in the first place, but that the ending of the pandemic encouraged the internalisation of these practices (and thus relationships) as part of the 'new normal'.

Finally, this work also has expressed interest in the relationship between Cultural Cohesion and SCDM Risk Level. In the 'before' and 'after' phases of the pandemic, the direction of the relationship (i.e. positive or negative) varied depending on whether the mean or median values were being analysed; however, both results indicated a positive relationship between these latent constructs during the pandemic. The correlational direction changing in this way can again be explained by the very small R-Squared values of below .003, as the minimal levels of correlation mean that the change in direction is not significant; these interpretations are also supported by the slopes produced. Aside from this, however, the significant relationship identified between Cultural Cohesion and SCDM Risk Level noted in the pandemic era is of critical importance to the central thesis of this research; the disruptive conditions caused by the pandemic appear to be facilitating the relationship between these variables, with the 'before' and 'after' stages of the pandemic having almost no relationship between them. Overall, this indicates that there is a relationship between the variables that the lens of SCDM has uncovered; this relationship between Cultural Cohesion and SCDM Risk Level warrants further investigation.

6.3. Integrated discussion of findings and research objectives

The COVID-19 pandemic disrupted global supply chains in unprecedented ways, highlighting critical vulnerabilities in food processing, food security, and workforce dynamics. This section synthesizes the findings to address the research objectives while offering a comprehensive analysis of the pandemic's impact through the lens of behavioral economics and organizational culture.

6.3.1. Food processing

The findings reveal significant disruptions in food processing operations during the pandemic. Supply shortages, safety protocols, and operational inefficiencies created severe challenges for FMCG and food supply chains. As shown in the analysis of **SCDM Risk Levels**, organizations responded by taking greater risks during the pandemic to sustain production levels. This aligns with the research objective of understanding how behavioral economics influenced decision-making. The increased willingness to take organizational risks reflects the application of bounded rationality, where firms prioritized short-term survival over long-term stability. Post-pandemic, risk-taking declined below pre-pandemic levels, indicating a shift toward more cautious and resilient operational strategies in the 'new normal'.

6.3.2. Food security

Food security emerged as a critical concern during the pandemic, particularly in cold supply chains. Inefficiencies in these chains heightened the risk of food scarcity, as delays and disruptions impeded the availability of perishable goods. The findings highlight the role of digitalization and adaptive practices in mitigating such risks, emphasizing the intersection of organizational culture and technology adoption. As cultural cohesion declined during the pandemic, organizations faced challenges in maintaining collaborative and innovative responses. However, the recovery of **Cultural Cohesion** post-pandemic underscores its importance in fostering sustainable and adaptive supply chain practices, directly addressing the research objective of exploring the role of organizational culture in disruption management.

6.3.3. Workers' responsibilities

The pandemic significantly reshaped workers' responsibilities and organizational dynamics. The findings indicate that **Personal Risk Value** declined during the pandemic, reflecting a cautious approach to individual decision-making amid heightened uncertainty. Concurrently, organizations experienced a decline in cultural cohesion, leading to fragmented decision-making processes. Despite these challenges, the strengthening of **Cultural Cohesion** in the post-pandemic period suggests a long-term shift toward more aligned and collaborative organizational cultures. This aligns with the research objective of evaluating the interplay between behavioral economics, organizational culture, and SCDM risk levels, as it highlights the critical role of workforce adaptability and collective decision-making during crises.

6.3.4. Interplay of key variables

The covariance analysis demonstrates significant relationships between *SCDM Risk Levels*, *Personal Risk Value*, and *Cultural Cohesion*:

- During the pandemic, *Personal Risk Value* and *SCDM Risk Levels* exhibited a positive correlation, indicating that as individuals became more cautious, organizations took on higher risks to address disruptions.
- The relationship between *Cultural Cohesion* and *SCDM Risk Levels* was strongest during the pandemic, highlighting the importance of a unified organizational culture in managing crises effectively.

These findings underscore the need for integrated frameworks that balance individual caution with collective organizational risk-taking, particularly in high-stakes environments like food supply chains.

7. Conclusions

Supply Chain Disruption Management relies on the decisions made by the groups and individuals composing firms and supply chains. Because humans are unable to engage with decision making 'rationally' (particularly under times of stress), adopting the behavioural approach would facilitate the generation of more nuanced explanations of the rationale behind the selection of SCDM techniques. Furthermore, the literature has shown that organisational culture influences all aspects of how a given focal firm, and thus a given supply chain, operates and performs (in terms of supply chain performance, teamwork, learning, communication, individual behaviour and more (Zanon et al., 2021)); SCDM is no different, and thus further investigation into how these disciplines interact with one another is required. This would not only allow academicians to explore interdisciplinary linkages more completely but would also allow practitioners to understand how these dynamics will affect their own decisions, which necessitates the consideration of both the behavioural and empirical components of decision-making. Thus, this work sought to explore the linkages between these three currently disparate disciplines through questionnaires. Ultimately, it was uncovered that the three topic areas do have notable relationships with one another. The descriptive statistical analyses indicated that SCDM Risk Levels peaked during the pandemic, while Personal Risk Values and Cultural Cohesion levels were at their lowest during the pandemic. The relationship between Cultural Cohesion and Personal Risk Value strengthened as the pandemic progressed, becoming even stronger in the post-pandemic era; this was also the case for the relationship between Personal Risk Value and SCDM Risk Level. On the other hand, the relationship between Cultural Cohesion and SCDM Risk Level was strongest during the pandemic, and the 'before' and 'after' periods showcased no significant relationship between the two variables. Although these results are not the most statistically significant (with the highest R-Squared being .253), they indicate that further research into this subject area as a sub-discipline of behavioural operations is warranted, particularly as supply chain disruptions become more frequent and severe. Furthermore, the choice of methodology, and the questionnaire itself have also been confirmed to be suitable for the purposes of future data collection.

7.1. Implications for theory and practice

This study advances the theoretical understanding of the interplay between behavioural economics, organizational culture, and supply chain disruption management (SCDM), providing insights into how these concepts interact during crises. By exploring frameworks such as risk aversion, bounded rationality, and heuristics, the study emphasizes the critical role of organizational culture in shaping risk perception and decision-making outcomes. These findings address existing gaps in the literature, particularly in the context of disruptions where cultural cohesion and human factors are pivotal.

From a practical perspective, the study highlights actionable strategies for supply chain managers, including fostering cohesive organizational cultures to mitigate disruption impacts and utilizing behavioural insights to enhance decision-making under uncertainty. These insights are particularly relevant for industries prone to frequent disruptions, offering guidance on integrating behavioural and cultural dimensions into operational resilience frameworks. By bridging theory and practice, this research lays a foundation for further empirical investigations and cross-industry applications.

Unlike prior studies, this work specifically examines the relationships between behavioural economics, organizational culture, and SCDM. While the limited sample size constrains the generalizability of practical implications, the findings provide an important starting point for understanding the human factors influencing SCDM decisions. These factors—such as prospect theory, risk aversion, and loss aversion—go beyond purely 'rational' decision-making models to underscore the significance of cultural cohesion and behavioural dynamics. Recognizing these elements enables organizations to better comprehend their own decision-making processes, refine their models, and ultimately enhance supply chain performance during disruptions.

From a theoretical standpoint, these findings justify further interdisciplinary exploration to strengthen the understanding of how behavioural economics, organizational culture, and SCDM interconnect. To improve decision-making capabilities in the face of disruptions, future research should not only expand data collection on these relationships but also explore additional frameworks, such as leadership, team dynamics, and corporate governance. Investigating these linkages will provide a more comprehensive understanding of the human rationale behind business-centric decisions, supporting the development of more robust models for managing supply chain disruptions.

7.2. Limitations and directions for future research

This study is based on twenty-one responses, which, while offering valuable insights, may not fully capture the diversity of experiences among the thousands of supply chain professionals who worked during COVID-19. However, the respondents held managerial roles and were directly involved in critical decision-making processes during the pandemic, providing a unique and informed perspective on supply chain disruption management (SCDM). These insights offer a strong foundation for understanding the relationships between behavioral economics, organizational culture, and SCDM.

The retrospective nature of the study, although necessary to meet the research objectives, may have affected the accuracy of participant recollections, introducing potential biases in the data. Despite these limitations, the findings underscore the questionnaire's suitability for exploring these concepts and highlight critical factors influencing SCDM during a global crisis. Future research involving larger, more diverse samples and employing longitudinal designs could build on this work, providing a more comprehensive understanding of the dynamic interplay between behavioral economics, organizational culture, and SCDM. Expanding the research to other industries beyond FMCG/food supply chains and exploring other types of disruptions or international contexts would further validate the findings and broaden their applicability. Cross-industry comparisons and mixed-methods approaches could also enrich understanding and contribute to a more comprehensive framework for managing disruptions across diverse sectors.

Authors contributions

We confirm that the manuscript has been read and approved by all named authors. Chase Smith was involved in the conception and design of the study, data collection, analysis, and interpretation. He drafted the initial version of

the manuscript. Hajar Fatorachian provided supervision for the project, contributed to revising the manuscript critically for intellectual content, and provided final editing. Both authors approved the final version of the manuscript to be published and agree to be accountable for all aspects of the work.

Ethical approval

Prior to commencing the research, ethical approval was secured from the Leeds Beckett University, Leeds Business School Ethics Committee. Additionally, written informed consent was obtained from all participants, ensuring they were fully informed about the study's purpose, procedures, and their rights.

Disclosure statement

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no financial support for this work that could have influenced its outcome.

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Data availability statement

The data and materials supporting the results or analyses presented in this paper will be made available upon reasonable request. Requests for data should be addressed to Chase Smith at Chase.smith@leedsbeckett.ac.uk. Please note that some data may not be shared due to ethical considerations, and this will be clearly explained upon request. We confirm that the order of authors listed in the manuscript has been approved by all named authors.

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