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Behavioral theories in inventory management and forecasting: Driving supply chain resilience

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Abstract – Supply chains play an essential role in ensuring operational efficiency and economic stability, yet they face challenges such as the "bullwhip effect," which amplifies demand fluctuations. Addressing these issues requires innovative strategies that integrate behavioral theories with technological advancements. This systematic review evaluates various approaches and synthesizes them into an Integrated Theoretical Framework for Enhancing Supply Chain Performance. Following PRISMA guidelines, peer-reviewed articles published from 2010 to 2024 were analyzed, focusing on behavioral theories in supply chain management. Key findings highlight that integrating theories, such as the Theory of Planned Behavior (TPB), improves demand forecasting accuracy and reduces the bullwhip effect by emphasizing behavioral intentions and social influences. Modern technologies, including AI and IoT, enhance real-time data handling and decision-making. This framework merges psychological insights and technology to improve supply chain resilience and efficiency.

Keywords: Behavioral theories, resilience, bullwhip effect, supply chains, technological advancements, performance

1. Introduction

In contemporary contexts, supply chains are recognized as indispensable systems for business operations and broader economic stability (Gino & Pisano, 2008). However, they face growing and complex challenges that can disrupt operations and adversely affect overall supply chain performance. Among these challenges, demand management and forecasting are particularly prominent, with the "bullwhip effect" serving as a notable example. This phenomenon refers to the amplification of demand fluctuations as they move upstream through the supply chain, from the end consumer to the manufacturer. Such amplification often results in inefficiencies, excessive inventory, and stock shortages, hindering inventory management and reducing overall supply chain efficiency (Boute & Lambrecht, 2007). The bullwhip effect represents one of many challenges requiring effective risk management within today's volatile supply chain environment. Disruptions caused by natural disasters, geopolitical tensions, or global events such as the COVID-19 pandemic have exposed critical vulnerabilities, driving organizations to diversify suppliers and enhance risk management strategies. Flexibility has also become a critical factor, as agile supply chains capable of quickly adapting to changing market demands demonstrate superior performance. For instance, Zara's ability to rapidly align inventory with consumer trends exemplifies such adaptability. Additionally, collaboration among supply chain partners strengthens resilience by fostering trust, improving communication, and facilitating resource sharing. Procter & Gamble's "Connect + Develop" program illustrates this approach by promoting real-time data sharing and collaborative problem-solving to enhance innovation and responsiveness. Addressing these challenges necessitates the adoption of innovative strategies and comprehensive theoretical frameworks that examine human behavior. This research emphasizes the integration of behavioral theories with advanced technological solutions to enhance supply chain resilience and

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foster innovation. Frameworks such as the Theory of Planned Behavior (TPB), the Behavioral Approach, the Classical Introspective Approach, and the Sociological Approach provide valuable insights into the decisions and behaviors of supply chain professionals, shaping management practices significantly (Ajzen, 2006; Ajzen, 1971).

Furthermore, contemporary technologies, including artificial intelligence (AI) and the Internet of Things (IoT), offer unprecedented opportunities for improving demand forecasting and inventory management processes. AI enables the analysis of extensive datasets to identify patterns in consumer behavior, resulting in more accurate demand predictions. IoT devices, on the other hand, facilitate real-time monitoring of inventory levels and supply chain conditions, allowing for proactive adjustments and increased efficiency. This review is motivated by a persistent lack of integrated research at the intersection of behavioral theories with supply chain management and the integration of modern technologies (Fife-Schaw et al., 2007). While extensive studies address the bullwhip effect, limited attention has been given to the synergistic application of behavioral theories and technological innovations to address supply chain challenges comprehensively. Current literature often lacks cohesive models that integrate human behavior with technological advancements, frequently neglecting the critical role of decision-making processes in shaping supply chain performance (Sager, 2001).

By examining the influence of human behavior and individual characteristics on decision-making, in conjunction with technological developments, this review aims to propose strategies that enhance supply chain resilience and innovation. This theoretical exploration is significant, as it offers new perspectives on addressing supply chain issues by merging insights from behavioral theories with technological advancements to improve efficiency, adaptability, and overall performance. The objectives of this review are as follows:

1. To evaluate how the Theory of Planned Behavior (TPB) enhances demand forecasting accuracy and mitigates the bullwhip effect in supply chains.
2. To analyze how the Sociological Approach contributes to understanding social interactions and collaborative dynamics within supply chains.
3. To explore the potential of contemporary technologies, including artificial intelligence (AI) and the Internet of Things (IoT), in refining demand forecasting and inventory management practices.
4. To study the effect of executive personality traits on decision-making processes and the overall effectiveness of supply chain management strategies.

2. Methods

This systematic literature review was conducted in accordance with the PRISMA guidelines, ensuring a rigorous and transparent reporting process. The PRISMA framework was utilized to establish a structured and reproducible review protocol, facilitating a comprehensive exploration of the research topic. This approach was selected for its capacity to provide a holistic perspective by synthesizing findings from multiple studies, offering insights that are often inaccessible through individual primary data studies.

2.1. Eligibility criteria

To ensure the systematic literature review maintained high standards of quality, inclusion criteria were established to focus on peer-reviewed journal articles published between January 2010 and December 2024. Eligible studies were required to examine behavioral theories within the context of supply chain management, specifically emphasizing their role in innovation and resilience, and to provide either empirical data or theoretical frameworks. Case studies, experimental research, and literature reviews addressing the influence of behavioral factors in supply chains were included to enhance the relevance and comprehensiveness of the review. Exclusion criteria eliminated non-peer-reviewed sources, gray literature, and articles not published in English to preserve academic rigor and consistency. Studies that concentrated exclusively on technical or operational aspects without incorporating behavioral theories or lacking empirical evidence or theoretical depth were also excluded. Additionally, articles published prior to January 2010 were omitted to ensure the review focused on recent developments in the field. These criteria were designed to ensure the review concentrated on high-quality, pertinent research, thereby advancing the understanding of the impact of behavioral theories on supply chain innovation and resilience.

2.2.   Search strategy and information sources

The literature search was carried out using Google Scholar, selected for its extensive coverage and accessibility to a wide range of scholarly articles, theses, and conference papers. Its broad scope allowed for the inclusion of diverse perspectives on the topics of interest. The search strategy employed a set of carefully selected keywords: "innovation," "resilience," "supply chains," and "behavioral theories." These terms were specifically chosen to align with the research questions, highlighting key aspects of supply chain management and the psychological and social dimensions that influence decision-making processes. Boolean operators were utilized to refine and optimize the search process. The operator "AND" was used to combine keywords, ensuring that articles addressed interconnected concepts, such as the relationship between behavioral theories and supply chain innovation. The operator "OR" allowed for the inclusion of variations in terminology, capturing studies with overlapping themes such as innovation or resilience. The operator "NOT" was employed to exclude irrelevant material, thereby maintaining focus on the specific research objectives. This targeted search strategy facilitated a comprehensive exploration of the impact of behavioral theories on supply chain innovation and resilience.

2.3.   Risk of bias assessment

The risk of bias in the included studies was evaluated using the ROBIS (Risk of Bias in Systematic Reviews) tool to ensure the reliability of the findings in this systematic review (Bühn et al., 2017). Biases can significantly influence the outcomes of a systematic review, and addressing them is critical for producing valid conclusions. Selection bias may arise if studies from less prominent sources are excluded, leading to incomplete or skewed evidence. Interpretative bias can occur when there are inconsistencies in how behavioral theories are defined and applied, potentially resulting in contradictory findings and limiting generalizability. Methodological bias, such as the inclusion of studies with small or non-representative samples, may distort conclusions about the effectiveness of behavioral theories. Reporting bias, which involves selectively highlighting positive outcomes, can present an overly optimistic portrayal of the evidence. Recognizing and addressing these biases ensures a more balanced and accurate analysis, contributing to a robust understanding of the role of behavioral theories in supply chain management and providing guidance for future research and practical applications.

2.4.   Data synthesis

Thematic analysis served as a fundamental method for data synthesis in this review. The process commenced with the identification of predominant themes and patterns related to behavioral theories, innovation, and resilience within supply chains, achieved through a rigorous examination of the study findings. This initial phase involved discerning the application of various behavioral theories and evaluating their impact on supply chain performance. Subsequently, the data were systematically categorized into relevant themes, such as the influence of behavioral theories on innovation and resilience, thereby facilitating the organization of the information and clarifying interconnections among the studies. In the final stage, the analysis examined the relationships between these themes to better understand how specific behavioral theories interacted with various facets of supply chain management. This provided valuable insights into their broader implications, contributing to the advancement of theoretical frameworks and practical applications in the field.

3.   Study selection

The study selection process was methodical and consisted of three stages: title screening, abstract screening, and full-text review. In the first stage, articles were screened by title to exclude those clearly unrelated to behavioral theories in supply chain management, innovation, and resilience. The articles that remained were then assessed by abstract to ensure they addressed these key themes. Any cases that were unclear or ambiguous were retained for full-text review. In the final stage, articles were examined in detail to ensure they met the inclusion criteria, which included peer review status and publication dates between 2010 and 2024.The PRISMA flow diagram provides a transparent and systematic visualization of the study selection process in a systematic literature review. This diagram illustrates the steps involved in identifying, screening, and selecting studies, ensuring a clear and methodical approach to synthesizing evidence. This flowchart (Fig. 1) not only highlights the number of studies

at each stage but also elucidates the reasons for exclusions, thereby enhancing the reproducibility and transparency of the review methodology.
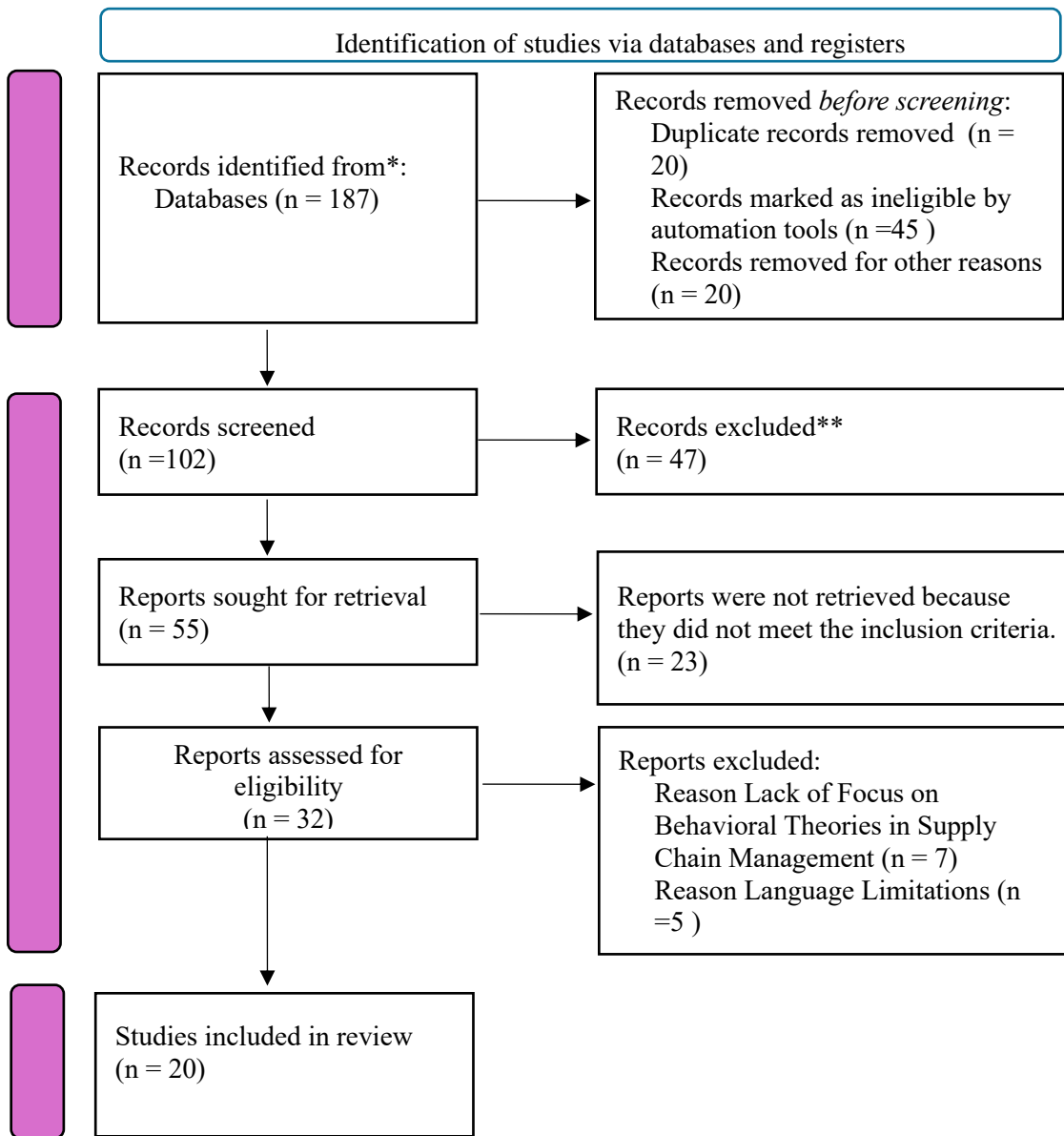
Identification of studies via databases and registers

Records identified from*: Databases (n = 187)	→	Records removed *before screening*: Duplicate records removed (n = 20) Records marked as ineligible by automation tools (n =45) Records removed for other reasons (n = 20)
Records screened (n =102)	→	Records excluded** (n = 47)
Reports sought for retrieval (n = 55)	→	Reports were not retrieved because they did not meet the inclusion criteria. (n = 23)
Reports assessed for eligibility (n = 32)	→	Reports excluded: Reason Lack of Focus on Behavioral Theories in Supply Chain Management (n = 7) Reason Language Limitations (n =5)
Studies included in review (n = 20)		

Figure 1. Identification of studies via databases using the PRISMA tool

3.1.   Study characteristics

This systematic review incorporated a diverse range of studies to examine the intersection of behavioral theories with innovation and resilience in supply chains. A variety of study designs, including empirical research, theoretical papers, and literature reviews, were analyzed, each offering distinct insights into the impact of behavioral theories on supply chain dynamics. The analysis addressed key aspects such as operational efficiency, risk management, decision-making, and interpersonal relationships. Table 2 summarizes the main characteristics of the included studies, outlining their design, sample sizes, focus areas, and the behavioral theories examined.

Table 2. Summary of Key Characteristics of Included Studies

	Study	Study Design	Sample Size	Focus Area	Key Behavioral Theories	Innovation & Resilience Aspects
1	Tiwari et all. (2024)	Review	N/A	Behavioral decision-making in SCM	Decision-making theories	Review of behavioral decision-making techniques to boost supply chain performance
2	Bitsch & Hanf (2022)	Empirical Study	80 firms	Interpersonal relationships in supply chains	Relationship management theories	Impact of interpersonal relationships on supply chain effectiveness
3	Singh et al. (2021)	Review	N/A	Social psychology in supply chain management	Social psychology theories	Analysis of social psychological factors in supply chain performance
4	Haeussler et al. (2021)	Empirical Study	90 firms	Lead time and behavioral traps	Behavioral economics theories	Analysis of lead time updating and behavioral traps in supply chains
5	Donohue et al. (2020)	Review and Synthesis	N/A	Behavioral operations management	Behavioral decision theory	Historical perspective on behavioral operations affecting innovation
6	Kwon & Silva (2020)	Systematic Literature Review	N/A	Behavioral theories in planning	Various behavioral theories	Insights into behavioral theories' influence on planning and innovation
7	El Mountasser, M. (2019).	Overview	N/A	Behavioral risk perspective	Risk management theories	Overview of behavioral factors in supply chain risk management
8	Erjavec et al. (2019)	Empirical Study	200 supply chain managers	Personality traits and decision quality	Personality and decision-making theories	Impact of personality traits on decision quality in supply chains
9	Khan et al. (2019)	Empirical Study	120 cases	Bullwhip effect and behavioral approach	Behavioral supply chain theories	Analysis of behavioral causes and impacts of the bullwhip effect
10	Davis-Sramek et al. (2018)	Empirical Study	75 carriers	Carrier selection in sustainable SCM	Behavioral decision theory	Application of decision theory in sustainable supply chain carrier selection
11	Schlüter et al. (2017)	Conceptual Framework	N/A	Behavioral theories in social-ecological systems	Social-ecological theories	Framework for understanding behavioral influences in systems resilience
12	Schorsch et al. (2017)	Theoretical Framework	N/A	Meta-theory of behavioral SCM	Meta-theory development	Meta-theory approach to understanding human factors in SCM
13	Daudi et al. (2016)	Empirical Study	50 logistics partnerships	Partner trust in logistics	Trust and collaboration theories	Influence of behavioral factors on logistics partner trust
14	Sood & Sharma (2015)	Empirical Study	150 professionals	Behavioral perspective in operations	Social cognitive theory	Examination of behavioral factors affecting operational efficiency

	Study	Study Design	Sample Size	Focus Area	Key Behavioral Theories	Innovation & Resilience Aspects
15	Alexander et al. (2014)	Review	N/A	Decision theory in sustainable SCM	Decision theory	Integration of behavioral decision theory in sustainable supply chain management
16	Lai (2014)	Theoretical Review	N/A	Behavioral Planning Theory	Planning theories	Overview of behavioral planning theory in business analytics
17	Katsikopoulos & Gigerenzer (2013)	Theoretical Review	N/A	Behavioral operations management	Heuristics and biases	Discussion on behavioral insights affecting operations management
18	Tangpong et al. (2013)	Conceptual Paper	N/A	Behavioral supply chain management	Behavioral decision theory	Theory development for behavioral supply chain management
19	Liu et al. (2012)	Empirical Study	60 firms	Knowledge management in lean SCM	Knowledge management theories	Framework for collaborative decision-making in lean SCM
20	Tokar (2010)	Literature Review	N/A	Behavioral research in logistics	Various behavioral theories	Review of behavioral research impacts on logistics

The ROBIS tool evaluated the risk of bias in this systematic review as moderate (Table 2).

Table 2. ROBIS tool assessment of risk of bias

	Concern	Rationale of concern
Concerns regarding specification of study eligibility criteria.	Medium	The eligibility criteria were clearly defined to focus on behavioral theories in supply chain management, innovation, and resilience. However, there was a potential concern about the specificity and applicability of these criteria across diverse studies, which might have led to the inclusion of studies that were not entirely relevant or comparable.
Concerns regarding methods used to identify and select studies	Medium	The search strategy was comprehensive, covering multiple databases such as PubMed, Scopus, and Google Scholar with relevant keywords. Nevertheless, there could be concerns about the potential for missing relevant studies not indexed in these databases or those published in non-peer-reviewed sources, possibly affecting the completeness of the review.
Concerns regarding used to collect data and appraise studies	Medium	Data were extracted using a standardized form, ensuring consistency. However, concerns exist regarding the subjective nature of evaluating study quality and potential inconsistencies in how different methodologies were assessed, which might impact the reliability of the synthesized results.
Concerns regarding synthesis and findings	Medium	The synthesis aimed to integrate diverse study findings, but there were concerns about potential selective reporting or over-generalization due to variability in study designs and contexts. This might have led to biased conclusions or an oversimplified view of the evidence.
Risk of bias	Medium	The risk of bias was systematically assessed using the ROBIS tool, addressing potential sources of bias in eligibility criteria, study selection, data collection, and synthesis. Despite this, inherent biases related to subjective judgments and variability in study quality could still impact the overall validity and reliability of the review's findings.

4. Results

4.1. Applying the theory of planned behavior and behavioral approach to inventory management and resilience in supply chains

The behavioral approach in supply chain management focuses on analyzing external, observable responses to stimuli, suggesting that human behavior can be predicted by examining measurable actions rather than internal mental processes. This approach can significantly enhance inventory management and resilience by understanding how employees and customers respond to specific interventions. For example, warehouse managers' reactions to a new inventory monitoring system, which alerts them to low stock levels, can provide insights into the system's effectiveness in promoting desired inventory behaviors Additionally, reward programs designed to encourage accurate recording of deliveries and the prompt reporting of stock shortages can foster compliance, improving both inventory accuracy and overall supply chain efficiency (Davis-Sramek et al., 2018). The integration of Public Choice Theory and Transaction Cost Theory further refines this approach by considering the external influences on supply chain decisions. Public Choice Theory examines the political and economic factors affecting inventory management, such as supplier selection and strategic inventory decisions. Transaction Cost Theory focuses on the costs involved in managing transactions, including contract enforcement. Long-term supplier agreements, for instance, can reduce transaction costs, improving forecasting accuracy and mitigating the bullwhip effect (Singh et al., 2021; Liu et al., 2012). The Theory of Planned Behavior (TPB) provides a powerful framework for understanding how external behaviors, such as those of suppliers, customers, and employees, are shaped by beliefs and intentions. TPB identifies three key belief types that influence decision-making: behavioral beliefs (perceptions of outcomes), normative beliefs (perceived expectations from others), and control beliefs (perceptions of ability to act). In inventory management, these beliefs play a crucial role. For example, if stakeholders view a new inventory tracking technology positively (behavioral beliefs), they are more likely to adopt it. Normative beliefs, such as organizational pressure to meet performance standards, can also encourage compliance with inventory best practices, while control beliefs, such as confidence in having the necessary resources and support, influence the successful implementation of new strategies (Lai, 2014; Daudi et al., 2016). Implementing TPB in supply chain management involves addressing these beliefs to shape stakeholder behaviors and improve inventory management. Organizations can align stakeholders' perceptions of the benefits of new strategies, such as demonstrating the efficiency of new inventory systems to encourage adoption and monitoring. Clear communication of expectations and the use of incentives can address normative beliefs, while providing adequate training, resources, and support can build control beliefs and empower employees to effectively manage inventory. By applying TPB, managers' intentions to implement flexible inventory strategies will be influenced by their beliefs about the strategies' effectiveness and the company's ability to execute them, ensuring better demand forecasting and reducing the bullwhip effect (Lai, 2014; Tokar, 2010). Overall, applying TPB and the behavioral approach to inventory management fosters improved decision-making, better stakeholder collaboration, and more resilient supply chain operations. By addressing the beliefs that drive behaviors, organizations can enhance their forecasting accuracy, reduce fluctuations in inventory levels, and build a more adaptable and efficient supply chain (Daudi et al., 2016; Tokar, 2010).

4.2. Classical introspective approach and personality characteristics of executives in decision-making for inventory management and resilience in supply chains

The classical introspective approach centers on examining the internal psychological processes that influence behavior and decision-making, particularly in supply chain management. Emotional states, unconscious mechanisms, and internal conflicts can significantly affect how executives make decisions, especially in areas such as inventory management and resilience. Psychoanalytic theory suggests that many of an individual's desires and needs are unconscious, impacting behavior without conscious awareness. For example, an executive may make decisions driven by an unconscious desire for recognition or validation, which could lead to prioritizing short-term outcomes over long-term inventory optimization. In high-pressure situations, like inventory shortages or disruptions in the supply chain, decision-makers may opt for quick solutions that address immediate concerns, potentially overlooking the longer-term effects on supply chain efficiency and resilience (Alexander et al., 2014). In addition to emotional states, internal conflicts between competing desires or values create psychological tension

that can disrupt rational decision-making. Executives might experience conflicts between their desire for control and the need to collaborate with others, or between the pursuit of personal recognition and the focus on broader organizational goals. This internal tension can lead to decisions that divert from more logical approaches, such as excessive risk-taking or avoiding necessary decisions in inventory management. For example, an overconfidence in their ability to handle inventory challenges could lead to underestimating risks, while heightened anxiety could cause executives to hesitate in making key decisions (Erjavec et al., 2019). Moreover, the introspective approach emphasizes the role of personality traits in shaping decision-making. Traits like extraversion, neuroticism, and conscientiousness influence how executives handle inventory management challenges. Executives high in neuroticism tend to be more cautious and risk-averse, which may make them less likely to adopt new inventory strategies, even when they are needed. On the other hand, those high in extraversion may be more open to embracing change and taking risks, potentially driving more adaptable inventory management decisions (Schorsch & Wallenburg, 2017). Executives' personalities also affect their approach to supply chain resilience. For example, those with a strong need for control may prefer centralized decision-making, while those seeking acceptance might focus on fostering collaborative relationships with supply chain partners to strengthen resilience. Recognizing these internal psychological factors helps improve decision- making in supply chains. By understanding how emotional states, unconscious drives, and personality traits influence decisions, organizations can design leadership strategies that enhance inventory management and build more resilient supply chains. Addressing these psychological dimensions supports executives in making more balanced and strategic decisions that prioritize long-term stability and adaptability, leading to more responsive and efficient supply chains.

4.3. Sociological approach and resilience in inventory management and supply chains

The sociological approach, grounded in the theories of Max Weber, Pitirim Sorokin, and Talcott Parsons, emphasizes the role of human actions within the context of social norms and cultural frameworks. This perspective acknowledges that behavior in supply chain management is influenced by social and cultural factors that affect collaboration and interactions within and between organizations. In the realm of inventory management, the sociological approach offers valuable insights into how social exchange, cooperation, and resilience contribute to effective inventory strategies and adaptive supply chain practices (Bitsch & Hanf, 2022). In this framework, organizations within the supply chain engage in exchanges designed to maximize mutual benefits, such as preferential pricing or improved service levels. These relationships foster collaborative strategies that combine resources and knowledge, improving the overall efficiency of inventory management processes. For example, strong relationships with suppliers may lead to better communication, which helps prevent stockouts or excess inventory, allowing for more precise inventory forecasting and management. Such cooperation leads to faster delivery times, improved stock rotation, and more reliable replenishment systems, which enhance both inventory management and supply chain resilience (Schlüter et al., 2017).

Power dynamics within these relationships are also a key consideration. Power within the supply chain often stems from control over critical resources, which can impact decision-making processes. Large firms with substantial bargaining power can influence the strategies of suppliers and customers, including inventory practices. By leveraging their control over resources, they can impose terms that promote efficiency across the supply chain, including inventory management. Social exchange theories highlight the importance of mutual trust and respect in strengthening these relationships, making it more likely for organizations to work together on shared inventory strategies and adapt more effectively to changing market conditions (Singh et al., 2021).

Resilience in supply chains, particularly in inventory management, can be significantly bolstered through the effective management of these social relationships. Strong collaborative ties enable organizations to adapt more quickly to disruptions, whether they are due to demand fluctuations, supplier issues, or external crises. Applying social exchange theory to resilience models shows that by investing in strong relationships with suppliers and customers, organizations are better equipped to recover swiftly from disruptions and ensure the continued flow of critical resources. In inventory management, this means faster identification of stock shortages or surpluses and the ability to implement corrective actions quickly, reducing the risk of stockouts and overstocking (Daudi et al., 2016).

In conclusion, the sociological approach to inventory management and resilience emphasizes the importance of fostering strong social ties, trust, and collaboration throughout the supply chain. Organizations that effectively

manage these relationships can not only improve their inventory accuracy and efficiency but also enhance their ability to respond to disruptions, leading to a more resilient supply chain overall.

4.4. Comparative applications of behavioral, policy and transaction theories in supply chain resilience

Theories such as Public Choice Theory, Transaction Cost Theory, and the Theory of Planned Behavior offer valuable frameworks for enhancing supply chain resilience, particularly in inventory management and demand forecasting. While these theories share certain analytical similarities, their practical implementations differ significantly in how they address supply chain challenges and contribute to building resilience in the face of uncertainty and disruption. The Theory of Planned Behavior focuses on the psychological factors that influence decision-makers' actions. In the context of supply chain resilience, this theory helps improve organizational responses to disruptions by addressing the beliefs, attitudes, and intentions of managers. Understanding how managers' perceptions of risk, control, and social pressures influence their decisions allows organizations to design interventions, such as training programs or incentive structures, that align decision-makers' behaviors with resilience goals. For example, by targeting psychological drivers, organizations can improve decision-making during crises, reduce biases in responses, and foster more effective communication across the supply chain, all of which contribute to a more resilient and adaptable supply chain. These interventions enhance forecasting accuracy and enable quicker, more coordinated reactions to disruptions, mitigating issues like the bullwhip effect during periods of uncertainty. In contrast, Public Choice Theory examines how external policies and administrative decisions impact supply chain resilience. This theory is particularly relevant when organizations must navigate changing regulations, trade policies, or industry standards that may disrupt supply chain operations (Schorsch & Wallenburg, 2017).

The practical application of Public Choice Theory involves monitoring shifts in governmental policies or regulatory environments and adjusting supply chain strategies to maintain resilience. For instance, supply chains may need to adapt to new tariffs, environmental regulations, or labor laws, all of which can influence inventory management and resource allocation. Organizations can also engage in proactive advocacy to influence policy changes that support their resilience goals. This theory highlights the importance of understanding and responding to external factors, ensuring that supply chains remain flexible and robust in the face of policy-related disruptions. Transaction Cost Theory, on the other hand, focuses on minimizing the costs associated with transactions within the supply chain, which is essential for maintaining resilience during disruptions. Practically, this theory is implemented by optimizing contracts, governance structures, and processes to reduce inefficiencies and improve supply chain flexibility. For example, organizations can streamline procurement processes, negotiate long-term contracts, or reduce the number of intermediaries involved in transactions to lower administrative costs. The application of technologies such as enterprise resource planning (ERP) systems or blockchain can improve transparency and reduce the need for costly monitoring and enforcement of contracts, which are crucial during disruptions. By minimizing transaction-related costs, organizations can ensure a more agile and responsive supply chain capable of quickly adjusting to changes in demand or supply (Erjavec et al., 2019).

In summary, while all three theories provide valuable insights into supply chain resilience, their practical applications differ in focus. The Theory of Planned Behavior emphasizes the psychological and behavioral aspects of decision-making, Public Choice Theory highlights the influence of external policies and regulations, and Transaction Cost Theory aims to minimize transaction-related inefficiencies. Together, these theories offer a comprehensive approach to improving supply chain resilience, each contributing unique strategies for enhancing decision-making, compliance, and adaptability in the face of disruptions and uncertainty.

4.5. Modern technologies and artificial intelligence: bias mitigation and automation in inventory management and supply chain resilience

Modern supply chain management has been significantly transformed by the integration of digital technologies, particularly artificial intelligence (AI) and the Internet of Things (IoT). These technologies have brought about revolutionary improvements in inventory management and decision-making systems, offering considerable advantages in accurate demand forecasting and mitigating the biases associated with human decision-making. By enabling the orchestration and analysis of vast amounts of real-time data, AI and IoT provide precise insights into demand patterns, inventory levels, and market conditions, thereby improving supply chain resilience and

efficiency. AI's ability to process complex data rapidly and with high accuracy is a key driver in reducing the need for large safety stocks and mitigating issues related to maintenance and storage. This capability enhances inventory strategies, allowing organizations to optimize their stock levels and minimize unnecessary expenses (Haeussler et al., 2021).

The integration of AI and IoT into demand forecasting systems further improves the accuracy of predictions, reducing the reliance on traditional methods that often involve human error and subjective judgment. One important strategy that aligns with these technological advancements is the postponement strategy, which involves delaying value-added activities until customer demand is confirmed. AI's real-time data analysis capabilities facilitate flexible and accurate adjustments to inventory strategies, reducing waste and enhancing supply chain responsiveness to fluctuations in demand. This results in improved supply chain resilience by ensuring that resources are allocated more effectively and that organizations can react quickly to changes in the market (Haeussler et al., 2021).

The integration of Behavioral Decision Theory (BDT) with modern technologies adds another layer of value in mitigating biases in decision-making. BDT acknowledges that human decisions are often influenced by cognitive limitations and heuristic rules, leading to satisfactory rather than optimal outcomes. The use of AI in automating decision-making processes helps to reduce these biases by relying on data-driven insights rather than human preferences and subjective judgments. This shift enhances the consistency and quality of decisions across the supply chain, contributing to better overall performance and increased resilience (Liu, et al. 2019). Together, the application of AI, IoT, and theoretical frameworks like BDT and the postponement strategy fosters greater supply chain resilience. By improving demand forecasting, reducing cyclical fluctuations, and optimizing inventory management, businesses can navigate the complexities and uncertainties of the modern market more effectively. Furthermore, the automation of decision-making systems through AI reduces the impact of human error, making supply chains more adaptive and responsive to disruptions. As a result, these technological advancements not only improve operational efficiency but also help organizations build more resilient and sustainable supply chains (Donohue et al., 2020).

4.6. Analysis of integrated theoretical framework: driving supply chain resilience in inventory management and forecasting

The integration of theoretical frameworks and modern technologies offers profound insights into Supply Chain Resilience in Inventory Management and Forecasting. This integrated approach enhances organizations' ability to address the challenges and opportunities in managing inventory and forecasting demand. By analyzing the influence of external behaviors on supply chain strategies, it becomes evident that improved demand forecasting and the reduction of the Bullwhip Effect are key to building resilient supply chains. Technologies such as artificial intelligence (AI) and Internet of Things (IoT) contribute to minimizing human biases, while also optimizing inventory management processes, enhancing personalization, and supporting automated decision-making systems that collectively drive efficiency. In this context, frameworks like the Behavioral Approach and the Theory of Planned Behavior are particularly valuable. These frameworks emphasize the importance of understanding individual behaviors and decisions that influence demand forecasting and mitigating the Bullwhip Effect, providing organizations with actionable insights for strategic adjustments. Furthermore, the integration of AI and other advanced technologies plays a significant role in improving forecasting accuracy and reducing the negative effects of biases, while also contributing to inventory optimization (Khan et al., 2019; Lai, 2014).

From a sociological standpoint, the focus shifts to social exchange, collaboration, and resilience within the supply chain. The sociological approach underscores how effective communication, trust-building, and cooperation among supply chain participants enhance resilience and improve forecasting accuracy. These collaborative efforts lead to improved forecasting strategies that are adaptable to changing market conditions and better equipped to withstand disruptions. Integrating a classical introspective approach—which examines the psychological processes and personality traits of decision-makers—adds another layer of understanding. Recognizing how mental processes and individual motivations shape decision-making enables more effective strategies that consider human biases in inventory management and demand forecasting. This introspective approach helps tailor strategies for decision-makers, ultimately improving overall supply chain efficiency (Singh et al., 2021).

Building resilience in inventory management and forecasting is further bolstered by modern technologies that allow for more agile responses to market volatility. The framework facilitates process flexibility, enabling quicker adaptation to market changes and demand fluctuations. Theories like Public Choice, Transaction Cost, and Behavioral Design offer additional insights into improving inventory management practices and demand forecasting strategies. The Theory of Behavioral Design and the Theory of Positive Design offer frameworks for analyzing participant behaviors and environmental conditions, helping to generate data-driven strategies that address real-time challenges. Meanwhile, the Theory of Public Choice and the Theory of Transaction Costs provide insights into improving decision-making processes and reducing inefficiencies through transaction and decision analysis (Sood & Sharma, 2015; Tangpong et al., 2013).

In Figure 2, we illustrate a comprehensive framework that combines psychological and sociological theories with contemporary technological advancements in inventory management and forecasting. Unlike traditional models that often isolate components, this approach takes into account the interaction between decision-makers' behaviors, social dynamics, and technological capabilities to create a cohesive strategy for supply chain resilience. The multi-dimensional nature of this framework allows organizations to better predict and understand real-time actions, decisions, and responses to rapidly changing supply chain conditions, making it particularly relevant for today's fast-paced, complex supply chain environments.
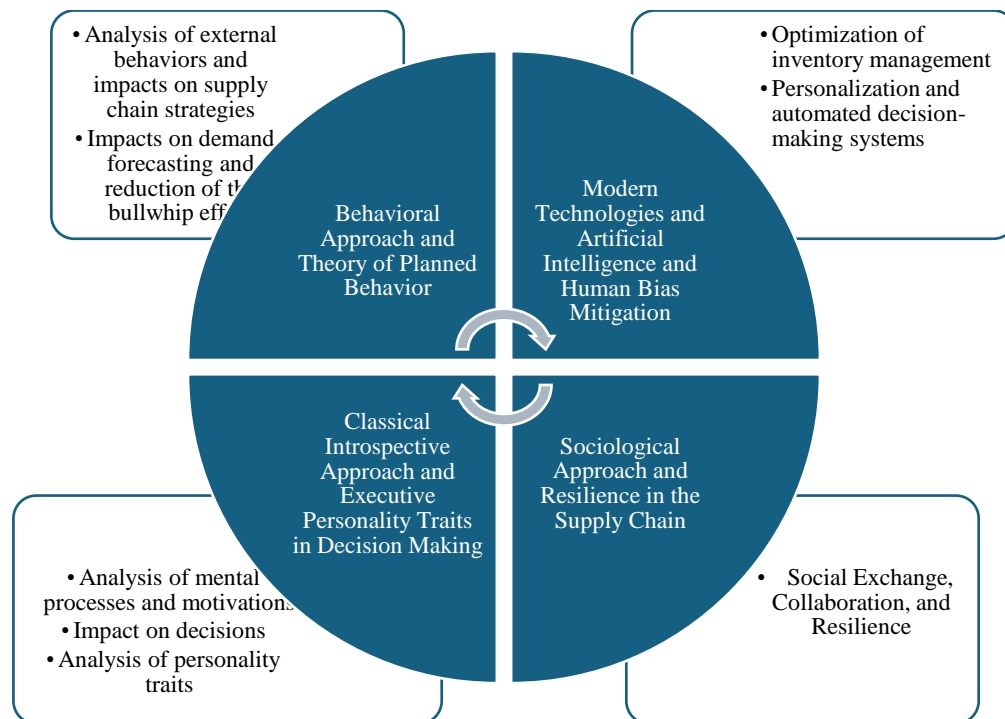

Figure 2. Integrated theoretical framework for enhancing supply chain performance

One of the key features of this framework is its emphasis on real-time data utilization via AI and IoT technologies. These tools enhance forecasting accuracy, reduce biases, and optimize inventory management. Real-time insights are indispensable for organizations that operate in dynamic environments where market conditions, demand patterns, and supply chain disruptions can evolve quickly. By leveraging real-time data, organizations can make data-driven decisions that align inventory management with actual demand, reducing the occurrence of stockouts and overstocking while improving operational efficiency and customer satisfaction. The framework also incorporates Behavioral Decision Theory (BDT) to address cognitive biases common in inventory management and forecasting. By integrating AI-driven, automated decision-making systems, this approach ensures more objective, rational, and data-driven decisions. The automation aspect of the framework not only reduces human

error but also promotes consistency in decision-making across large and complex supply chains, ensuring that organizations remain resilient even in high-pressure environments (Yang et al., 2019; Hendijani, 2019).

Moreover, the sociological approach embedded in this framework strengthens collaboration among supply chain partners. By fostering trust, shared values, and communication, the framework supports resilient supply chains that can better withstand disruptions, respond to crises, and quickly adjust to changes in demand. Real-time collaboration becomes more effective, allowing for quick adjustments to inventory levels and forecasting models, ensuring the continuity of the supply chain. Incorporating psychological insights from the introspective approach, which analyzes decision-makers' cognitive biases and personality traits, further enhances resilience in inventory management and forecasting. This understanding allows organizations to personalize their strategies to align with the specific cognitive strengths and decision-making styles of their leaders. Such a tailored approach ensures that strategies are not only more effective but also better suited to the unique characteristics of the organization and its leadership. The integration of the Theory of Behavioral Design and the Theory of Planned Behavior adds another layer of insight into shaping supply chain behaviors. By studying how individual actions and decisions influence supply chain outcomes, the framework helps organizations design targeted interventions that improve forecasting accuracy, reduce inventory imbalances, and mitigate the Bullwhip Effect. This data-driven approach ensures that decisions align with strategic objectives, enhancing overall supply chain performance (Ivanov et al., 2017; Shukaili et al., 2023).

Finally, the framework's focus on resilience, supported by both sociological and technological insights, allows organizations to proactively manage crises. Continuous monitoring of the supply chain environment and decision-makers' behaviors helps identify potential risks and disruptions early. By responding to these early signals, organizations can adapt inventory and forecasting strategies quickly, minimizing disruptions and maintaining the stability of the supply chain. This adaptive approach enhances supply chain resilience, ensuring that organizations can maintain performance even in uncertain conditions. In conclusion, this integrated framework offers a comprehensive solution to Supply Chain Resilience in Inventory Management and Forecasting. By combining behavioral theories, sociological principles, and modern technologies like AI and IoT, the framework provides organizations with the necessary tools to improve forecasting, optimize inventory management, and enhance overall supply chain efficiency and resilience.

5. Discussion

The first objective of this review was to evaluate the impact of the Theory of Planned Behavior (TPB) on demand forecasting and the bullwhip effect. The findings demonstrated that TPB significantly enhances demand forecasting accuracy by emphasizing behavioral intentions and social influences. By examining how individual actions shape supply chain dynamics, organizations can identify critical areas for strategic adjustments. This understanding enables more effective responses to demand fluctuations, ultimately mitigating the bullwhip effect and improving overall supply chain efficiency. Next, the review investigated the influence of behavioral and classical introspective theories on supply chain management strategies. Integrating these theories provided insights into the psychological processes driving decision-making among supply chain professionals. Insights into executive motivations and personality traits reveal their influence on strategic decision-making, particularly in aligning inventory management practices with organizational goals. This dual focus not only refines forecasting and inventory management practices but also enhances overall supply chain performance by aligning strategies with the internal motivations of decision-makers. The third objective addressed the contributions of the Sociological Approach, particularly in fostering collaboration and resilience within supply chains. The review highlighted how social exchange theory underscores the importance of cooperative practices and effective communication among supply chain participants. Fostering collaborative relationships enhances adaptability to market fluctuations and strengthens supply chain resilience by promoting trust, efficient communication, and resource sharing.

The fourth objective explored the potential of modern technologies, such as artificial intelligence (AI) and the Internet of Things (IoT), in refining demand forecasting and inventory management. The findings emphasized AI and IoT technologies minimize cognitive biases, optimize decision-making through real-time data, and improve demand forecasting accuracy by addressing variability and disruptions in supply chains. Lastly, the review analyzed the effect of executive personality traits on decision-making processes. By employing a classical introspective approach, it was revealed that understanding the personality traits of decision-makers can lead to

tailored strategies that enhance decision-making effectiveness. This insight enables organizations to consider individual differences when formulating supply chain strategies, ultimately improving efficiency and responsiveness to market demands.

Managers' confidence in controlling inventory and forecasting processes is key for adopting effective forecasting methods and reducing the bullwhip effect. When managers feel skilled and in control of inventory management, they are more likely to utilize advanced forecasting techniques, improve communication across supply chain levels, and adopt shared information systems to smooth out cyclical fluctuations. Social influences, such as customer demands and industry best practices, can further improve forecasting accuracy and reduce demand variability. Behavioral theories and the classical introspective approach significantly impact inventory and forecasting strategies. External reinforcements, such as rewards for adopting best practices, can motivate managers to use advanced forecasting models, improving inventory control. Conversely, understanding managers' internal motivations helps tailor strategies that align with organizational needs, boosting forecast accuracy and inventory management effectiveness. Sociological theories, like exchange theory, encourage collaboration, fostering trust and shared data that improve inventory forecasting and reduce disruptions (Ivanov et al., 2017). Personality traits, such as extraversion, neuroticism, and conscientiousness, also influence inventory and forecasting decisions. Extraverted managers may embrace innovative forecasting tools and riskier inventory strategies, while neurotic managers may be more cautious, limiting flexibility in inventory decisions. Conscientious managers tend to focus on systematic inventory control and precision in demand forecasting (Erjavec et al., 2019).

Research by Gino and Pisano (2008) and Boute and Lambrecht (2007), highlights how cognitive biases, social pressures, and altruism affect forecasting and inventory decisions. Ajzen's (2006) work on behavioral interventions supports the use of TPB principles to improve inventory management practices by leveraging managers' beliefs and social influences. However, TPB has limitations. Managers' intentions may not translate into action if external factors, like resource constraints or organizational pressures, prevent them from implementing forecasting methods. While social pressures encourage best practices, they can also lead to conformity, stifling innovation in forecasting. Overemphasis on rewards or personality traits may overlook deeper factors, like situational context, that impact decision-making in inventory management. In competitive environments, fostering trust for shared inventory data can be challenging, and personality-driven strategies may oversimplify decision-making, ignoring the complexities of the inventory and forecasting process. A more integrated approach is needed to address both internal and external factors for improving inventory forecasting and management.

6.   Practical applications of behavioral theories and advanced technologies in supply chain resilience

The integration of theoretical approaches and contemporary technologies into real-world supply chain contexts provides substantial benefits for practitioners, particularly in inventory management and forecasting. Integrating Behavioral Decision Theory into decision-making processes helps companies counteract human biases. For example, a food distributor might use AI analytics to refine inventory decisions based on accurate data rather than subjective judgments. Amazon exemplifies this approach by leveraging AI and machine learning to mitigate human biases in inventory management. Its automated recommendation system analyzes vast amounts of sales data, predicting customer demand with high accuracy, which improves inventory turnover and minimizes excess stock, ultimately contributing to resilient supply chain operations. From a sociological perspective, fostering collaboration among supply chain partners enhances communication and strengthens resilience. A tech company might create a shared platform for real-time information exchange with suppliers, enabling faster responses to market fluctuations. Procter & Gamble (P&G) highlights this approach through its "Connect + Develop" program, fostering open communication with external suppliers and innovators, enhancing responsiveness to consumer demands, and increasing supply chain resilience by adapting more quickly to changes in the market. Applying a Classical Introspective Approach involves understanding the psychological traits of decision-makers, enabling organizations to identify and address specific decision-making styles. By evaluating these traits through assessments, organizations can provide targeted training that enhances leadership effectiveness and strategic alignment. Unilever applies introspective assessments to its supply chain leadership, evaluating decision-making styles and psychological traits of managers to design training programs that improve strategic thinking and forecasting accuracy, boosting resilience in supply chain management. Modern technologies, such as AI and IoT,

significantly enhance operational efficiency and resilience in supply chain processes. A clothing retailer can employ IoT sensors for real-time inventory tracking, enabling dynamic adjustments in stock levels based on actual consumer demand. Zara, a fast-fashion leader, employs IoT sensors for real-time inventory tracking, enabling dynamic production adjustments to align stock levels with actual consumer demand, thereby reducing overstock and improving resilience (Yang et al., 2019).

Finally, implementing a postponement strategy allows companies to delay final production until customer demand is confirmed, reducing waste and increasing responsiveness. A consumer electronics manufacturer might leverage real-time data analytics to adjust production schedules based on actual orders. Dell exemplifies this strategy by allowing customers to customize computer configurations before assembly, waiting to assemble products only after an order is placed. This reduces waste, offers a wide range of product options, and improves market responsiveness, contributing to a more resilient supply chain. By integrating these theoretical frameworks and modern technologies, companies can enhance inventory management and forecasting strategies, improving both operational efficiency and resilience in the face of fluctuating market conditions.

7.   Conclusions

This review highlights the critical role that behavioral theories and contemporary technologies play in addressing the challenges of supply chain management, particularly in relation to the "bullwhip effect." By integrating insights from the Theory of Planned Behavior (TPB), behavioral theories, the Classical Introspective Approach, and the Sociological Approach with modern technological advancements such as artificial intelligence (AI) and the Internet of Things (IoT), this review provides a nuanced understanding of how these elements interact to enhance supply chain resilience and efficiency. The review also reveals gaps in literature, particularly in the empirical application of these theoretical approaches. While the theoretical insights are robust, there is a need for more empirical studies that explore how these theories translate into practical applications within various supply chain contexts. The review's limitations, such as variations in research methodologies and the generalizability of findings, should be acknowledged. Despite these limitations, the insights gained offer valuable implications for both practice and theory.

Practically, supply chain managers are encouraged to develop strong intentions for improving demand forecasting, foster collaborative relationships with supply chain partners, and consider the influence of personality traits on decision-making. Theoretically, this review advocates for the creation of comprehensive models that integrate behavioral theories with practical strategies and technological innovations. Future research should investigate empirical validation of these models and explore their application across different industries and geographical contexts. Combining behavioral theories with technological advancements presents a promising avenue for advancing supply chain management. By addressing the bullwhip effect through a multifaceted approach that includes behavioral insights and modern technologies, organizations can enhance their resilience, efficiency, and overall performance in an increasingly complex and dynamic business environment.

To address the challenges identified, organizations should adopt several key strategies. Firstly, supply chain managers should focus on developing strong intentions and a sense of control over demand forecasting processes. Implementing training programs and advanced forecasting tools can support these goals and improve forecasting accuracy. Additionally, organizations should incorporate insights from behavioral and introspective theories by developing strategies that consider both external rewards and internal motivations. Providing incentives for best practices and understanding decision-making processes can help mitigate the bullwhip effect and enhance supply chain performance. Building collaborative partnerships through trust and shared information systems is vital for improving supply chain resilience and adaptability to disruptions Organizations should apply social exchange theories to foster stronger relationships with suppliers and customers, thereby building trust and mutual benefits that improve resilience. Tailoring human resource management strategies based on executives' personality traits can further enhance decision-making and strategy formulation. For example, offering additional support to executives with high neuroticism and encouraging innovation among those with high extraversion can lead to more effective management practices.

Finally, integrating technological solutions with behavioral insights is vital. Organizations should develop and implement models that combine advanced technologies like AI and IoT with an understanding of behavioral factors. Investing in these technologies while considering behavioral aspects can significantly enhance demand forecasting and inventory management. Future research should focus on empirical studies that explore the practical

application of these theories and technologies across various industries and regions to refine and validate the proposed models. By following these recommendations, organizations can improve their supply chain management practices, boost resilience, and drive innovation, ultimately leading to more efficient and adaptable supply chains.

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