Scientific Research Publishing

American Journal of Industrial and Business Management, 2026, 16(3), 311-322
https://www.scirp.org/journal/ajibm
ISSN Online: 2164-5175
ISSN Print: 2164-5167

Structural Limitations of Push Inventory Management Systems in High Environmental Variability Conditions

Sviatoslav Oliinyk

CEO at ABM Cloud Intuiflow, Kyiv, Ukraine
Email: oliinyk.s.y@gmail.com

How to cite this paper: Oliinyk, S. (2026). Structural Limitations of Push Inventory Management Systems in High Environmental Variability Conditions. *American Journal of Industrial and Business Management, 16,* 311-322.
https://doi.org/10.4236/ajibm.2026.163015

Received: February 18, 2026
Accepted: March 16, 2026
Published: March 19, 2026

Abstract

The article examines the structural limitations of push-type inventory management systems as an integral property of decision architecture under conditions of high environmental variability, stochastic lead times, and fragmented distribution networks. The analysis is based on a comparative review of contemporary studies addressing safety stocks, the bullwhip effect, buffer parameterization, production–inventory planning, and warehouse centralization strategies. It is shown that isolated optimization of order quantity or service level does not ensure system stability and leads to reproducible trade-offs between holding costs, stockout probability, and flow throughput. The study argues that the primary source of instability lies in the forecast-centric decision sequence "inventory-production-distribution," which amplifies sensitivity to demand dispersion and temporal deviations. It is demonstrated that increasing safety stocks performs a function of local fluctuation compensation while simultaneously scaling systemic imbalances when misaligned with production capacities and replenishment lead times. Particular attention is given to distribution architecture and the risk-pooling effect, indicating that centralization reduces variability amplitude without eliminating its forecast-driven nature, whereas signal-buffer and pull logics enhance flow adaptability but do not guarantee the removal of structural constraints. It is shown that managerial stability is determined by the coherence of informational, resource, and spatial contours rather than by the precision of individual parameters. The article may be useful for researchers of logistics systems, supply chain management professionals, and developers of inventory planning models under uncertainty.

Keywords

Inventory Management, Push Systems, Demand Variability, Safety Stock, Bullwhip Effect, Distribution Architecture

1. Introduction

Rising environmental variability, accelerating product life cycles, and the increasing complexity of multi-echelon supply chains are reshaping the requirements for inventory management systems, shifting the focus from local parameter tuning to the robustness of decision architecture (Fernandes et al., 2025). Environmental variability in the context of this study is interpreted operationally as the joint variability of demand processes, replenishment lead times, and market response conditions affecting replenishment decisions. Following contemporary inventory management literature, environmental variability is characterized using three measurable dimensions: 1) demand variability expressed through the coefficient of variation of demand ($CV = \sigma/\mu$), 2) lead time variability measured as the relative standard deviation of replenishment time, and 3) market-induced variability reflected in price or promotion volatility influencing order synchronization across channels. The classical push model, based on demand forecasting and safety stock formation, is increasingly ill-suited to conditions of stochastic lead times, consumer price sensitivity, and production capacity fluctuations. Inventory management ceases to be a task of precise order quantity calculation and becomes a task of aligning the system's informational, resource, and temporal contours.

In this study, a push-type inventory management system is defined as a forecast-driven replenishment architecture in which production and distribution decisions are initiated on the basis of anticipated demand rather than observed consumption signals. Operationally, push systems include base-stock policies, material requirements planning (MRP) logic, and forecast-to-order planning mechanisms where inventory targets are calculated ex ante using demand projections and predefined service-level constraints.

This definition distinguishes push logic from pull systems, where replenishment is triggered by actual downstream consumption events; from signal-buffer approaches, where buffer penetration dynamically regulates order release; and from Demand Driven MRP (DDMRP), which combines decoupled buffer positioning with adaptive signal-based replenishment rules. In contrast to these approaches, push systems preserve a sequential decision structure in which inventory targets determine production schedules and distribution flows, thereby maintaining dependence on forecast accuracy.

Despite this, push architectures retain dominance due to their simplicity and predictability, which transform into sources of inflexibility in a turbulent environment. The amplification of the bullwhip effect, the accumulation of excess inventory, unfulfilled production plans, and distribution network conflicts indicate the structural nature of this approach's limitations (Ghanem et al., 2021). The proliferation of demand-driven and pull methodologies reflects an attempt to transition from forecast-based logic to signal, buffer, and flow-based management mechanisms; however, their systemic integration into existing production and organizational contours remains limited.

The aim of this study is to form a systemic understanding of the structural limitations of push-type inventory management systems under conditions of high environmental variability and to identify the architectural factors determining their instability and the economic trade-offs between service level and costs. To achieve this goal, the following tasks are addressed:

–identify the mechanisms of excess ordering and inventory accumulation;

–analyze the misalignment of inventory, production capacity, and lead time contours;

–determine the influence of distribution architecture and the degree of warehouse network centralization on total logistics costs;

–develop a multi-level conceptual scheme of the structural limitations of push inventory management in a turbulent environment.

The research hypothesis posits that the key limitations of push-type inventory management systems are conditioned not by individual safety stock parameters, but by architectural dependence on forecast-based logic and the "inventory-production-distribution" decision sequence. To clarify the causal mechanism underlying the proposed hypothesis, the push-based decision architecture can be represented as a simplified decision-flow sequence linking informational inputs, managerial decisions, operational constraints, and system outcomes. In forecast-oriented inventory systems, replenishment logic follows a sequential structure in which expected demand determines inventory targets prior to production and distribution feasibility assessment.

The generalized causal chain may be expressed as follows:

- Demand forecasts and historical data (inputs) → calculation of target inventory and safety stock levels (decisions) → generation of production plans and replenishment orders → interaction with capacity limits and stochastic lead times (constraints) → realized inventory levels, throughput variation, and stockout or overstock outcomes (outputs).
- Within this structure, amplification emerges because forecast deviations propagate downstream before resource constraints are evaluated. When lead time variability or bottleneck capacity interacts with pre-committed inventory targets, corrective actions occur only after imbalance formation, resulting in oscillatory order behavior and increased system sensitivity to environmental variability. This sequential logic operationalizes the "inventory → production → distribution" dependency discussed in the study.

Such a structure forms persistent trade-offs between service level, inventory cost, and flow stability as environmental variability increases.

The scientific novelty of the work lies in considering push-based inventory management as a multi-level construct, where limitations arise at the level of order quantity and safety stocks, at the level of capacity and lead time alignment, and at the level of distribution network configuration. The proposed systematization integrates probabilistic, behavioral, and architectural factors into a unified analytical model explaining cost growth, bullwhip effect amplification, and the formation of stable compromise management regimes.

The scope of the study is limited to the analysis of production and distribution supply chains with high uncertainty in demand and lead times, and does not cover sectoral regulation, individual contractual schemes, or macroeconomic market aspects. The work is based on secondary scientific and applied sources and does not involve proprietary field experiments or longitudinal observations, focusing instead on the analytical interpretation of existing empirical results and the identification of structural regularities.

2. Materials and Methods

The methodological basis of the study was formed through a stepwise selection and comparative-analytical review of peer-reviewed scientific publications on inventory management under conditions of high environmental variability, including demand uncertainty, lead time fluctuations, production capacity constraints, and multi-echelon supply chain structures. Search and selection were performed as a formalized multi-step process ensuring the reproducibility of the inclusion procedure and the transparency of relevance criteria.

The literature search was conducted using major international scientific databases to ensure coverage of peer-reviewed research in operations management and supply chain analytics. The primary sources included Scopus, Web of Science Core Collection, ScienceDirect, and MDPI Open Access journals. The search process was performed between January and March 2025, with an update verification conducted in May 2025 to include recently published articles.

Search queries combined inventory management terminology with uncertainty and planning architecture concepts using Boolean operators. An example of a full search string applied in Scopus is provided below:

(“inventory management” OR “inventory control” OR “MRP” OR “push system”) AND (“demand variability” OR “lead time uncertainty” OR “bullwhip effect”) AND (“safety stock” OR “buffer management” OR “replenishment strategy”) AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “re”)) AND (PUBYEAR > 2020).

The search results were restricted to peer-reviewed journal articles written in English and containing formalized analytical, simulation, or optimization models. Conference abstracts, conceptual essays without methodological specification, and studies lacking reproducible modeling assumptions were excluded during the screening stage.

The analysis included articles published in 2021-2025 containing formalized inventory management models, simulation modeling, optimization formulations, or statistical procedures for calculating safety stocks, service levels, and buffering parameters. Review publications without original methodological results, duplicate materials, and works lacking reproducible calculation steps or clearly defined model assumptions were excluded.

The primary dataset was formed using key search terms reflecting the topic of structural limitations of forecast-oriented inventory management in a turbulent environment. The following keywords were used: inventory management, demand variability, lead time uncertainty, safety stock, bullwhip effect, omnichannel supply chain, material requirements planning, lot sizing, production scheduling, strategic buffers, closed-loop supply chain, warehouse centralization, push, pull, MRP, DDMRP. Subsequently, screening of titles and abstracts was conducted, followed by a full-text check for compliance with inclusion criteria. The primary search dataset consisted of 37 publications, of which, after screening and full-text verification stages, 10 studies met the selection criteria and formed the final analytical corpus.

The final corpus of sources was structured by levels of limitation manifestation. At the parametric level, mechanisms of safety stock formation, order quantity, and excess inventory costs were analyzed. At the resource-temporal level, the effects of capacity constraints and lead time uncertainty, leading to plan unfeasibility and rising inventory costs, were examined. At the distributional level, the role of warehouse network configuration and the degree of centralization in changing total logistics costs and system resilience to demand variability was evaluated.

The study by Aiello et al. formalizes an inventory management model for a closed-loop supply chain considering waste reduction. Bayard et al. (2024) describe key concepts and DDMRP behavior through a case study. Demiray Kırmızı et al. (2024) analyze safety stock strategies based on company data; Fernandes et al. (2025) evaluate a DDMRP replenishment model using simulation modeling. Fleuren et al. (2025) investigate joint production-inventory planning in high-tech low-volume chains. Gao et al. (2025) model the bullwhip effect and inventory costs in an omnichannel chain; Ghanem et al. (2021) compare push and pull scheduling at the work execution level. Javadi et al. (2025) propose a lot-sizing method and production scheduling algorithm for MRP tasks; Krajčovič et al. (2024) develop a statistical and optimization procedure for strategic buffer tuning. Milewski considers the joint problem of selecting a replenishment strategy and the degree of warehouse network centralization.

Based on the comparison of source results and assumptions, a theoretical-synthetic analysis was performed, aimed at isolating recurring causal links, persistent trade-offs between service level and inventory cost, and architectural factors amplifying the instability of forecast-oriented management contours. The synthesis involved consolidating the identified mechanisms into a unified multi-level model of structural limitations of push-type systems, suitable for subsequent empirical verification on applied data.

The analytical interpretation developed in this study relies on a set of modeling assumptions defining the conditions under which structural limitations of push-oriented inventory systems are expected to manifest. First, service level requirements are assumed to be enforced through predefined availability targets translated into safety stock calculations. Second, demand is treated as stochastic with non-zero variance and may exhibit non-stationary behavior within planning horizons. Third, replenishment lead times are considered uncertain and partially independent from planning decisions. Fourth, production capacity is assumed to be finite, implying the presence of potential bottlenecks affecting schedule feasibility.

Finally, unmet demand is interpreted primarily as lost sales rather than fully backlogged demand, reflecting typical commercial distribution environments.

Under these assumptions, forecast-based replenishment generates sequential decision dependence that amplifies variability propagation across planning stages. However, a boundary condition exists in which push logic may remain stable: when demand variability is low, lead times are deterministic, and production capacity significantly exceeds demand fluctuations. In such environments, forecast error remains bounded and inventory targets do not conflict with resource feasibility, allowing push systems to operate without structural instability. This boundary case clarifies that the identified limitations are conditional rather than universal and emerge primarily under high environmental variability regimes.

3. Results

Comparison of order parameters and safety stock levels across the selected corpus of studies revealed a reproducible dependency. Rising demand variability was accompanied by an increase in the calculated replenishment volume in push-type inventory management systems. In the investigated scenarios, the intensification of consumption fluctuations was accompanied by a systematic shift of the order optimum relative to the baseline forecast and an expansion of buffer levels (Aiello et al., 2025). The obtained relationship persisted across changes in planning horizons and modeling types, allowing safety stock to be fixed as a smoothing tool and a deviation scaling mechanism.

Additional amplification of the effect is established when service level standards and penalty coefficients for non-delivery are included. In calculation scenarios, tightening product availability requirements leads to a systematic increase in buffer volumes relative to the initial forecast (Demiray Kırmızı et al., 2024). This forms a stable configuration where protection against stockouts is accompanied by the accumulation of unrealized inventory. Similar dynamics are recorded when distributing demand across multiple sales channels, where consumption heterogeneity amplifies order amplitude at lower chain levels and increases safety stock dispersion (Gao et al., 2025). The totality of obtained relationships indicates a direct link between rising uncertainty and buffer expansion within the analyzed sample of supply chains and product types. **Table 1** presents a quantitative comparison of optimal order volumes, expected inventory, and stockout probability during the transition from a linear to a closed-loop supply chain.

Table 1. Comparison of push decision results in linear and closed-loop supply chains (Compiled by the author based on source: Aiello, 2025).

Scenario	Optimal Order, units	Expected Inventory, units	Expected Lost Sales, units
Linear Supply Chain	9277	677	1400
Closed-Loop Supply Chain	7670	237	2567
Change, %	−17.3%	−65.0%	+83.4%

The table data show the redistribution of risks between excess inventory and stockouts during the transition from a linear to a closed-loop supply chain configuration. The linear model is oriented toward preventing non-delivery and therefore maintains a higher order level, leading to the accumulation of unrealized inventory. Conversely, the closed loop reduces replenishment volume by internally accounting for end-of-life product costs, which decreases excess inventory but simultaneously raises the probability of stockouts. Thus, changing the chain architecture does not eliminate demand uncertainty but shifts its consequences between holding and lost sales, confirming the structural nature of the limitation (Aiello, 2025).

At the meso-level, the study results record a persistent misalignment between safety stock parameters and the actual feasibility of production plans. Comparison of scenarios revealed that the "inventory first-then production" decision sequence forms a systematic accumulation of unfeasible schedules, as buffering volumes are calculated without accounting for bottleneck throughput and replenishment lead time fluctuations (Fleuren et al., 2025). This configuration results in safety stock ceasing to function as a flow stabilizer and beginning to create overloads at subsequent order processing stages. Similar dynamics are traced in models where replenishment parameters are set independently of current production line utilization and calendar constraints (Javadi et al., 2025). In the analyzed configurations, the growth of buffer volumes does not lead to increased system stability and is accompanied by an increased probability of work-in-process accumulation and queues.

The introduction of stochastic lead times changes the nature of inventory accumulation and amplifies system sensitivity to temporal deviations. When varying replenishment time even within moderate fluctuations, a disproportionate increase in total holding cost is recorded, driven by the need to simultaneously compensate for delays and capacity overloads. This dependency is reproduced across various production network configurations and is confirmed by simulation results, where the expansion of buffer zones is accompanied by increased order volatility and reduced throughput of critical nodes (Fernandes et al., 2025). Parallel calculations of strategic buffering parameters show that statistical calibration is capable of smoothing local fluctuations but does not eliminate the systemic gap between inventory volumes and their actual processing speed. **Table 2** considers the comparison of total inventory costs under increasing planning environment complexity and the simultaneous action of capacity constraints and lead time uncertainty.

Comparison of scenarios demonstrates a qualitative change in the nature of costs under the simultaneous action of temporal and resource constraints. A transition is observed from local inventory redistribution to network-wide buffer accumulation, accompanied by a sharp rise in total holding costs. This dynamics is confirmed by production-inventory planning calculation results, where increasing safety levels without synchronization with the capacity schedule leads to the formation of excess queues and a reduction in the system's actual throughput. Collectively, the obtained relationships indicate the loss of stability of the push architecture with rising network variability and the simultaneous action of stochastic lead times and bottlenecks.

Table 2. Degradation of Push-Oriented Base Stock Levels under Increasing Planning Complexity (Compiled by the author based on source: Fleuren et al., 2025).

Planning Environment Condition	Total Inventory Cost, $MM	Structural Effect
Capacity Constraints Only	26.77	Inventory shift toward downstream nodes to bypass bottlenecks
Lead Time Uncertainty Only	24.61	Buffer growth at nodes with uncertain inflow and across the network
Capacity + Lead Time	83.88	Superlinear cost growth due to simultaneous protection from congestion and delays

The totality of obtained results demonstrates that limitations of the push architecture manifest simultaneously at the level of safety stock parameters and at the level of aligning production capacities and replenishment times. Environmental variability growth is not eliminated by increasing buffer volumes but is redistributed between excess inventory accumulation, deficit formation, and reduced actual system throughput. The observed relationships are reproduced across various supply chain configurations and confirm that the key instability factor in the reviewed scenarios and models is not an individual inventory management parameter, but the structural interconnection between demand forecast, buffering volumes, and flow processing time constraints (Fleuren et al., 2025).

4. Discussion

At the macro-level, distribution architecture sets the framework within which inventory management limitations manifest. Stability is determined by the magnitude of safety stock and how the warehouse network transforms demand into replenishment decisions. As the number of distribution nodes increases, the push-type system amplifies dependence on forecast information because aggregate demand disintegrates into multiple local signals, each with its own error. In such a structure, deviations cease to be compensated at the network level and begin to reproduce at each warehouse individually, leading to the parallel emergence of excess inventory and stockouts across different items. In the analyzed scenarios, network fragmentation manifests as a structural mechanism for amplifying forecast error, rather than as an isolated operational failure.

Comparison of centralized and decentralized configurations reveals the differing nature of variability redistribution. Warehouse centralization reduces the aggregated fluctuation amplitude through the risk-pooling effect, yet it does not eliminate the forecast nature of the push approach itself. Even with a reduced number of nodes, the dependence of replenishment volume on calculated expectations persists, limiting adaptation speed during sharp demand changes. The transition to pull and demand-driven logic in the same configurations shifts the focus from calendar planning to signal-based replenishment and allows flow redistribution in accordance with actual consumption. Within the analyzed scenarios, this is accompanied by a more stable distribution of inventory between network nodes and lower sensitivity to local environmental fluctuations (Milewski, 2025). **Figure 1** presents the dynamics of logistics costs under changes in replenishment strategy and warehouse network configuration.

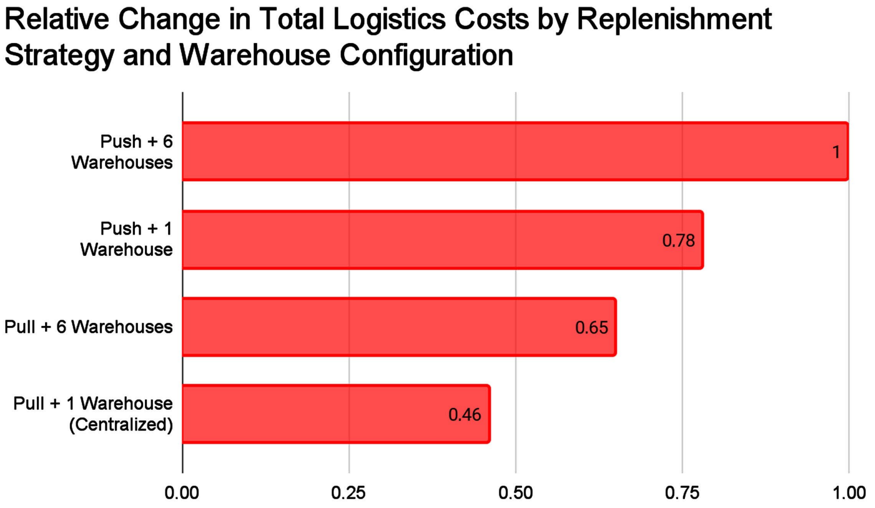

Figure 1. Relative change in total logistics costs when changing the replenishment strategy and warehouse network configuration (Compiled by the author based on source: Milewski, 2025).

The diagram demonstrates a consistent reduction in the relative total logistics cost index as the transition is made from a decentralized push-type system to a centralized pull-type system. The value of 1.00 for the Push + 6 Warehouses variant reflects the highest cost level and is used as the baseline comparison point, showing the system's maximum sensitivity to demand variability with a fragmented warehouse network. Transitioning to the Push + 1 Warehouse configuration reduces the index to 0.78, indicating partial fluctuation smoothing due to centralization; however, a noticeable share of costs remains due to forecast-based replenishment logic. The Pull + 6 Warehouses configuration demonstrates a further decrease in the indicator to 0.65, evidencing more flexible flow redistribution even with a distributed warehouse structure. The minimum value of 0.46 in the Pull + 1 Warehouse (Centralized) scenario reflects the greatest cumulative effect of simultaneously using adaptive replenishment logic and demand pooling, where inventory fluctuation amplitude decreases and both warehousing and transport costs are reduced. The sequence of values 1.00 → 0.78 → 0.65 → 0.46 shows that the number of warehouses and the type of managerial replenishment logic exert the key influence on costs.

The systemic configuration of push inventory management forms a persistent contradiction between the striving for a high service level and holding cost limitations, which manifests as a recurring regularity across various models and organizational contours. Increasing product availability is achieved by expanding safety stocks, which amplifies the load on warehouse infrastructure and increases the share of capital tied up in inventory. Attempts to neutralize this effect by refining the forecast or shortening the planning horizon lead to shifting the imbalance in the opposite direction. Buffer volume decreases, but the probability of stockouts and the frequency of unscheduled replenishments increase. A regime of parametric compensation arises, where the improvement of one indicator is accompanied by the deterioration of another, and the achieved equilibrium proves short-term and sensitive to external fluctuations.

This dynamics becomes more pronounced when distributing demand across multiple sales channels and intensifying consumer price sensitivity. Information signal fragmentation leads to order amplitude growth at lower chain levels and accelerated propagation of fluctuations throughout the entire supply structure. The bullwhip effect in these conditions ceases to be local and acquires a network character. Even minor changes in end demand transform into disproportionate adjustments of production and procurement volumes. Increasing safety stocks does not eliminate instability but merely redistributes its consequences toward excess inventory accumulation and warehouse node overload. The higher the demand elasticity and the more intense the price fluctuations, the faster the system loses flow predictability and the higher the probability of sharp total cost fluctuations.

Buffer and demand-driven class approaches act as an attempt to mitigate the parametric limitations of the traditional scheme by shifting focus from the forecast to the current flow state and actual consumption levels. Their effectiveness is determined by the precision of statistical calibration of buffer zones and the degree of alignment with production capacities and the network distribution configuration. In the absence of such synchronization, adaptive mechanisms begin to reproduce the same disparities as the classical scheme, differing only in the scale of fluctuations and the speed of their propagation.

Thus, the main line of tension is found not in the absolute magnitude of inventory, but in the architecture of managerial decisions and the sequence of information signal processing. The transition from forecast to signal-buffer logic changes the form and frequency of fluctuations but does not guarantee their disappearance if flow fragmentation and the gap between informational and resource contours persist. This manifests the structural nature of the trade-off, where system stability is determined not by individual replenishment parameters, but by the coherence of the entire configuration of flows, capacities, and distribution nodes.

5. Conclusion

The conducted analysis shows that the limitations of push-type inventory management systems are predominantly structural in nature and manifest simultaneously at the parametric, resource-temporal, and distributional levels. Rising environmental variability amplifies the dependence of order quantity on forecast information, leading to a persistent redistribution of risks between excess inventory, stockouts, and reduced flow throughput. Increasing safety stocks acts not as a universal stabilizer, but as a temporary compensation mechanism capable of smoothing local fluctuations while simultaneously amplifying systemic imbalances when misaligned with capacities and replenishment times. Distributional fragmentation additionally reproduces forecast errors at the level of individual nodes, whereas centralization reduces fluctuation amplitude without eliminating their forecast-driven nature.

The obtained results confirm the hypothesized proposition that the key limitations of the push architecture are conditioned not by individual safety stock parameters, but by architectural dependence on the "inventory-production-distribution" decision sequence. The identified regularities demonstrate the persistence of trade-offs between service level, inventory cost, and flow stability, which remain across various supply chain configurations and product types. Thus, management effectiveness is determined not by the precision of an individual calculation coefficient, but by the coherence of the system's informational, resource, and spatial contours.

From a managerial perspective, the identified structural limitations imply that improving inventory system stability requires architectural rather than purely parametric interventions. At the parametric level, buffer calibration should be explicitly synchronized with production throughput constraints, preventing safety stock expansion beyond feasible processing capacity. At the resource-temporal level, bottleneck protection policies and decoupling points may be introduced to align replenishment timing with actual production responsiveness, reducing schedule infeasibility caused by forecast-driven commitments. At the distributional level, network design decisions should consider selective warehouse centralization or hybrid replenishment strategies that combine demand pooling with adaptive signal-based control mechanisms.

These design levers do not eliminate environmental variability but reduce its amplification by improving coherence between informational signals, physical capacities, and spatial distribution structures. Consequently, managerial effectiveness shifts from optimizing individual inventory parameters toward configuring resilient decision architectures capable of absorbing stochastic disturbances.

Prospects for further research are associated with the empirical validation of the proposed multi-level model on industry data, comparative analysis of hybrid replenishment architectures under omnichannel conditions, and the development of quantitative flow coherence metrics enabling the evaluation of the structural stability of inventory management systems in dynamics.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Aiello, G., Muriana, C., Quaranta, S., & Abusohyon, I. A. S. (2025). A Sustainable Inventory Management Model for Closed Loop Supply Chain Involving Waste Reduction and Treatment. *Cleaner Logistics and Supply Chain, 16,* Article 100244. https://doi.org/10.1016/j.clscn.2025.100244

Bayard, S., Grimaud, F., & Delorme, X. (2024). Demand Driven Material Requirement Planning: Core Concepts and Analysis of Its Behavior on a Case Study. *IFAC-PapersOnLine, 58,* 1054-1059. https://doi.org/10.1016/j.ifacol.2024.09.134

Demiray Kırmızı, S., Ceylan, Z., & Bulkan, S. (2024). Enhancing Inventory Management through Safety-Stock Strategies—A Case Study. *Systems, 12,* Article 260. https://doi.org/10.3390/systems12070260

Fernandes, N. O., Djabi, S., Thürer, M., Ávila, P., Ferreira, L. P., & Carmo-Silva, S. (2025). The DDMRP Replenishment Model: An Assessment by Simulation. *Mathematics, 13,* Article 3483. https://doi.org/10.3390/math13213483

Fleuren, T., Merzifonluoglu, Y., Sotirov, R., & Hendriks, M. (2025). Production-Inventory Planning in High-Tech Low-Volume Manufacturing Supply Chains. *International Journal of Production Economics, 288,* Article 109687. https://doi.org/10.1016/j.ijpe.2025.109687

Gao, D., Liu, C., & Sun, X. (2025). Analysis of Bullwhip Effect and Inventory Cost in an Omnichannel Supply Chain. *Journal of Theoretical and Applied Electronic Commerce Research, 20,* Article 182. https://doi.org/10.3390/jtaer20030182

Ghanem, M., Hamzeh, F., Seppänen, O., Shehab, L., & Zankoul, E. (2021). Pull Planning versus Push Planning: Investigating Impacts on Crew Performance from a Location-Based Perspective. *Frontiers in Built Environment, 8,* Article 23. https://doi.org/10.3389/fbuil.2022.980023

Javadi, S. M., Sadjadi, S. J., Teimoury, E., & Makui, A. (2025). Material Requirements Planning with a Novel Lot Sizing Method and a New Algorithm for Production Scheduling. *Scientific Reports, 15,* Article No. 27637. https://doi.org/10.1038/s41598-025-13197-8

Krajčovič, M., Gabajová, G., Gašo, M., & Schickerle, M. (2024). Parameter Setting for Strategic Buffers in Demand-Driven Material Resource Planning through Statistical Analysis and Optimisation of Buffer Levels. *Applied Sciences, 14,* Article 3012. https://doi.org/10.3390/app14073012

Milewski, D. (2025). The Combined Decision Problem: "Pull" vs. "Push" and the Degree of Centralization of Warehousing in the Field of Physical Distribution with a Special Focus on the Polish Market. *Applied Sciences, 15,* Article 3970. https://doi.org/10.3390/app15073970