Exploring the Impact of Business Infrastructure on a Multi-Echelon Inventory Control System

A case study of a distributing company

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Background

Inventory management is crucial for organizations, with inventory control being a key component. Efficient inventory control involves balancing various business functions' goals, while also managing economies of scale (EOS) and uncertainties. Multi-echelon inventory control systems (MEICS) consider interdependent stocks and have gained importance with advancements in inventory control techniques (Axsäter, 2015). MEICS are particularly significant in industries dealing with perishable goods due to their complexity and high integration needs (Transchel & Hanser, 2019).

The case company, the Company, a global food distributor with a two-echelon divergent inventory system, is dissatisfied with its supply chain's availability and inventory turnover rates. To address this, the Company wants to evaluate whether the operation of its MEICS contributes to this suboptimal performance. Committed to continuous improvement, the Company will thoroughly investigate these issues, examining both hard factors and soft factors such as organizational structure, information sharing, synchronization, performance measurement, and IT systems.

Purpose and Methodology

The performance of inventory control systems (ICSs) depends not only on technical aspects but also on organizational context. This thesis explores the Company's MEICS, considering both technical aspects and organizational context. Drawing from de Vries (2005), it aims to analyze the Company's MEICS functionality and identify organizational factors affecting its performance.

This master's thesis uses an embedded single case study, combining interviews and archival records from the Company. It begins by understanding theoretical concepts and the Company's MEICS, then combines quantitative and qualitative data analysis. The thesis culminates in a cross-analysis of the exploratory findings and established theory, leading to the final conclusions and answers to the research questions.

de Vries Framework

How a company's infrastructure can affect the performance of its ICS is a relatively unexplored area. A researcher who has contributed to this field is de Vries, in an article from 2005. He designed a model that shows how physical context, inventory planning and control, and the organizational setting of the inventory system can impact the execution of an ICS. This thesis is inspired by de Vries (2005)'s framework.

Results & Analysis

The quantitative analysis for fiscal year 2023 reveals that average inventory levels for the studied products are excessive at both the CDC and the RDC in Parma, with slightly higher levels at the CDC, hinting at a potential bullwhip effect. All products exceed the Company's inventory turnover target, but this target is set globally and may not suit the market studied. Distribution orders (DOs) from the CDC show inconsistent patterns in quantities and timing. The provisional safety

stock analysis, due to a lack of historical data, indicates excessive safety stock levels. Forecasts generally align with demand, though some products show significant discrepancies. The low number of obsolete products found in the data analysis shows that shelf life is a non-critical factor, which is reasonable since all products have a shelf life over 360 days while lead times are approximately six days. Only two out of 14 products met availability targets, but the binary measurement of availability does not reflect actual demand fulfillment.

The quantitative analysis reveals no significant relationship between the studied variables and the suboptimal performance in inventory levels, availability and inventory turnover rate, suggesting that the issue may instead be related to business infrastructure.

The qualitative results from the interviews highlight six key areas. First, the organizational setup is described as overly complex, with many siloed functions involved in the inventory control process. Second, there are misaligned KPIs between departments and functions, leading to inefficiencies due to differing perspectives on improvement. Third, information exchange both internally and externally is unsatisfactory, primarily due to poor communication channels and isolation between functions. Fourth, despite clear process descriptions, delivery planners responsible for the DOs employ different approaches. Variations in adherence to ERP system proposals, forecasts, and truck fill rates can impact inventory levels. Fifth, the ERP system is initially challenging to learn, and there is no uniform strategy for training newly hired employees. Sixth, the Company's supply chain maturity can be improved through greater integration across the supply chain, while its technological maturity remains high.

Conclusions

The study finds excessive inventory levels but low availability for the products. The analyzed RDC exceeds the Company's inventory turnover rate goal, which may not accurately reflect market conditions since it is set globally.

The study reveals numerous potential underlying reasons for this outcome, including a complex organizational structure, misaligned objectives, inadequate definitions and measurements of KPIs, insufficient information sharing, an ERP system that lacks integration of the multi-echelon aspect of its inventory setup, and differing levels of system knowledge among users. According to established theory, these components of business infrastructure are considered to degrade the efficiency of the Company's MEICS, which is potentially the cause of the observed excessive inventory levels and suboptimal performance in terms of availability and inventory turnover rate.

References

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