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A Process-Based Dead Stock Management Framework for Retail Chain Store Systems

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Abstract

Dead stocks refer to inventories in warehouses sitting for an extended length of time with no demand. All supply chain levels experience the dead stock problem. However, the impact is felt more in the retail level due to the volume and diversity of products handled especially when chain stores are involved. Causes of dead stock accumulation in the retail level of the supply chain include inventory policies, forecast inaccuracy, sudden change in demand, product expiration, product damages, etc. Literature is divided into strategy-based and management-based approaches in handling the dead stock problem. Strategy-based approaches build upon a single strategy to provide better solutions while management-based approaches identify root causes and provide solutions for a specific problem situation. Proactive and reactive strategies were proposed in literature to either prevent the accumulation of dead stocks or manage dead stock accumulation as it happens. This paper examines the causes of dead stocks and the different dead stock management strategies developed through the years to conceptualize a framework for a solution process that can effectively control the accumulation of dead stocks in retail chain store systems. The result is an end-to-end process-based dead stock management framework that starts from problem recognition and ends with selection of strategies in reducing the dead stocks of retail chain stores. The proposed framework minimizes dead stock costs of the retail chain store system through timely recognition of dead stocks and an optimal balance among dead stock warehouse costs, strategy-related costs, and stockout costs across all retain chain stores.

Keywords: *dead stock, dead stock accumulation, dead stock management, retail chain store systems, proactive strategy, process-based dead stock management framework, reactive strategy*

INTRODUCTION

Dead stock is inventory that has long stayed in the storage units, expired, and has no selling opportunity for a long duration of time (Sugumaran & Sukumaran, 2019). In industry, firms define stock as dead if it has not moved for a specific length of time. This length depends on the type of product, type of market, and the product's position in supply chain (Wild, 2018). The arbitrary nature of this length of time of "no movement" provides adequate reason for companies to delay classifying inventories as dead stocks. These unwanted inventories therefore accumulate in the warehouse over time until they become too burdensome for management to ignore. Since problem recognition is a prerequisite to solution development in the problem-solving process, timely classification of excess inventories as dead stocks becomes a key to unlocking the dead stock puzzle faced by many companies.

The dead stock problem is experienced in all levels of the supply chain as products move down from manufacturers to distributors to wholesalers and retailers. However, the impact of the problem is felt more significantly in the retail level due to the volume and diversity of products they handle which is further amplified when managing inventories involving retail chain stores. The benefits and value derived from a process-based approach to dead stock management also favor a closer look into the retail level of the supply chain. Firstly, it is very challenging to match supply with demand at the retailer level since retailers derive their demand from highly diverse sets of

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customers with varying needs and behavior, thereby making demand forecasting harder than it already is. Additionally, the existence of multiple competing brands in the retail chain store system adds complexity to the demand forecasting process which make dead stock management more difficult in the retail level. Secondly, the retail level absorbs most of the effects of changes in customer decisions that affect inventory levels in different retailer locations. Timely coordination of information across retail chain stores becomes critical in controlling inventory levels of the retailer and the supply chain in general. Timely inventory information sharing among retail chain stores also prevents unnecessary placement of orders that increases dead stock levels throughout the supply chain due to the bullwhip effect. (Glas, Kleemann, & Essig, 2013). Lastly, failure to quickly recognize dead stocks in the retail level results in opportunity losses, unnecessary storage and stockout costs, and expiration costs. Additionally, the value of wastes increases significantly in the retailer level since costs increase as products move downstream in the supply chain (Li & Yu, 2018).

Literature has provided proactive solutions to the dead stock problem through demand forecasting (Sugiono & Alimbudiono, 2020), inventory ordering and replenishment policies (Deniz, Karaesmen, & Scheller-Wolf , 2020), facility location and vehicle routing (Liu, Zhu, Xu, Lu, & Fan, 2021) and artificial intelligence (Kharfan, Chan, & Efendigil, 2020). Reactive solutions such as lateral transshipment (Nakandala, Lau, & Zhang, 2017), product bundling (Sugumaran & Sukumaran, 2019), burning (Napier & Sanguineti, 2018), and scrapping (Kakarlamudi, 2018) have also been proposed.

The application of proactive and reactive strategies to solve the dead stock problem is just one aspect of the problem-solving process. To date, literature has used single strategy solutions in managing and controlling the accumulation of dead stocks without considering the more important aspects of the dead stock management process. It has missed out on the fact that solution success is dependent on a standardized process of timely problem recognition, information coordination and collaboration among retail chain actors, and the option to simultaneously apply multiple strategies across retail chain stores to maximize the benefits derived through synergy of business decisions.

LITERATURE REVIEW

Dead stock literature consists of two tracks: strategy-based developments and management-based applications. Strategy-based papers build upon a concept or tool to provide better solutions for the dead stock problem. Management-based papers, on the other hand, are those that make use of a problem-solving approach in finding the root causes of dead stocks. Solutions are then developed specifically for a company or for a problem situation.

For the strategy-based development papers, these can be divided further into proactive and reactive dead stock management strategies. Proactive strategies seek to prevent or control the occurrence of dead stocks. Reactive strategies are those wherein companies respond to unwanted occurrence of excess inventories.

Many proactive strategies have been developed through the past decades to address root causes of excess inventory such as forecasting errors and large production quantities. For causes related to forecasting errors, sales forecasting models have evolved from the traditional time-series models to those that incorporate pattern seeking models using external data to predict purchase behavior and its impact on demand. Machine learning decision tree techniques were adopted in the study of Sugumaran & Sukumaran (2019) to predict sales patterns of fast-fashion products and boost sales through product bundling. The work of Choi & Suh (2020) validated a selection of data mining

techniques to develop a forecasting model that yielded the least error measures in generating forecast values compared to traditional time series models.

For causes of dead stock related to overproduction and over-ordering, strategies include developments in inventory management models and policies from the early work of Ishii, Takahashi, & Muramatsu (1988) who developed an integrated production, inventory, and distribution model as a control method to cover for rapidly changing products in the market, to the work of Teng, Cárdenas-Barrón, Chang, Wu, & Hu (2016) who developed inventory lot-size policies for deteriorating products with expiration dates where he stressed that very little attention has been given to the effects of expiration date and actual remaining shelf life on the deterioration rate of the product. This increase in deterioration rate of the product as expiration date approaches affects demand and is modeled accordingly in his study to determine the optimal inventory cycle time. The work of Deniz, Karaesmen, & Scheller-Wolf, 2020 reviewed and compared inventory policies for perishable products. He said that for models on inventory management where demand is sensitive to product age, as shown in the work of Teng, Cárdenas-Barrón, Chang, Wu, & Hu (2016), the Fixed Quantitty policy proved to be optimal as compared to the Base Stock level policy.

Reactive strategies such as lateral transshipment (Nakandala, Lau, & Zhang, 2017), product bundling (Sugumaran & Sukumaran, 2019) and other disposal strategies (Niinimaki, Peters, Dahlbo, Perry, Rissanen, & Gwilt, 2020) were also developed through the past decade. Notable papers on lateral transshipment among distributors (Hu & Yu, 2014) and retailers (Li & Yu, 2018) dealt with reactive lateral transshipment decisions and developed decision rules as to when lateral transshipment is cost effective in reducing excess inventory while preventing stockout for both perishable and non-perishable products. The costs considered in these papers covered spoilage, transshipment, penalty costs for stockout and excess stocks, carbon emissions, freshness, etc. with the general objective of preventing a stockout and optimizing vehicle speed. Other strategies include disposal by incineration (Napier & Sanguineti, 2020), disposal by donating to organizations or giving away to employees and community (Sugiono & Alimbudiono, 2020), and returning to supplier for rework or reuse (Kakarlamudi, 2018).

For management-based papers, problem analysis and problem-solving methodologies such as Root Cause Analysis (Negi & Kharde, 2021), Lean Six Sigma (Lertanantasuk, 2013), House of Risk Framework (Hakim, Atmaja, & Baihaqi, 2018) and similar tools were used to diagnose and address company or industry-specifuc causes of inventory accumulation problems. According to Sugiono & Alimbudiono (2020), slow moving stocks in the ceramics industry, if not immediately addressed, turns quickly into dead stocks. Kakarlamudi (2018), Negi & Kharde (2021) and Sugiono & Alimbudiono (2020) all recognized the importance of timely identification of potential dead stocks in the system to avoid accumulation of dead stocks in the warehouse. The conclusion that can be drawn from these studies is that it is good to recognize the importance of identifying potential dead stocks early. However, the recognition part of this dead stock management process will not happen in a consistent and sustainable manner unless effort is placed in standardizing this important first step of the dead stock management process. So far, this has not been given deliberate attention in literature.

These management-based application papers also showed that causes of dead stock are generally similar across companies/industries and include forecasting errors, overproduction/bulk purchase, too many SKUs, rapid changes in customer preference, communication gaps, IT system limitations, human capability limitations, data entry errors and data mismatch. These are then subjected to development of alternatives where single strategy solutions have been developed through the past decades to address specific root causes of excess inventory. However, the weakness of these papers is that multiple strategy alternatives were not explored quantitatively in solving dead stock problems which stem from multiple root causes in many instances. Other

notable weaknesses of papers in the management-based application track include the absence of a quantitative analysis (cost trade-offs) in recommending a strategy or a set of solutions, not to mention that the solution strategies were only applied to single entities, i.e., one manufacturer, wholesaler or retailer, in the supply chain which took away the importance of coordination and collaboration among multiple entities to more effectively solve the dead stock problem.

To summarize, literature review shows that there is an absence of an end-to-end dead stock management process that will effectively reduce dead stocks in the warehouses of retail chain store systems. Approaches have been generally situational and focuses only on specific steps of the dead stock management process. The critical gaps in the dead stock management process lies in the standardization of the recognition process, the collaboration among multiple entities, the consideration of strategy and system related cost tradeoffs in strategy mix generation, and the computed results of these cost tradeoffs upon solution recommendation.

METHODOLOGY

A comprehensive dead stock literature review and analysis was conducted on the most recent papers available. A review of the articles showed that there are mainly two streams of papers published in this field of study. These are the strategy-based papers which are tied down to specific dead stock prevention or reduction strategies. These papers mainly use mathematical modelling, simulation modelling, data mining, artificial intelligence, and other model development approaches in quantifying the decisions that must be made to theoretically solve the dead stock problem. The other stream of papers includes those that analyze the dead stock problem of specific companies or industries and propose customized solutions and quick fixes to solve the dead stock problem. These solutions are mostly not thoroughly quantified, validated and implemented.

From the two streams, each was analyzed to see how they attacked the dead stock problem from a process perspective. Strategy-based papers focus on developing, selecting, and testing alternatives mathematically to incorporate more real-life complexities and improve on previous strategy solutions. Management-based papers, on the other hand, focus on identifying the causes of non-moving inventories using proven problem analysis frameworks and then proposing both qualitative and quantitative solutions to reduce the dead stocks in warehouses. These papers begin with problem analysis given that the problem already exists.

Based on the literature review and analysis, strengths and weaknesses of recent work in dead stock management are identified in relation to the process adopted in solving the dead stock problem.
A conceptual framework for the dead stock management process is then developed to strengthen and further enhance the existing literature approaches to dead stock management.
Based on this developed process-based dead stock management framework, gaps from existing dead stock management papers are further examined and analyzed to come up with recommendations that will support a more effective end-to-end dead stock reduction approach.
Please refer to Figure 1 for the Research Methodology.

Figure 1. Research Methodology Flowchart

FINDINGS AND DISCUSSION

The conceptual process-based dead stock management framework proposed in this paper is shown in Figure 2.

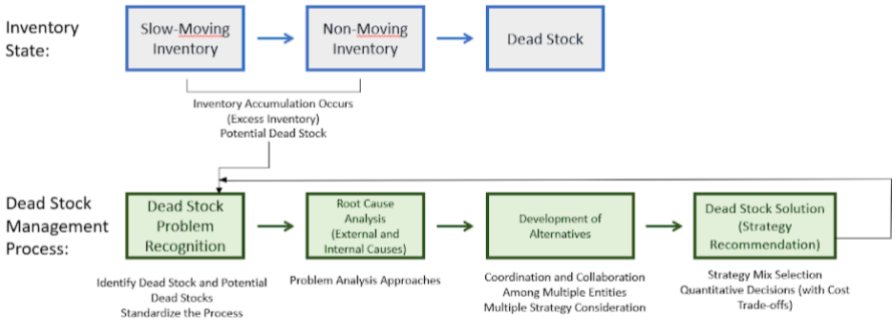

Figure 2. Conceptual Process-Based Dead Stock Management Framework

Dead stocks do not happen overnight. There are red flags and warning signals before inventories become dead stocks. The first sign is the slowdown in inventory movement. Inventory starts to accumulate at this stage, and this is where potential dead stocks threaten the inventory system. When the state of inventory shifts from slow-moving to non-movng, dead stocks accumulate and become a serious problem for most retail companies especially if warehouse space for fast-moving items becomes limited.

The conceptual framework developed seeks to standardize the process of identifying potential dead stocks in the warehouse to prevent slow moving stocks from becoming non-moving stocks, thereby significantly reducing the eventuality of potential dead stocks from turning into dead stocks. Careful thought and effort are required to standardize the problem recognition process. The objective is to recognize potential dead stocks proactively and consistently in a timely manner to prevent inventory accumulation. Inventory management systems of retail chain stores may be used independently to classify the state of inventory movement for each item in inventory based on demand. Non-moving stocks are recognized as dead stocks. Slow moving stocks, on the other hand, may be examined further as to its inventory levels and expiration dates to recognize them as potential dead stocks. Both dead stocks and potential dead stocks require priority management intervention. The data on dead stocks, potential dead stocks, and inventory stock levels should be shared horizontally across chain stores and used collaboratively to achieve inventory balance.

After problem recognition, problem analysis should be done internally to determine both external and internal root causes of inventory accumulation. External causes such as those that pertain to supplier and customer behavior, as well as internal causes such as errors in ordering should be resolved internally first before proceeding to development of alternatives. On the other hand, external causes of slow inventory movement such as competitors' pricing and promotions and

internal causes such as inventory imbalance are very good inputs the the next step of alternative strategy development.

For the development of alternatives, coordination and collaboration among retail chain stores are necessary in generating multiple alternatives that will help the retail chain store system achieve inventory balance, reduction in dead stocks, and reduction in total system inventory costs.

Once these alternatives are developed, multiple strategy selections known as strategy mix decisions are done quantitatively within and across retain chain stores based on tradeoffs between inventory management costs and strategy-specific costs. The strategy mix is then recommended as the dead stock solution for one dead stock management cycle. This cycle should be repeated regularly until dead stocks are eliminated from the warehouse through a consistent timely recognition and management intervention of potential dead stocks in the system.

CONCLUSION AND FURTHER RESEARCH

Based on literature review and analysis, the important first step in the proposed process-based dead stock management framework has not been given due attention. The need for a standardized process to ensure consistent timely recognition of the dead stock problem is a significant finding of this paper. In retail chain store systems, inventory information sharing and collaboration among individual stores are important activities that allow for strategy mix decisions in reducing the dead stock level of the retail system. The proposed framework considers and minimizes dead stock costs of the retail chain store system through timely recognition of dead stocks and an optimal balance among dead stock warehouse costs, strategy-related costs, and stockout costs across all retain chain stores.

Recommendations for further exploration include the development of a standardized process of potential dead stock recognition, a rating scheme that determines the priority level of potential dead stocks for management intervention, and a decision support model for strategy mix decisions based on cost trade-offs.

REFERENCES

Choi, B. and Suh, J.H. (2020) 'Forecasting spare parts demand of military aircraft: Comparisons of data mining techniques and managerial features from the case of South Korea', Sustainability, 12(15), pp. 1-20.
Deniz, B., Karaesmen, I., and Scheller-Wolf, A. (2020) 'A comparison of inventory policies for perishable goods', Operations Research Letters, 48(6), pp. 805-810.
Glas, A.H., Kleemann, F.C., and Essig, M. (2013) 'Bullwhip-effect and countermeasures: Case study of an asian-european automotive supply chain', International Journal of Information, Business and Management, 5(2), pp. 81-93.
Hakim, M. S., Atmaja, I. R., and Baihaqi, I. (2018). Managing dead stock spare part using house of risk framework. International Journal of Supply Chain Management, 7(3).
Hu, Z., and Yu, X. (2014) 'Optimization of fast-fashion apparel transshipment among retailers', Textile Research Journal, 84(20), pp. 2127-2139.
Ishii, K., Takahashi, K., and Muramatsu, R. (1988) 'Integrated production, inventory and distribution systems', International Journal of Production Research, 26(3), pp. 473-482.

Kakarlamudi, S. (2018) Deadstock inventory identification and disposition. Pennsylvania: Pennsylvania State University.
Kharfan, M., Chan, V.W K., and Efendigil, T. (2020) 'A data-driven forecasting approach for newly launched seasonal products by leveraging machine-learning approaches', Annals of Operations Research, 303(1-2), pp. 159-174.
Lertanantasuk, T. (2013) Dead stock reduction by the DMAIC concept: A case of construction fittings trading company. Thailand: Assumption University of Thailand.
Li, Q., & Yu, P. (2018) 'Reducing waste of perishables in retailing through transshipment' [online]. Available at: http://www.bm.ust.hk/isom/files/OM/FacultyPublications/LiQing/Rotation_Clearance_Dec2018.pdf (Accessed: 1 December 2021)
Liu, A., Zhu, Q., Xu, L., Lu, Q., and Fan, Y. (2021) 'Sustainable supply chain management for perishable products in emerging markets: An integrated location-inventory-routing model', Transportation Research. Part E, Logistics and Transportation Review, 150, p. 102319.
Nakandala, D., Lau, H., and Zhang, J. (2017) 'Strategic hybrid lateral transshipment for cost-optimized inventory management', Industrial Management + Data Systems, 117(8), pp. 1632-1649.
Napier, E., and Sanguineti, F. (2018) 'Fashion merchandiser's slash and burn dilemma: A consequence of over production and excessive waste?' [online]. Available at: https://rbr.business.rutgers.edu/sites/default/files/documents/rbr-030205.pdf (Accessed 1 December 2021)
Negi, L.S., and Kharde, Y. (2021) 'Identifying the root causes for inventory accumulation and prioritizing them using an MCDM-based TOPSIS approach. Modern Supply Chain Research and Applications, 3(2), 145-154
Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., and Gwilt, A. (2020) 'The environmental price of fast fashion', Nature Reviews Earth & Environment, 1(4), pp. 189-200.
Sugiono, N., and Alimbudiono, R. (2020) 'Slow moving and dead stock: Some alternative solutions', Proceedings of the 17th International Symposium on Management (INSYMA 2020), 2020, pp. 330-335.
Sugumaran, P., and Sukumaran, V. (2019) 'Recommendations to improve dead stock management in garment industry using data analytics', Mathematical Biosciences and Engineering, 16(6), pp. 8121-8133.
Teng, J., Cárdenas-Barrón, L.E., Chang, H., Wu, J., and Hu, Y. (2016) 'Inventory lot-size policies for deteriorating items with expiration dates and advance payments', Applied Mathematical Modelling, 40(19-20), pp. 8605-8616.
Wild, A. (2018) Best practice in inventory management. 3rd ed. England: Routledge.