

## **Literature survey**

### **Retail Store Stock Inventory Analytics**

#### **Improving inventory management in the retail store: The effectiveness of RFID tagging across product categories**

**AUTHORS: Bill C. Hardgrave, Sandeep Goyal & John A. Aloysius**

While there is a growing body of evidence that Radio Frequency Identification (RFID) tagging can be effective in improving inventory management in the retail store, retailers have little guidance on best practices for implementation. One important unresolved issue is whether tagging is equally effective across different product categories, and if there is a way to predict which categories are better candidates for deployment. We conduct a field experiment comparing the improvement in inventory record accuracy before and after implementing RFID-enabled adjustments to the inventory management system. We find evidence that the effectiveness of RFID tagging is not homogenous for all products. Reductions in the percentage of stock outs ranged from 21% to 36%, depending on category. Categories that are most likely to see a decrease in stock outs, thanks to RFID, have a greater turnover, greater sales volume, greater product variety, lower item cost, and greater inventory density. We draw inferences for retail supply chains which are considering how best to allocate their resources in the most effective manner.

#### **Relationships between inventory, sales and service in a retail chain store operation**

**AUTHORS: Chris Dubelaar, Garland Chow Paul D. Larson**

Effective inventory management is critical to retailing success. Surprisingly, there is little published empirical research examining relationships between retail inventory, sales and customer service. Based on a survey of 101 chain store units, this paper develops and tests a series of hypotheses about retail inventory. Seventy-five percent of the store owners/managers responded to the mail survey. As expected, significant positive relationships were found between inventory, service and sales. Specifically, support was found for the theory that inventory is a function of the square root of sales. Also, greater product variety leads to higher inventory, and service level is an exponential function of inventory. Finally, demand uncertainty was found to have no apparent effect on inventory levels.

## **Optimal inventory management for a retail chain with diverse store demands**

**AUTHORS: Narendra Agrawal, Stephen A. Smith**

Item demands at individual retail stores in a chain often differ significantly, due to local economic conditions, cultural and demographic differences and variations in store format. Accounting for these variations appropriately in inventory management can significantly improve retailers' profits. For example, it is shown that having greater differences across the mean store demands leads to a higher expected profit, for a given inventory and total mean demand. If more than one inventory shipment per season is possible, the analysis becomes dynamic by including updated demand forecasts for each store and re-optimizing store inventory policies in midseason. In this paper, we formulate a dynamic stochastic optimization model that determines the total order size and the optimal inventory allocation across nonidentical stores in each period. A generalized Bayesian inference model is used for demands that are partially correlated across the stores and time periods. We also derive a normal approximation for the excess inventory from the previous period, which allows the dynamic programming formulation to be easily solved. We analyze the tradeoffs between obtaining information and profitability, e.g., stocking more stores in period 1 provides more demand information for period 2, but does not necessarily lead to higher total profit. Numerical analyses compare the expected profits of alternative supply chain strategies, as well as the sensitivity to different distributions of demand across the stores. This leads to novel strategic insights that arise from adopting inventory policies that vary by store type.

## **Inventory Behavior, Demand, and Productivity in Retail**

**AUTHORS: Florin Maican, Matilda Orth**

This paper studies the factors underlying the heterogeneity in inventory behavior and performance across retail stores. We use a dynamic model of multi-product retailers and local competition to estimate store productivity and consumers' perceived quality of the shopping experience, and we analyze their relationship with inventory behavior and product variety. Using novel and detailed data on Swedish stores and their products, we find that stores learn from demand to improve future productivity. Store productivity is the main primitive that increases inventory turnover and product variety, and this increase is larger for stores with already high inventory turnover. Stores in small markets with intense competition from rivals have higher inventory turnover. Consumers in large markets and markets with large investments in technology benefit from a broader product variety. Counterfactual experiments show that the increase in inventory turnover due to innovations in productivity is three times greater when uncertainty in demand is reduced by 30 percent. Our analysis highlights important trade-offs between productivity and demand that allow retailers to reach high levels of inventory turnover and offer a broad product variety to consumers.

## **Simulation of inventory management systems in retail store**

**AUTHORS: Puppala Sridhar, C.R. Vishnu, R Sridharan**

Inventory management has become a key factor in today's world of uncertainty, particularly in the retail sector. Accordingly, there is a high requirement of managing and controlling the inventory with appropriate policies to elevate the organization's performance. In fact, a proper system has to be implemented for monitoring customer demand. This system will, in turn, assist in maintaining the right level of inventory. In this direction, the present research focuses on a retail store and explores a solution for an inventory-related problem experienced by the firm. A simulation model is developed and run for particular merchandise using Arena simulation software. Rigorous experimentation is conducted with the model by altering the inputs/model characteristics, and a more effective system is proposed. Compared with the existing traditional inventory management system, the proposed system will reduce the inventory level by 40% and lost sales by 87%. Furthermore, the proposed system is optimized using the Opt Quest module in Arena simulation software. As a result, the inventory level is further reduced by 73% compared to the existing system. Store managers in various organizations may utilize the proposed methodology for improving their inventory management system.

## **Application and Analysis of Retail Inventory Using Data Mining Techniques**

**AUTHORS: MD. Imtiaz Uddin, Tanvir Ahmed, A.H.M Saiful Islam, Redoyan Raz, Tanvir Ahmed, A.H.M Saiful Islam**

Data mining is one of the most essential tools for gathering information from different datasets in almost all recent industries. In this 21st-century, data mining gained attention because of its significance in decision making, and it has become a key component in various industries such as retail. Inventory management requires pre-planned goals and attention to detail, and prioritizing items that require less attention can be a waste of time and resources. Learning indications about customers' shopping patterns by showing associations among various provides significant value in managing retail inventory. In the present research paper, popular data mining techniques have been applied and analyzed for multi-item inventory management in retail sales stores to show how data mining techniques can optimize and organize the retail inventory.

## **Retail supply chain management: a review of theories and practices**

**AUTHORS: Zuo-Jun (Max) Shen, Yi Pan, Deng Ge.**

Retail business has been rapidly evolving in the past decades with the boom of internet, mobile technologies and most importantly e-commerce. Supply chain management, as a core part of retail business, has also gone through significant changes with new business scenarios and more advanced technologies in both algorithm design and computation power. In this review, we focus on several core components of supply chain management, i.e. vendor management, demand forecasting, inventory management and order fulfillment. We will discuss the key innovations from both academia and industry and highlight the current trend and future challenges.