INVENTORY MANAGEMENT SYSTEM FOR A RETAIL STORE TO OPTIMISE INVENTORY

Submitted on: Word Count:

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BSc Data Science and Computing Final Project Report

Birkbeck College, University of London, 2025

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# Abstract

Retail businesses are increasingly reliant on data to drive operational efficiency and decision-making. High-quality data is essential to ensure smooth business operations and maintain customer satisfaction. However, poor inventory management practices and data inaccuracies can lead to significant challenges, such as stockouts, overstocking, inefficient resource allocation, and missed sales opportunities. These issues can manifest as operational inefficiencies and financial losses that reduce trust in systems and processes.

When inventory management systems (IMS) cannot provide accurate, real-time data, staff must adopt workarounds, leading to inefficiencies and errors. Persistent issues can result in a loss of user confidence, resulting in reliance on external solutions or manual processes that further reduce productivity. It is insufficient to solely address data inconsistencies; businesses must understand and mitigate the broader impacts on operations and decision-making.

This project seeks to address these challenges by developing a tailored IMS that empowers retail businesses to maintain accurate stock levels, streamline operations, and enhance decision-making capabilities. By enabling real-time tracking, actionable insights, and user-friendly interfaces, the system aims to improve inventory management processes and ensure alignment with business objectives.

The solution also acknowledges the limitations of existing systems, such as high costs, complexity, and a lack of flexibility. By providing a custom-built alternative, this project offers retailers a simplified yet robust system meeting specific requirements while fostering trust, operational efficiency, and strategic agility.

Contents

[Abstract 1](#_Toc197023493)

[Introduction 3](#_Toc197023494)

[Aims and Objectives 5](#_Toc197023495)

[Project Objectives 5](#_Toc197023496)

[Literature review and context 6](#_Toc197023497)

[Case Studies 6](#_Toc197023498)

[References 8](#_Toc197023499)

[Appendices 9](#_Toc197023500)

# Introduction

The increasing demand for IMSs emphasises its importance in modern retail operations, with an estimated 57% of retail enterprises increasing investments in software in 2024 “according to Gartner”[1] and this combined with the estimated annual growth of its market value by 9.7% of IMS’s between 2024-2031[2]. The challenges faced by retail businesses include increasing customer expectations, navigating supply chain complexities, increased procurement and infrastructure costs, and rapid technological innovations. Customers now demand a user-friendly interface, a smooth shopping experience, accurate product description, and availability and timely delivery of products; this increases the importance of an efficient IMS. Also, disruptions with supply chains magnified by events out of businesses’ control such as the COVID-19 pandemic have stressed the importance of having resilient and adaptable systems. Addressing these concerns with an efficient IMS becomes an important factor for long-term sustained success for retail businesses.

Additionally, the impact of social media and frequently changing consumer habits can affect how businesses are perceived, thus accentuating the importance of a smooth customer experience when shopping and an IMS is key to this. This also drives and improves operational efficiency and customer satisfaction, which is vital in the current age due to increasing competition from similar retailers and potentially negating the negative impacts of social media. Insufficient management of stock also directly impacts finances with 62% of businesses’ finances affected by failure in inventory tracking[3], this immediately impacts cash flow stock capacity being one reason why businesses may fail. There is also the missed opportunity of sales and promotional optimisation, and stock shrinkage.

This project aims to address these challenges and provide a solution to mitigate them as much as possible while also being flexible enough to adapt to differing requirements. By implementing a robust IMS, the project seeks to ensure accurate, real-time tracking of stock levels, maximise efficiencies, and reduce the risk of stockouts or overstocking. The system will also include features such as insights through data analysis, and user-friendly interfaces to improve accessibility. The solution aims to enhance operational efficiency, customer satisfaction, and long-term business resilience.

Due to rapid technological advancements, the IMS can be distributed across multiple platforms, enabling the creation of applications and software. This approach allows users to view, manage, and access data seamlessly while incorporating Role-Based Access Control (RBAC) to ensure secure and restricted access based on user roles.

Existing IMSs share similar features to those proposed in this project. These include:

1. **QuickBooks Commerce**: This solution offers a platform for managing inventory, orders, and sales. It includes features such as real-time stock tracking, barcode scanning, and a user-friendly interface that can integrate with multiple e-commerce platforms. Like the proposed system, QuickBooks Commerce focuses on maximising efficiency, improving stock visibility, and enabling scalability to its inventory management processes.
2. **Cin7**: This solution is a cloud-based IMS designed to handle inventory, point of sale, and order management across multiple channels. Cin7 is known for its real-time tracking features, automation tools, and advanced reporting capabilities. It also incorporates role-based access control (RBAC), which is a key feature of the proposed system, ensuring secure management of inventory data based on user roles.
3. **NetSuite ERP**: This solution is a leading enterprise resource planning system; NetSuite offers a comprehensive IMS as part of its suite of business solutions. It includes features such as real-time inventory tracking, barcode scanning, and advanced analytics. NetSuite's scalability and integration capabilities make it suitable for businesses of all sizes, aligning with the project’s goal of developing a flexible and adaptable solution for diverse retail needs.

These examples illustrate the types of IMS solutions currently available and demonstrate how the proposed project fits within this evolving landscape. By incorporating similar features—such as real-time tracking, and role-based access control—the proposed system aims to enhance operational efficiency and resilience, responding to the challenges faced by modern retailers.

The challenges posed by global supply chain complexities and disruptions, such as those experienced during the COVID-19 pandemic, highlighted the necessity for adaptability and resilience in IMSs. The context has shaped the project to prioritise real-time tracking and accurate data management, enabling businesses to respond effectively to uncertainties. Additionally, evolving customer expectations for seamless shopping experiences have driven the inclusion of user-friendly interfaces and rapid data accessibility to enhance customer satisfaction and operational efficiency.

Financial risks linked to inventory mismanagement, such as stock shrinkage and increased carrying costs, further influenced the project's design. Features like role-based access controls will be integrated to enhance security and ensure system reliability. By addressing these contextual challenges, the project aims to provide a robust and adaptable solution tailored to the strategic needs of modern retail businesses.

The remainder of this report is structured as follows: **Chapter 2** outlines the project's aims and objectives, focusing on its specific goals and expected outcomes. **Chapter 3** provides a literature review, contextualising the relevance of IMSs in the current retail landscape and examining existing solutions and theories. **Chapter 4** details the methodology used to design and develop the system, including the tools and frameworks selected. **Chapter 5** specifies the system requirements and design principles, describing how the proposed solution addresses the identified needs. **Chapter 6** focuses on the development of the project. **Chapter 7** focuses on the implementation process, elaborating on how the system's components were developed and integrated. **Chapter 7** analyses the system's functionality, efficiency, and performance. **Chapter 8** presents the results, evaluating the system's impact and highlighting its benefits. **Chapter 9** discusses the implications of the findings, exploring challenges encountered and potential improvements. Finally, **Chapter 10** concludes the report, summarising the project's contributions and proposing directions for future work.

# Aims and Objectives

This project aims to design and implement an efficient and adaptable Inventory Management System (IMS) tailored to meet the complex needs of modern retail businesses. This system aims to improve operational efficiency, enhance customer satisfaction, and ensure long-term business resilience by providing real-time tracking of inventory, optimising stock levels, and incorporating features such as role-based access control (RBAC). By addressing the growing challenges of inventory mismanagement, supply chain disruptions, and evolving consumer demands, the system will help businesses streamline their operations, reduce costs, and improve their responsiveness to market changes.

## Project Objectives

To achieve the aims of the project, the following objectives have been defined with measurable outcomes:

1. Analyse the challenges faced by retail businesses in inventory management.
   1. **Outcome**: A detailed understanding of the key issues related to stock accuracy, supply chain, and customer expectations. This will inform the IMS design to address problems.
   2. **Measurable Outcome**: A report summarising key findings and identifying the most pressing inventory management issues.
2. Design the architecture and features of the proposed IMS
   1. **Outcome**: A detailed proposal of the IMS, including features like real-time stock tracking, RBAC, and data analysis, prioritising scalability, user-friendliness, and security.
   2. **Measurable Outcome**: A finalised design document, including system architecture diagrams and feature specifications.
3. Develop the IMS system, focusing on core functionality and integration with external platforms.
   1. **Outcome**: The development of the IMS software allows seamless inventory management across platforms, with core features such as real-time tracking, and multi-platform accessibility.
   2. **Measurable Outcome**: A functioning prototype of the IMS with core features.
4. Implement user testing and feedback collection to refine the system.
   1. **Outcome**: Identify and resolve any user experience issues, bugs, or feature gaps ensuring the system meets end-user expectations.
   2. **Measurable Outcome**: User feedback reports and a list of improvements made based on testing.
5. Assess the effectiveness of the IMS in addressing the challenges through performance metrics.
   1. **Outcome**: Evaluation of system success in solving the inventory management issues identified in objective one. Key performance indicators (KPIs) like stock accuracy levels, time saved in inventory tracking, and user satisfaction to measure success.
   2. **Measurable Outcome**: A report documenting the system's performance against KPIs.
6. Provide recommendations for future improvements and scalability of the IMS.
   1. **Outcome**: A plan for improving the IMS, including new features, improvements to the user interface, and scaling the system for larger businesses.
   2. **Measurable Outcome**: A report with proposed improvements, reinforced by user feedback and system performance data.

By defining and achieving the set objectives, the project aims to deliver a functional, scalable, and user-friendly IMS addressing challenges faced by retail businesses, improving operational efficiency, and providing long-term value.

# Literature review and context

Effective inventory management is essential to business operations, directly impacting profitability, efficiency, and customer satisfaction. Reports show that 20-40% of most businesses' working capital is tied up in inventory, highlighting its importance in financial management. Poor inventory practices can lead to major consequences, evidenced by the findings of a Tuck Business School study, which identified 117 errors in 25 sample spreadsheets. While 40% of these errors had minimal impact, seven resulted in severe losses ranging from $4 million to $110 million[6]. Additionally, inventory mismanagement due to out-of-stock and overstocked products was projected to cost retailers $1.77 trillion worldwide in 2023, according to IHL Group[10].

Apple CEO Tim Cook, famously likened inventory to dairy products, stating, “No one wants to buy spoiled milk.” Under Cook’s leadership, Apple adopted just-in-time manufacturing, slashing its inventory turnover time from months to as little as five days, demonstrating the value of strategic inventory control[7]. Examples from major companies illustrate the risks of mismanagement. Nike faced significant challenges in the early 2000s, losing approximately $100 million in sales due to inventory problems[8]. Similarly, retail giants Kohl’s and Nordstrom recently experienced sharp declines in profit margins due to excess inventory, requiring major discounts to clear stock[9]. This shows that even industry leaders are susceptible to the dangers of poor inventory management.

The studies below explore various inventory management challenges and solutions across different sectors, drawing lessons from successful and failed implementations.

## Case Studies

1. **Goods Order Inventory System and Shopify Integration (Home Appliances Retailer)[4]**
   1. Challenges
      1. Manualworkflows lead to order delays.
      2. Fragmentedinventory tracking and lack of real-time data.
   2. Solutions
      1. Adoption of Goods Order Inventory integrated with Shopify.
      2. Real-time inventory tracking, barcode systems, and automation of processes.
   3. Results
      1. Improved efficiency, reduced manual errors, and improved customer satisfaction.
2. **Wasp Barcode Inventory Solution (Topgolf)[5]**
   1. Challenges
      1. Dependence on spreadsheets leads to inefficiencies and errors.
      2. Lack of visibility into inventory levels across multiple locations.
   2. Solutions
      1. Implementation of Wasp's inventory tracking system.
      2. Real-time updates, automated tracking, and streamlined order processing.
   3. Results
      1. Significant time savings, improved accuracy, and reduced stress on operations.
3. **Inventory Management Lessons from Industry Giants[6]**
   1. Examples: Nike, Best Buy, Target Canada, and KFC.
   2. Challenges and Failures:
      1. Excess inventory and inaccurate demand forecasting (Nike).
      2. Stock-outs during peak seasons (Best Buy).
      3. Poor implementation of new systems leading to operational breakdowns (Target).
      4. Supply chain disruptions causing widespread store closures (KFC).
   3. Lessons Learned
      1. The importance of robust forecasting systems, reliable supply chain partners, and scalable technology solutions.

The challenges and successes highlighted in the case studies and industry examples provide key insights framing the context of this project. From Apple's adoption of just-in-time manufacturing to Topgolf's implementation of automated inventory tracking, it is clear that technological integration and strategic planning are key to effective inventory management. Equally, failures like Nike's demand forecasting issues or Kohl’s struggles with excess inventory demonstrate the consequences.

This project seeks to build on these lessons by examining how businesses, especially smaller or resource-constrained ones can adopt scalable, adaptable inventory management practices tailored to their specific operational needs. While current research and case studies emphasise the importance of advanced technology and robust forecasting systems, this project will explore how these principles can be effectively applied in smaller organisations, by positioning the project within the broader context of successful and failed inventory management strategies.

# References

All references should be cited in the body of the report

● All references should be listed in an alphabetical order

● Please use the Harvard Referencing system

● There might be literature that has not been cited in the report

✔ List this literature in a separate Bibliography section, following the References section

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# Appendices

User Manual

● Relevant code

● Technical information

● Transcripts of interviews that might have taken place

● Detailed data

● Extensive presentation of test, or evaluation, results

✔ Link to this section from from within the main text in the results, or discussion