DEVELOPING A DATA VISUALIZATION DASHBOARD FOR DECISION SUPPORT IN MULTI-BRANCH SHOP ORDERING: A CASE STUDY OF A DRUGSTORE IN PHITSANULOK, THAILAND

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Submitted: 6 December 2024
Revision received: 14 December 2024
Accepted: 19 December 2024

Abstract

Managing inventory efficiently across multiple branches poses significant challenges, particularly in the drugstore industry. This paper explored these challenges through a case study of drugstores in Phitsanulok, Thailand, which operate under a central ordering system yet struggle with discrepancies between ordered and received inventory due to a lack of visibility across branches. To address these inefficiencies, we proposed a data visualization dashboard designed to support inventory decisions and enhanced inventory management by providing updated inventory data for all branches. This study introduced a conceptual framework for the dashboard, analyzing current ordering processes, identifying key challenges, and suggesting system improvements. Our findings suggest that implementing such a dashboard can significantly improve decision-making and operational efficiency, serving as a model for similar multi-branch businesses.

Keywords: Business intelligent, Dashboard, Decision making, Inventory, Procurement

1. Introduction

In recent years, businesses with multiple branches have faced significant logistical challenges, particularly in inventory management. These businesses often face the dual task of managing a centralized inventory while also keeping track of individual stock levels at each branch. This configuration necessitates a smooth integration of inventory data across the network to ensure efficiency and accuracy in stock replenishment and order fulfillment (Axsäter, 2015). The requirement for such integration becomes particularly critical in sectors where service delivery impacts health and safety, such as the drugstore industry.

Drugstores play a key role not only in retail but also in the healthcare system, dealing directly with consumer health needs. They must efficiently manage two major operational aspects: customer service and management their internal processes such as procurement or inventory management. The customer service process involves managing prescriptions, advising customers, and selling over-the-counter products, while the internal processes entail ordering, receiving, and managing inventory. Balancing these processes requires precise inventory management to prevent stockouts and overstock situations, which can directly affect service quality and operational costs (Singh *et al*., 2015). Despite the availability of advanced technologies capable of showcasing real-time inventory levels, these systems often need to be personalized specifically to the unique demands of the drugstore sector. Generic systems may not address the nuances of pharmaceutical management, such as compliance with health regulations, handling of perishables, and managing controlled substances, which demand stringent oversight and tracking.

In response to these challenges, this paper proposes the conceptual development of a data visualization dashboard to aid decision-makers in managing inventory across all branches of a drugstore chain. The goal is to harness technology to streamline the ordering process by offering comprehensive visibility into inventory status, thus enabling informed decision-making, and enhancing operational efficiency. The effectiveness of the proposed system will be analyzed through a case study of a drugstore in Phitsanulok, Thailand. This study will assess how the dashboard can bridge

the gap between inventory management needs and the demand for data visibility, crucial for supporting key business operations. Through this investigation, we aim to demonstrate the transformative potential of such technological advancements in inventory management for multi-branch businesses, with the drugstore industry serving as a primary example.

2. Literature Review

The ordering process in multi-branch shops is inherently complex, requiring coordination across various locations to ensure product availability and customer satisfaction. One significant limitation in this system is the lack of real-time inventory data, which makes it exceedingly difficult for decision-makers to effectively manage stock levels (Cheng & Chou, 2008; Jian-fang, 2008). Without real-time data, branches may face frequent issues with understocking or overstocking, leading to lost sales or increased holding costs, respectively (Shinde, 2023; Xu *et al*., 2009). The inability to access updated inventory information in a timely manner also hampers the efficiency of supply chain operations, as decisions are often made based on outdated or incomplete data. This gap in information can significantly impact the overall responsiveness and agility of the business, leading to inefficiencies that affect both the top line and the bottom line.

The integration of advanced technologies, particularly business intelligence and data analytics tools like Microsoft Power BI, has revolutionized the management of inventory across distributed retail environments. These tools support the creation of interactive, real-time dashboards that can aggregate and visualize data from multiple branches simultaneously. By implementing such technology, businesses can gain instant insights into inventory dynamics, which facilitates rapid decision-making and better alignment of supply with demand. The use of Microsoft Power BI in inventory management has been explored in various studies. Ridho (2023) emphasizes the need for a Business Intelligence (BI) Dashboard to monitor IT software asset inventory, which can be effectively addressed using Power BI. Parks (2014) highlights the self-service business intelligence features of Power BI, which can help in visualizing data and

sharing insights. Liu (2022) demonstrates the application of Power BI in sales forecasts, which can be extended to inventory management for demand forecasting.

Moreover, dashboards can be customized to highlight key metrics such as sales trends, stock turnover rates, and potential shortages, enabling managers to proactively adjust their strategies rather than reacting to crises. This technological advancement not only optimizes inventory management but also enhances operational efficiency and improves service levels across all branches (Vlahakis *et al*., 2020). Numerous research studies have applied dashboards to support decision-making across various fields. Examples include dashboards supporting dynamic pricing decisions in wholesale (Chapparadalli, 2019), a decision support system for procurement operations (Moynihan *et al*., 2006), the adoption of e-procurement for savings in staff time (Aisbett *et al*., 2005), and the use of proactive decision-making to enhance efficiency, agility, and cost management in supply chains (Vlahakis *et al*., 2020).

Given the considerable benefits demonstrated by existing research and case studies in various sectors, we propose the implementation of a customized Power BI dashboard tailored specifically for multi-branch shop ordering processes. This solution is designed to streamline operations, enhance decision-making accuracy, and improve overall supply chain efficiency. By adopting this advanced technological approach, multi-branch shops can expect not only to overcome the current limitations but also to achieve greater operational agility and competitive advantage. Therefore, moving forward with the development and deployment of a Power BI dashboard is not just an operational improvement but a strategic necessity for modern retail environments.

3. Methodology

This section outlines the methodology of the research as depicted in Figure 1, which comprises four steps for the development and evaluation of a data visualization dashboard for decision making support for a multi-branch shop in the ordering process.

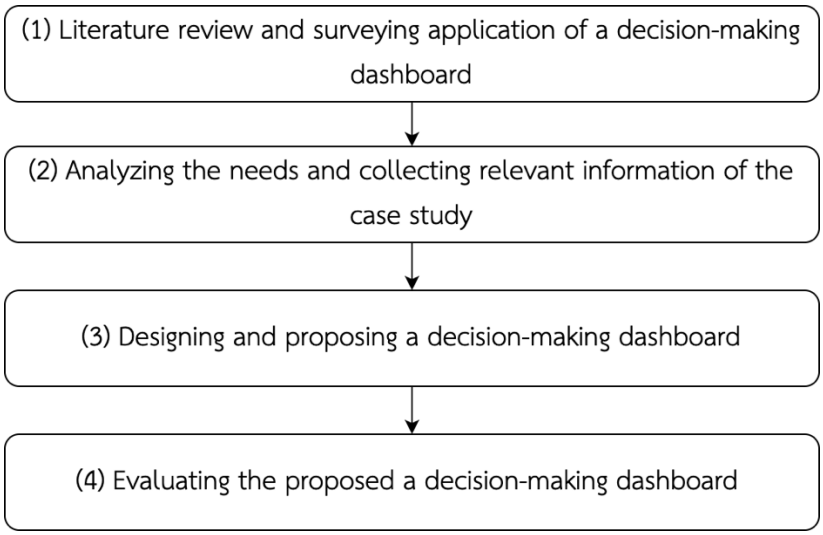


Figure 1 Research Methodology

Initially, a literature review and survey of existing data visualization dashboard applications establish a foundational understanding, essential for informing the subsequent design process. In this study, a drugstore serves as the case study. The second step involves a deeper analysis of the drugstore's specific needs and the collection of relevant information, while also reviewing additional literature to solidify the theoretical framework underpinning the dashboard. This step includes designing a preliminary dashboard using feedback from the case study to ensure alignment with operational requirements. The design is then refined and implemented using Microsoft Power BI, chosen for its robust data visualization capabilities. The final step involves evaluating the effectiveness of the dashboard by comparing error rates, such as the number of incorrect orders, before and after its deployment, and assessing user satisfaction. For instance, this evaluation might demonstrate a decrease in the percentage of incorrect orders received following the implementation of the proposed system.

4. Case Study

This section describes a case study which is a drugstore located near Nuresuan University, Phitsanulok, Thailand. This store mainly provides services to students, teachers, and residents while also serving as a training center for pharmacy students.

The pharmacy collaborates primarily with another branch from which it orders products. However, it operates on a standalone system that does not support data linkage between branches.

The operational processes of the pharmacy are included: 1) Customer service, which includes taking medical histories, selecting, and dispensing pharmaceuticals, and educating customers about the properties and usage of medical supplies and medicines. 2) Internal operations, which encompass the ordering process, inspection of received goods, logging products into the system, managing inventory, and checking drug expiration dates.

The internal ordering operations start with placing orders for medical supplies, where specific items and quantities are specified and sent to a primary supplier, which could be another branch, a pharmaceutical company, or a wholesale store. Upon receiving the goods, the pharmacy staff checks the quantity and expiration dates of the medicines. Products are then logged into the system according to the order list. Care is also taken in the placement of products on the shelves to ensure accuracy and prevent errors.

5. A Data Visualize Dashboard to Support Decision in Ordering Process of Multi-Branche Shop

In this section, we present a conceptual data visualization dashboard designed to support the decision-making process for ordering in multi-branch shops, as demonstrated in our case study. Figure 2 depicts a proposed enhancement to a drugstore's inventory management system, which integrates a decision support system into the ordering process. The existing system, equipped with inventory tracking, stock control, and reporting functionalities, communicates with a centralized database. However, it lacks updated feedback for decision-makers at critical moments. To address this gap, we propose an extended system where data is processed using Microsoft Excel and visualized through a Power BI dashboard, providing essential information for salesclerks, pharmacists, and store managers. This proposed system aims to enhance inventory visibility and decision-making efficiency across multiple

branches, ensuring that decision-makers have all the necessary information to make informed choices.

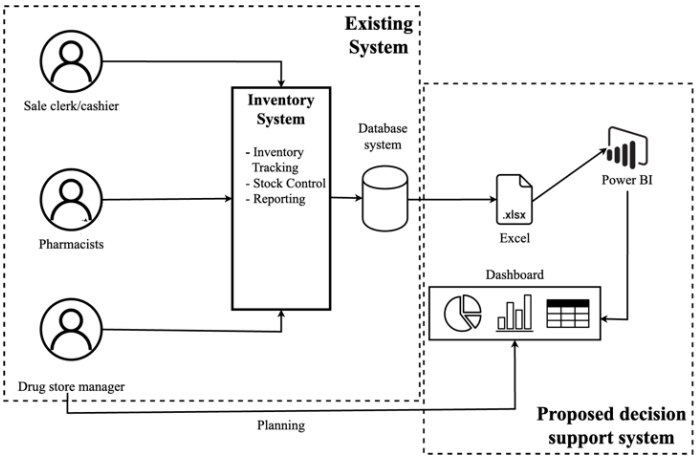


Figure 2 The proposed system.

In the case study, there are two branches for drugstore which share some part of their inventory. This proposed dashboard enables the decision maker of the case study to easily check the current inventory status at both branches by simply downloading an Excel document and importing it into the Microsoft Power BI program. This system streamlines decision-making, saves time, and reduces errors in the ordering and receiving processes. Additionally, the dashboard displays data in various formats such as charts, graphs, tables, and includes report filters that allow users to drill down into the data and focus on specific information of interest.

The proposed dashboard provides a single-screen overview of the total inventory at the second branch and the quantities that should be ordered, facilitating easy navigation and efficient management. It also allows for the recorded information to be used to create reports and analyze data related to product orders. The proposed dashboard is structured into four pages as follows:

- **Home**: As illustrated in Figure 3, this page displays the total number of products, the quantities that should be ordered, and products that are nearly out of stock, offering a comprehensive view of the ordering decisions for the case study

- **Low-level stock**: This page provides details of the items that need to be ordered and displays them in a bar chart to effectively compare the quantities of products that are low in stock. This visual representation is fundamental for decision-makers to assess which products are nearing critical low levels and may require immediate ordering. By presenting the items in a bar chart from the smallest to the largest quantity, it helps prioritize orders based on urgency and stock levels, as shown in Figure 4.

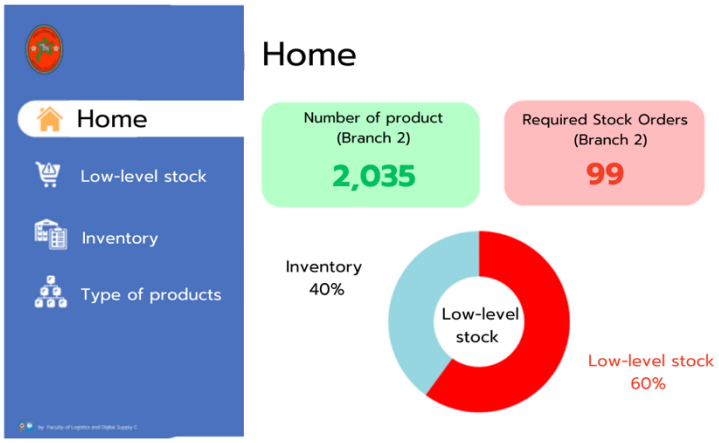


Figure 3 An example proposed dashboard screen: home

- **Inventory**: Displayed in Figure 5, this page shows details of medical supplies from both branches, such as medicines, medical equipment, herbs, and cosmetics, in bar charts for easy comparison of product quantities between the case study and Branch 1.

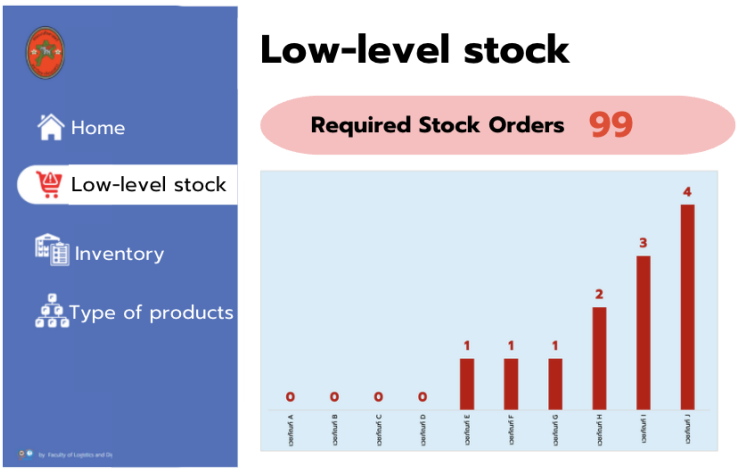


Figure 4 An example proposed dashboard screen: low-level stock

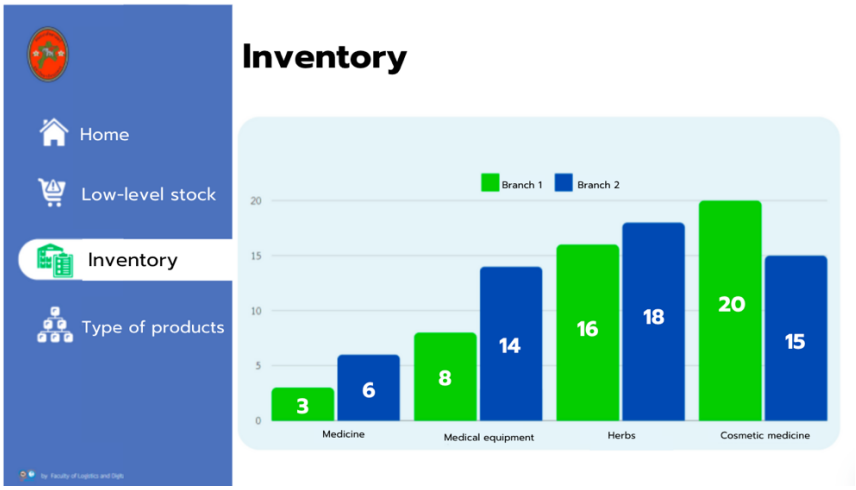


Figure 5 An example proposed dashboard screen: inventory

- **Type of products**: As shown in Figure 6, this page details the types of medical supply products in the warehouse, including product code, product list, and quantity for each item. It also highlights products that are nearly out of stock according to product type, simplifying purchasing decisions across various product categories.

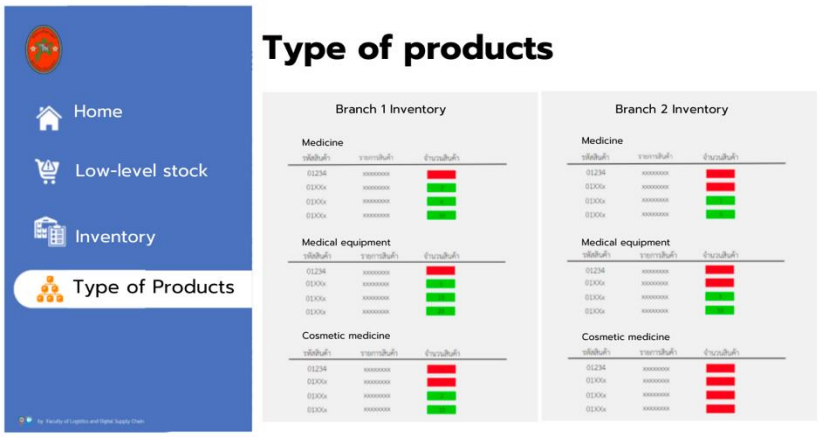
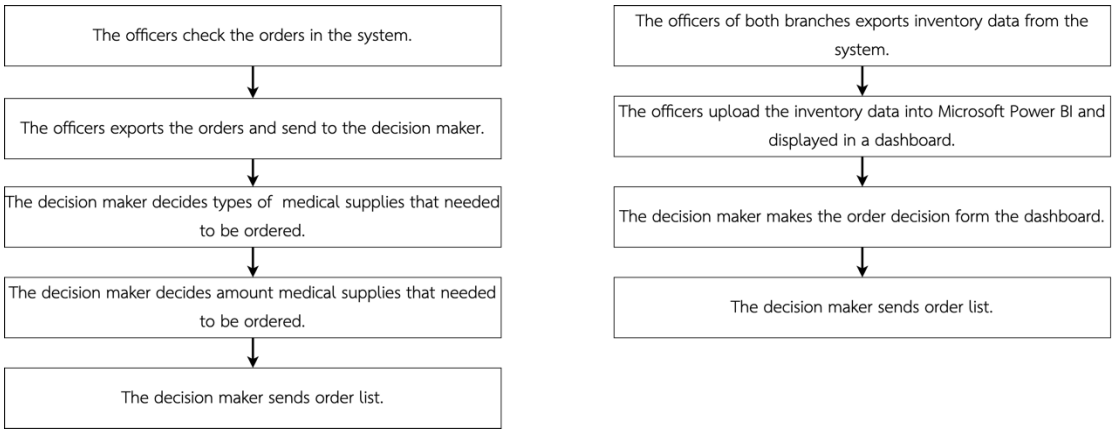


Figure 6 An example proposed dashboard screen: type of products

6. Expected Results and Discussion

From the previous section, we have explained the proposed dashboard. In this section, we illustrate the expected results of utilizing the dashboard. By developing a decision-making dashboard for ordering using the Microsoft Power BI program, the ordering process is anticipated to become more efficient. The comparison of the processes before and after implementing the dashboard is shown in Figure 7.

The current process, as shown in Figure 6 (a), involves manual checks of orders in the system by officers, followed by exporting and sending these orders to the decision maker, who then decides on the types and amounts of medical supplies needed. This method is time-consuming and error-prone, involving multiple steps of handling and transferring data. In contrast, the revised process (Figure 6 (b)) introduces the dashboard to enhance efficiency, reducing the number of steps from 5 to 4. Officers from both branches directly export inventory data to Microsoft Power BI, which is then displayed on a dashboard. This integration allows the decision maker to access real-time inventory data and make informed ordering decisions directly from the dashboard. The availability of real-time data not only simplifies the workflow but also ensures more accurate and timely order placements, leading to more precise decision-making and minimizing errors associated with manual data handling.



(a) Before (b) After

Figure 7 The ordering process comparison

7. Conclusion

Due to one of the limitations in the ordering process of a multi-branch shop, particularly the lack of shared inventory information across multiple branches, complexities often arise in the receiving process. Each branch operates independently without real-time access to the inventory levels of others, leading to inefficient and unnecessary processes. For the case study, the decision makers are required to predict the inventory that other branches can supply, resulting in wasted time and effort in guessing and comparing product list information. To address these challenges, a conceptual framework for developing a data visualization dashboard for supporting ordering medical supplies for the case study is proposed. The aim is for the dashboard to ease constraints in the ordering process by displaying inventory quantities from both branches in various graphical formats, thereby supporting quick and convenient decision-making. In developing the dashboard, the goal was to create a tool that responds to these emerging challenges and aligns with the operations of the case study. The proposed dashboard will be practically applicable in the future, representing a technological adjustment to enhance organizational operations by providing essential inventory visibility across branches.

From the literature, it highlights the critical issue of lacking real-time inventory data, leading to challenges such as understocking, overstocking, and inefficient decision-making due to outdated or incomplete information (Cheng & Chou, 2008; Jian-

fang, 2008; Xu et al., 2009; Shinde, 2023). The proposed dashboard addresses these challenges by providing real-time inventory visibility across branches, enabling proactive stock management and timely decision-making. Unlike traditional systems, it enhances operational efficiency and reduces stock-related risks. This technological solution aligns with literature findings, offering a practical adjustment to improve supply chain operations and meet modern organizational needs.

This study represents an initial step towards implementing a decision-making system for a drugstore case study, focusing primarily on data visualization to support decision-making processes. At this stage, the case study is constrained by limited resources, which restricts the deployment of a fully automated system. Current limitations include the lack of advanced tools for automatically updating data and insufficient human resources, requiring that data updates be conducted manually by staff. Consequently, this paper only addresses the development and application of a data visualization dashboard. However, further research involves proposing a more comprehensive system that will automate supply ordering decisions by providing precise recommendations on the quantity of supplies needed, as well as the optimal times and locations for placing orders, thereby offering enhanced support to decision-makers in managing the supply ordering process.

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