DESIGNING A PARCEL SORTING AREA FOR DELIVERY USING ABC ANALYSIS THEORY FOR A DISTRIBUTION CENTER OF COURIER COMPANY IN NONG BUA LAM PHU PROVINCE

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Abstract

The objectives of the research were 1. Reduce errors in parcel sorting for delivery at distribution center of courier company, 2. Design a parcel sorting area for delivery by applying the ABC Analysis theory for distribution center of courier company. The study focuses on a distribution centers of courier company located in Nong Bua Lamphu province. The ABC Analysis theory, which prioritizes categorization, labeling, grouping, and systematic zone arrangement, is applied to optimize the sorting process and align with delivery time requirements. This quantitative research employs an experimental approach. The population consists of 10 participants, including managers and sorting staff from the distribution centers of courier company. Data were collected through unstructured interviews and direct observation. Error data from parcel sorting processes before and after improvements were recorded and analyzed using the ABC Analysis framework to evaluate the impact of the redesigned sorting area. The findings revealed that applying ABC Analysis to redesign the sorting area significantly reduced sorting errors. Before the redesign, 85 sorting errors were recorded, while after the redesign, errors dropped to 31, reflecting a reduction of 54 errors. Therefore, implementing the ABC Analysis approach is proven to be effective in enhancing operational efficiency, expediting parcel management, minimizing sorting errors, reducing operational costs, and increasing customer satisfaction with the service.

Keywords: ABC Analysis, Warehouse Layout Design, Distribution Center

Introduction

The transportation and logistics industry plays a crucial role in driving economic growth and supporting e-commerce, particularly in Thailand, where the parcel delivery business has rapidly expanded alongside the rise of online shopping. Sub-distribution centers, as integral components of parcel delivery operations, face numerous challenges, especially in handling the large volume of parcels processed daily.

One significant issue is sorting errors, which can result from inaccuracies in parcel categorization, the complexity of operational processes, or ineffective management. These errors often lead to misrouted parcels, delivery delays, customer dissatisfaction, and reduced overall operational efficiency. Addressing these challenges is essential to maintaining service standards and minimizing costs associated with delivery errors.

A promising solution to this problem is the application of ABC Analysis, a theory that prioritizes items or parcels based on their value or volume. By incorporating ABC Analysis into the parcel sorting process, organizations can improve the accuracy of handling high-priority parcels, reduce sorting errors, and enhance operational efficiency.

This study focuses on analyzing and applying the ABC Analysis theory to the parcel sorting system at sub-distribution centers of parcel delivery companies. The goal is to redesign the sorting area to streamline delivery operations, reduce errors, and improve overall efficiency. This research aims to serve as a guideline for minimizing mistakes and optimizing the performance of the delivery process.

Research Objectives

1. Reduce errors in parcel sorting for delivery at distribution center of courier company.
2. Design a parcel sorting area for delivery by applying the ABC Analysis theory for distribution center of courier company.

Scope of the Research

1. Population Scope

The key informants for this study comprised 10 individuals: 2 executives, 2 team leaders, and 6 employees responsible for parcel sorting.

2. Time Scope

In this study, the researcher conducted data collection, analysis, interpretation, and prepared the research report over a period from July to November 2024.

3. Spatial scope

The study was conducted in a distribution center of courier company located in Nong Bua Lamphu Province.

Literature Review

Warehouse management

Warehouse management involves overseeing and organizing all aspects of warehouse operations to ensure efficiency. This includes the entire process, from receiving products into the warehouse to dispatching goods for sale or consumption. It encompasses warehousing, inventory management, equipment maintenance, restocking, order packing, deliveries, tracking, and enhancing overall warehouse performance.

The objectives of warehouse management are to minimize movement distances, optimize space usage, ensure that labor, tools, equipment, and other resources are adequate and aligned with business requirements, and maintain satisfaction among those handling goods. The management process uses purchasing quantities and delivery needs as criteria to plan, control, and sustain the efficient use of resources, all while providing services at a cost-effective level suited to the business's scale.

The benefits of effective warehouse management include reducing transportation and production costs, taking advantage of bulk purchase discounts, preventing stock shortages, supporting the business's customer service strategy, and enhancing the ability to adapt to changing market conditions.

Warehouse Layout Design

The design of warehouse spaces is a critical aspect of logistics and supply chain management, influencing operational efficiency and productivity. This literature review synthesizes key findings from various studies on warehouse layout design, focusing on frameworks and methodologies that enhance functionality and adaptability.

A systematic approach to warehouse layout design is essential for optimizing space utilization and workflow efficiency. The design process can be structured into seven steps: investigating the current situation, determining operating policies, selecting equipment, forming a general layout, allocating aisles, determining space usage, and evaluating alternatives.

Space allocation is a pivotal factor in warehouse design. The literature indicates that careful planning of aisle widths and storage areas significantly impacts material handling efficiency. For instance, pathways between storage units should be designed to accommodate both manual and powered equipment, with recommended widths ranging from 0.75 to 1.00 meters (Pinumka K. et al, 2023). This ensures smooth operations and minimizes congestion during picking and stocking activities.

Several methodologies have been proposed to enhance warehouse layout design. The Systematic Layout Planning (SLP) method is one such approach that emphasizes the importance of analyzing activity relationships and grouping products based on their handling frequency. A study by Pinumka K. et al. (2023) applied SLP to a case study of a distribution center, demonstrating its effectiveness in minimizing operational distances and improving overall workflow. Additionally, data-driven approaches have been explored, particularly in specialized environments like chilled warehouses, where temperature and humidity control are crucial for product quality (Suriyamanee G. et al, 2023).

Effective warehouse layout design is integral to optimizing logistics operations. By employing systematic frameworks like SLP and focusing on strategic space allocation, organizations can significantly improve their operational efficiency.

Thus, effective warehouse design is crucial for optimizing performance in distribution centers. By focusing on layout optimization, strategic space allocation, and integrating technology, organizations can significantly enhance their operational efficiency, leading to improved productivity and reduced costs.

ABC analysis

ABC analysis is a method that categorizes products into three groups to facilitate efficient management based on product groupings. The ranking criteria can vary depending on organizational policies, such as classifying products by their total annual inventory value, sales value, or profit contribution. The classification process often considers both the number of items (units) and their value, which could be defined by holding value, sales value, or profit share, to organize the products into groups effectively.

- Product Group A consists of a small number of items, typically around 5-15% of the total, but these products account for 70-80% of the total inventory value. These are the high-value items in the inventory.
- Product Group B includes secondary value products, making up about 15-30% of the inventory. These items account for less than 30% of the total value and are considered less important compared to Group A. The value of products in Group B, whether in terms of holding value, sales value, or profit share, is lower than that of Group A but still of moderate importance.

- Product Group C comprises the largest portion of inventory, around 50-60%, consisting of high-volume items. However, these products represent only 5-10% of the total value, making them the least important in terms of value.

The concept of ABC analysis is derived from Pareto's Principle, proposed by Italian economist Vilfredo Pareto, who observed that "The few essential items are more important than the many less essential ones," with a ratio of 20:80. This principle highlights that a small number of high-value items often contribute more to the overall worth than a larger number of low-value items (Diana. et al, 2017).

Research Methodology

Research Methodology: The research methodology was determined using a quantitative research approach.

Research Instrument: The research instrument used in this study were in-depth interviews, observation, and short-term participation, while maintaining the research's significance through a quantitative research approach. A survey research method was chosen, conducted as a field study, focusing on observing the environment and the parcel sorting management process at the distribution center of the parcel delivery company.

Data Collection: Data collection for this research involved gathering information from documents. The data collected includes the following:

1. Primary Data: The data collection for this research involved gathering information from the parcel distribution center of courier company, including data on errors in parcel sorting. In-depth interviews and participant observation were conducted to identify the various issues faced by the company. The data collected from interviews with executives, team leaders, and employees responsible for parcel sorting at the company's distribution center were then used to apply the ABC Analysis for zone allocation in the parcel sorting process. This approach was implemented to improve the management of the distribution center.

2. Secondary Data: The data was collected from documents, research papers, articles, and theses related to the topic, both from Thailand and internationally, as well as from relevant sources on websites.

Data Analysis: Data analysis to comparative analysis refers to the comparison of errors in parcel sorting by employees before and after improvements. The analysis of errors in parcel sorting before the improvements revealed that the unloading and sorting processes lacked proper planning, signage, and categorization of parcels, as well as a clear zoning system for sorting according to the designated responsibility areas. After the improvements, the area was organized with proper planning, signage, categorization of parcels, and sorting according to a clearly defined zoning system. The analysis of errors in parcel sorting after the improvements indicated that mistakes occurred due to employee errors and customers failing to specify the correct and clear delivery zones, which led to sorting mistakes by the employees.

Research Results

Present the analysis results, including a detailed description of the data analysis process, followed by the results and their interpretation. For results presented in tables or figures, provide accompanying explanations, rather than just displaying the tables or figures without context.

The study analyzed and compared data on sorting errors recorded before and after implementing improvements. The solution involved applying the ABC Analysis theory to optimize the sorting process by planning, creating clear labels, categorizing parcels, organizing

groups, and arranging sorting zones systematically. This approach was designed to align with delivery schedules and facilitate faster and more efficient parcel handling.

The improvements resulted in a significant reduction in sorting errors. Before the implementation, 85 sorting errors were recorded. After the improvements, the number of errors decreased to 27, reflecting a reduction of 58 errors.

By incorporating the ABC Analysis approach, the parcel sorting process became more accurate, efficient, and cost-effective. This enhancement not only reduced operational costs but also improved customer satisfaction by delivering better service quality.

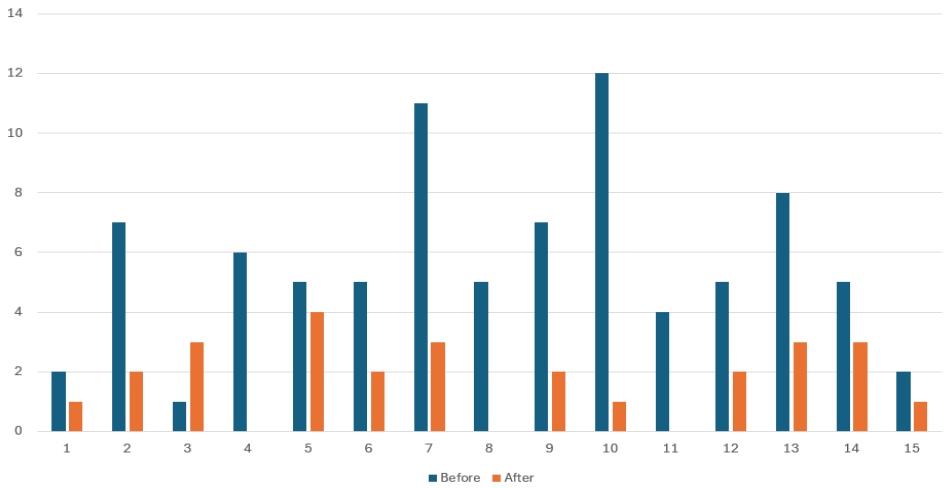

Figure 1: Comparison of error data in parcel sorting by employees before and after the improvements

From figure 1 show that the comparative chart analyzing data on reducing parcel sorting errors recorded by employees before and after the improvements. A comparative chart was created to showcase the data on reducing parcel sorting errors recorded by employees before and after the improvements. The data collection was conducted over 15 days prior to the improvements and another 15 days after the implementation. The improvements involved applying the ABC Analysis theory, which was adapted to plan the process, create clear labels, categorize parcels, organize sorting groups, and arrange sorting zones systematically. Following these changes, implemented to address sorting errors in September and October, the results were remarkably clear. The error rate in parcel sorting significantly decreased from 85 errors before the improvements to 27 errors after, marking a reduction of 58 errors. Notably, no errors were recorded on specific days after the improvements, including the 4th, 8th, and 11th of the observation period. These outcomes demonstrate the effectiveness of the applied solution compared to the error data recorded before the improvements in August, highlighting a positive impact on operational accuracy and efficiency.

Discussion

Design a parcel sorting area for delivery by applying the ABC Analysis theory for distribution center of courier company by organizing the planning process, creating clear signage, categorizing, and grouping items distinctly, and prioritizing zones for parcel sorting, the sorting process was aligned with delivery timelines and transfer operations to ensure speed and efficiency. This approach significantly reduced the number of errors which is consistent with Suriyamanee G. et al. (2023) researched to analyze the existing storage practices in a chilled warehouse and introduce an optimized layout through a data-driven approach. The

researchers utilized ABC analysis and postharvest management techniques to develop the layout, focusing on identifying the key characteristics and specific requirements of the products. This could enhance warehouse operations by minimizing processing time and facilitating a more seamless workflow within strict time constraints.

Design a parcel sorting area for delivery. This will Reduce errors in parcel sorting at the courier company's distribution center. Efficient management of these activities can help mitigate environmental impacts which is consistent with Munkongtum C. and Moryadee C. (2023) researched examines activities contributing to carbon footprint emissions in warehouse operations. The findings reveal that warehouse activities, including receiving, storing, picking, dispatching, and delivering goods, the significantly impact carbon emissions. The efficient management of these activities can help mitigate environmental impacts.

The method of distribution center design has proven effective in significantly reducing the distance required to move goods, thereby directly improving operational efficiency which is consistent with Jiraphong D. et al. (2023) research focuses on parcels coming from various locations, including the distribution center, the large external customer pickup points, and the pickup counters at XYZ company. After the sorting process, all parcels are distributed to multiple zones, including DB1, DB2, and DB3, using motorcycles and vehicles. By planning the sorting process and increasing the number of employees involved, the operation time was reduced, and errors were minimized.

Conclusion

The study identified and understood the existing issues, leading to the application of the ABC Analysis theory to design the parcel sorting area for delivery. This involved planning, creating clear signage, categorizing items, and organizing the sorting zones to align with delivery timelines. The design aimed to facilitate rapid and efficient parcel handling, resulting in a noticeable reduction in errors. Before the improvements, data recorded in the error log revealed that 85 sorting errors occurred, accounting for 22.6%. These errors were attributed to two main causes: 78 errors (from mis-sorting by employees) and 7 errors (due to customers providing incorrect delivery area information). After that, the after implementing the improvements, the recorded sorting errors decreased to 27, representing 10.2%. Of these, 20 errors resulted from employee mistakes, while 7 stemmed from customers providing unclear or incorrect delivery area information. The application of ABC Analysis successfully reduced sorting errors by 58 instances, equivalent to an 8.1% improvement. This enhanced operational efficiency, streamlined parcel management, reduced operational costs, and bolstered the company's credibility. Customers gained greater confidence in the company's services due to the consistent accuracy of deliveries. Additionally, this solution alleviated the workload of personnel responsible for sorting and managing inventory, improving overall productivity in the sorting and storage processes.

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