

Lean Six Sigma Implementation in a Small Business Warehouse Inventory Management Redesign

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Abstract

This research investigates the problem of ineffective inventory management systems in small businesses using a qualitative case study approach. The study focuses on Dixon's Refrigeration, identifying the root causes of poor inventory management, including difficulties in forecasting demand, managing stock levels, identifying slow-moving inventory, reordering products, and tracking inventory across multiple locations. The DMAIC process improvement methodology was applied to address these challenges, resulting in recommendations that include implementing inventory management software, automated data collection and analysis, mobile inventory tracking, and adopting best practices. The findings provide valuable insights into the problem and offer practical solutions for Dixon's Refrigeration and other small businesses facing similar challenges. By implementing these recommendations, businesses can improve efficiency, reduce costs, enhance customer satisfaction, and strengthen their overall competitiveness in the market.

Key Terms — Inventory management, Process improvement, Root cause analysis, Small businesses.

Problem Statement

Dixon's Refrigeration, a small business established for 3 years and operating in the southwest of Puerto Rico, is facing challenges in effectively managing its inventory, which ultimately results in increased costs and inefficiency in its business operations. Specifically, the business is facing difficulties in accurately forecasting demand, properly managing stock levels, efficiently identifying, and eliminating slow-moving or obsolete inventory, effectively implementing a system for reordering products, and accurately tracking inventory across multiple locations. These challenges significantly impact the overall efficiency and profitability of the business. The goal of this research is to conduct a comprehensive analysis of the root causes of these challenges and to develop a set of practical and effective recommendations for Dixon's Refrigeration to improve its inventory management system, with the potential to serve as a valuable case study for other small businesses facing similar challenges in inventory management.

Methodology

This research will employ a qualitative case study approach to investigate the lack of an effective inventory management system at Dixon's Refrigeration. Data will be collected through literature review, interviews, and data analysis of inventory levels, sales, and customer complaints.

Data analysis tools such as statistical analysis, process mapping, root cause analysis, and Pareto analysis will be used to analyze the data and identify key drivers of the inventory management challenges.

Recommendations will be tailored to Dixon's Refrigeration's context and will focus on leveraging technology, such as inventory management software, automated data collection and analysis, and mobile inventory tracking. Additionally, a set of best practices for inventory management will be provided for small businesses facing similar challenges.

The research will conclude with a comprehensive report that includes research findings, recommendations, and a plan for implementation and future research. The DMAIC methodology, a structured method used in Six Sigma and Lean Six Sigma for process improvement, will be integrated into each stage of the research process to ensure a systematic and data-driven approach to problem-solving.

Results and Discussion

At Dixon's Refrigeration, a comprehensive research process identified a deficiency in the company's inventory management system, leading to increased operational costs and decreased business efficiency. To address these challenges, the DMAIC process improvement methodology was employed, which facilitated identifying and resolving key issues related to inventory management.

During the Define phase, a host of issues were identified, including challenges in forecasting demand, managing stock levels, identifying and eliminating slow-moving or obsolete inventory, establishing an efficient system for reordering products, and tracking inventory across diverse locations such as company vehicles and storage facilities. A SIPOC diagram and a Project Charter were developed to comprehend these issues and their impact on the overall process, while an economic impact analysis revealed that these issues were costing the company an estimated \$30,000 annually.

In the Measure phase, data related to inventory levels, sales, and customer complaints were meticulously collected and analyzed. The four main metrics measured were the inventory turnover rate, stockout rate, inventory accuracy, and customer complaints related to inventory. These metrics were used to identify areas of inefficiency and waste within the inventory management process.

The Analyze phase involved the use of various tools and techniques to analyze the inventory management process and identify the root causes of the problems. Two key tools used were a process map and a root cause analysis. The process map provided a visual representation of the inventory management process, which helped to identify areas of inefficiency and waste. The root cause analysis was used to determine the underlying causes of the inventory management problems. Armed with the findings from the analysis, we developed a prioritized set of recommendations for enhancing the inventory management system at Dixon's Refrigeration during the Improve phase. These recommendations included implementing a specific inventory management software, "Inventory Plus," automating data collection and analysis, introducing a mobile inventory tracking solution like "Sortly Pro," and adopting industry best practices like the "Just-In-Time" inventory method. To ensure a smooth transition, a comprehensive implementation plan was developed.

In the Control phase, a plan was developed for future monitoring of the inventory management process to ensure the sustainability of the improvements made. This includes setting up control charts, conducting regular audits on a bi-monthly basis, and monitoring the key performance indicators. The DMAIC methodology provided a structured and systematic approach to identifying and addressing inventory management issues at Dixon's Refrigeration, resulting in significant cost savings and increased customer satisfaction. These findings and recommendations are expected to be a valuable guide for Dixon's Refrigeration and other small businesses facing similar inventory management challenges.

Table 1 – SIPOC Table

SIPOC Component	Action Plan
Supplier	Identify reliable manufacturers and distributors; establish long-term relationships with suppliers; perform regular audits of suppliers.
Input	Develop a demand forecasting system; monitor inventory levels; create a system for tracking customer orders.
Process	Implement inventory management software; establish a system for order placement and fulfillment; improve receiving and storage procedures.
Output	Conduct regular inventory audits; establish metrics for measuring customer satisfaction; create a system for monitoring order fulfillment.
Customer	Conduct customer surveys to assess satisfaction; establish a system for addressing customer complaints and feedback.

Table 2 - Baseline Measures of Inventory Management

Measure	Current Status
Inventory Turnover Rate	4 times/year
Stockout Rate	30%
Inventory Accuracy	70%
Customer Complaints Related to Inventory	15 complaints/month

Table 3 - Root Cause Analysis

Root Cause	Effect on Inventory Management
Difficulty in forecasting demand	Overstocking or understocking
Inefficient stock level management	Increased holding costs and stockouts
Inability to identify slow-moving or obsolete inventory	Stockpiling of inventory leading to increased holding costs
Lack of an efficient system for reordering products	Stockouts and overstocking
Lack of tracking inventory across multiple locations	Inaccurate inventory levels and stockouts

Table 5 - Key Performance Indicators (KPIs) for Monitoring Inventory Management

KPI	Target
Inventory Turnover Rate	6 times/year
Stockout Rate	10%
Inventory Accuracy	95%
Customer Complaints Related to Inventory	5 complaints/month

Table 4 – Process Map

Process Step	Activity	Inputs	Outputs
1	Customer places order	Order request	Order confirmation
2	Check inventory for availability	Order details, Inventory records	Inventory availability status
3	Schedule installation or service	Order details, Inventory availability status	Installation or service appointment scheduled
4	Pick up product and equipment	Installation or service appointment details, Inventory availability status	Product and equipment
5	Transport product and equipment to customer location	Product and equipment	Customer location
6	Install or service product	Product and equipment, Installation, or service appointment details	Installed or serviced product
7	Obtain customer sign-off	Installed or serviced product	Customer sign-off
8	Update inventory records	Installed or serviced product, Inventory records	Updated inventory records

Conclusion

In conclusion, this research aimed to investigate the problem of the lack of an effective inventory management system in Dixon's Refrigeration. Employing a qualitative case study approach, the root causes of the problem were identified as difficulty in forecasting demand and managing stock levels, identifying, and eliminating slow-moving or obsolete inventory, implementing an efficient system for reordering products, and tracking inventory across multiple locations.

The research found that these issues were causing increased costs and inefficiency in business operations. To address these challenges, the DMAIC process improvement methodology was applied. The research provided several contributions, including identifying the root causes of the ineffective inventory management system in Dixon's Refrigeration and developing a set of recommendations for the company to improve its inventory management system.

The recommendations included implementing inventory management software, automated data collection and analysis, mobile inventory tracking, and adopting best practices for inventory management. Furthermore, the research provided a set of best practices that can be implemented to improve efficiency and reduce costs in other small businesses facing similar challenges.

The comprehensive report includes a summary of the research findings, recommendations for Dixon's Refrigeration, and a plan for implementation and future research. These findings and recommendations are expected to serve as a valuable reference for Dixon's Refrigeration as they work to improve their inventory management system and to serve as a case study for other small businesses that face similar problems in inventory management.

However, it is important to note that this study has some limitations, such as being focused on one specific case study, and it would be beneficial to replicate the study in other small businesses to generalize the findings. Future research could explore the effectiveness of the proposed recommendations in other contexts, industries, and business sizes, as well as investigate other factors that may influence inventory management.

In summary, this research has provided valuable insights into the problem of the lack of an effective inventory management system in Dixon's Refrigeration and has offered practical solutions to improve the inventory management system, along with best practices that can be implemented in other small businesses. By implementing the research findings and recommendations, Dixon's Refrigeration and other small businesses can potentially improve efficiency, reduce costs, enhance customer satisfaction, and strengthen their overall competitiveness in the market.

References

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