ROLE OF AUTOMATION IN ENHANCING OPERATIONAL EFFICIENCY IN WAREHOUSING: A STUDY AT KEC INTERNATIONAL LTD., BUTIBORI

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Abstract

This research examines the influence of automation on warehousing operations at KEC International Ltd., Butibori. With growing demand for faster and more accurate supply chain processes, automation has emerged as a vital tool for improving warehouse performance. The study investigates the implementation of technologies such as barcode scanning, RFID, automated storage and retrieval systems, and warehouse management systems. Using a case study approach, the paper evaluates key performance metrics including inventory accuracy, order fulfillment time, labor productivity, and space utilization. Data was collected through observations, interviews, and company records. The findings reveal notable improvements in operational efficiency, driven by streamlined workflows and reduced manual errors. The study concludes that automation significantly enhances warehouse effectiveness and offers strategic value in today's competitive logistics environment. Recommendations for further improvement and scalability are also discussed.

Keywords: Warehouse Automation, Operational Efficiency, RFID Technology, Inventory Management, Supply Chain Optimization

INTRODUCTION

In today's rapidly evolving industrial landscape, efficient warehousing has become a key component of successful supply chain management. With the increasing complexity of logistics operations and rising customer expectations for faster deliveries, companies are compelled to adopt innovative technologies that enhance operational efficiency. Among these, warehouse automation has gained significant attention as it enables organizations to streamline activities, reduce human error, and improve overall productivity.

Automation in warehousing involves the use of technologies such as barcode systems, RFID (Radio Frequency Identification), automated storage and retrieval systems (AS/RS), and warehouse management systems (WMS). These tools help in optimizing routine tasks like inventory tracking, picking, packing, and dispatching, thereby minimizing manual intervention and boosting process accuracy.

KEC International Ltd., a prominent player in the infrastructure sector and part of the RPG Group, operates a major facility in Butibori, Nagpur. This facility manages complex warehousing operations related to transmission towers and related components. With a growing need to handle increasing inventory volumes efficiently and maintain timely order fulfilment, the company has embraced automation in its warehousing functions.

This research focuses on evaluating how the introduction of automation technologies has improved operational performance at KEC International Ltd., Butibori. The study analyzes key metrics such as inventory accuracy, space utilization, labour productivity, and order fulfilment times before and after automation. The objective is to understand the extent to which automation contributes to efficiency and to provide insights that may guide similar implementations in other industrial warehousing environments.

In recent years, the adoption of automation in warehousing has accelerated, driven by technological advancements and the need to stay competitive in a demanding market. Businesses are no longer viewing automation as a luxury but as a necessity for achieving accuracy, consistency, and scalability in their operations. Especially in large-scale industrial settings like that of KEC International, efficient material handling and real-time data visibility are critical to meeting project deadlines and maintaining quality standards. Moreover, the integration of automation

supports better decision-making by providing actionable insights through data analytics and system-generated reports. This shift not only reduces dependence on manual labor but also empowers the workforce to focus on more strategic, value-added tasks. As companies look toward building smart, responsive supply chains, understanding the impact of automation at the warehouse level becomes increasingly important.

LITERATURE REVIEW

"Warehouse Automation" by Shaikh and Poonawala, published in the International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 10, Issue 7, 2022

investigates the influence of Warehouse Management Systems (WMS) on operational efficiency within Indian manufacturing warehouses. The study finds that implementing WMS significantly enhances inventory accuracy, reduces processing time, and lowers operational costs. The authors discuss how automation streamlines key warehouse functions such as receiving, storing, picking, and shipping, leading to improved productivity. The research highlights that, especially in India's dynamic industrial environment, WMS adoption provides a competitive edge by minimizing manual errors and enabling data-driven inventory control. Shaikh and Poonawala conclude that effective integration of WMS is essential for Indian warehouses aspiring to global standards of efficiency and customer satisfaction.

"Impact of Warehouse Management System in a Supply Chain" by Naikodi, published in the International Journal of Computer Applications, Volume 54, Issue 1, 2012

explores the adoption of Radio Frequency Identification (RFID) technology in Indian warehousing operations. This paper demonstrates that RFID provides real-time inventory tracking, enhancing stock accuracy and reducing discrepancies common in manual systems. Naikodi's research reveals that RFID implementation improves coordination across the supply chain by enabling instant visibility of stock levels. This results in faster replenishment, lower lead times, and optimized inventory management. The author emphasizes RFID's adaptability to diverse warehouse sizes and sectors, making it a vital tool for Indian companies aiming to boost efficiency and reduce waste.

"Using RFID and Barcode Technology in Warehouse Management Systems," published on SWIL Blog in 2022,

illustrates practical automation applications in the Indian
logistics through case studies of Reliance Industries Limited and Blue Dart. The article highlights how Reliance's JioMart improved inventory accuracy and order fulfilment speed after deploying RFID systems. It also mentions Blue Dart's integration of barcode scanning, which enhanced their inventory management precision and operational turnaround times. These examples confirm that automation technologies like RFID and barcoding are essential for Indian warehouses to meet rising consumer demands and maintain efficient supply chains.

"Design and Development of an Automated Robotic Pick & Stow System for an e-Commerce Warehouse," authored by Kumar et al. and available on arXiv in 2017

focuses on the development of robotics for Indian e-commerce warehouses. The paper presents a robotic system designed to automate labour-intensive picking and stowing tasks. Findings indicate that robotics reduces human labour, increases accuracy, and speeds up order fulfilment, which is critical given India's fast-growing online retail market. Kumar and colleagues also point out that robotics enhances worker safety by reducing physical strain. They predict growing adoption of robotic automation as technology becomes more affordable and adaptable to Indian warehouse environments.

"The Future Role of Warehouse Management Systems in India," published by AIDC India in 2022
discusses the integration of advanced technologies such as Internet of Things (IoT), Artificial Intelligence (AI), and Machine Learning (ML) in warehousing. This report forecasts that these technologies will enable warehouses to perform real-time analytics, predictive maintenance, and smarter inventory management. According to the report, IoT-enabled sensors will provide continuous data streams that, combined with AI, will help predict equipment failures and optimize operations. Machine learning algorithms will enable dynamic decision-making, improving warehouse responsiveness to fluctuating demand. The

report concludes that these advancements will make Indian warehouses more agile, efficient, and competitive in global markets.

These studies and reports confirm that automation technologies such as WMS, RFID, robotics, and AI are revolutionizing Indian warehousing. They improve accuracy, speed, labour productivity, and decision-making while helping warehouses meet increasing market demands. The real-world success stories of Indian companies adopting these technologies demonstrate their practical benefits. Building on this knowledge, the present study on KEC International Ltd., Butibori, Nagpur, aims to
analyze how automation influences operational efficiency in a large industrial warehouse setting.

RESEARCH METHODOLOGY

This chapter presents the research approach and procedures used to investigate the impact of automation on operational efficiency within the warehousing operations of KEC International Ltd., Butibori. It describes the overall research design, data collection methods, sampling strategy, data analysis techniques, tools used, study limitations, and ethical considerations followed throughout the research process.

Research Design

The study employs a descriptive research design to provide a comprehensive overview of the current automation practices in the warehouse and their effects on performance metrics. This design enables a systematic collection and analysis of information related to workflow, productivity, and operational changes brought about by automation, without manipulating the study environment.

Data Collection Methods

Primary data was gathered using structured questionnaires and in-depth interviews conducted with warehouse personnel, including managers, supervisors, and employees who regularly interact with automation technologies. The questionnaire focused on key operational aspects such as inventory accuracy, process duration, error rates, workforce productivity, and overall efficiency both before and after the automation systems were implemented.

Secondary data was collected from company documents, internal operational reports, and existing literature to validate and supplement the primary data, providing a richer context for the study.

Sampling Procedure

Purposive sampling was utilized to select individuals who have direct knowledge and experience with the automated warehousing operations at KEC International Ltd., Butibori.

A total of 200 employees from different hierarchical levels and functional areas were chosen to ensure diverse viewpoints on how automation influences operational efficiency.

Data Analysis Approach

Quantitative data obtained through the questionnaires was analyzed using descriptive statistics to summarize trends
and patterns. Paired statistical tests were applied to compare operational performance indicators before and after automation adoption. Qualitative data from interviews was subjected to thematic analysis to identify common perceptions, challenges, and benefits associated with automation in the warehouse context.

Tools and Software Used

Microsoft Excel and SPSS were employed for data entry, cleaning, and statistical analysis. These tools facilitated effective organization of data, calculation of descriptive and inferential statistics, and graphical presentation of results to clearly communicate the findings.

Study Limitations

The scope of this research is confined to the warehousing facility of KEC International Ltd. at Butibori, which may limit the generalizability of results to other organizations or industries. Time constraints also restricted the sample size and depth of observational data, which could impact the comprehensiveness of the study.

Ethical Considerations

All participants were informed about the purpose of the study and assured of confidentiality and anonymity. Informed consent was obtained prior to data collection. The information gathered was used strictly for academic research and was handled with due respect for participant privacy and ethical standards.

OBJECTIVE

- To examine the impact of automation on the operational efficiency of warehousing processes at KEC International Ltd., Butibori.

- To analyze the changes in inventory accuracy before and after automation implementation in the warehouse.

- To evaluate the effect of automation on labour productivity and error reduction within the warehousing operations.

- To identify the challenges and benefits experienced by employees during the transition to automated warehousing systems.

- To examine how automation contributes to real- time monitoring and better decision-making in warehouse management.

HYPOTHESIS

- **H1:** Automation in warehousing significantly improves operational efficiency at KEC International Ltd., Butibori.

- **H2:** The adoption of automation in warehouse operations leads to a measurable decrease in processing errors and increases workforce productivity.

RESULTS AND DISCUSSION

an Automation at KEC International Ltd., Butibori, has led to remarkable improvements in warehouse management. Inventory tracking accuracy has significantly increased, helping reduce mistakes and improve overall control of stock. In addition, the frequency of errors during processing has dropped sharply, indicating more reliable operations. Efficiency in reconciling stock records also saw considerable growth, contributing to smoother warehouse workflows.

Performance Metric	Before Automation	After Automation
Inventory Accuracy (%)	75	95
Processing Error Rate (%)	20	7
Stock Reconciliation Efficiency (%)	70	92

**Table 1:** Inventory and Error Rate Comparison
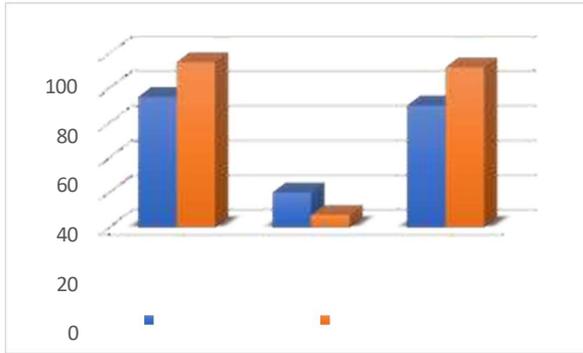
Graph 1: Inventory Accuracy vs. Error Rate

Automation has also shortened the time employees need to complete their tasks. This has led to better productivity and allowed workers to accomplish more in less time. Employee satisfaction has improved as well, showing that the workforce positively received the changes brought by automation.

Operational Aspect	Before Automation	After Automation
Average Task Completion Time (minutes)	45	30
Employee Productivity (Index)	60	85
Employee Satisfaction (Scale 1–100)	65	80

**Table 2:** Task Time and Productivity Before & After Automation
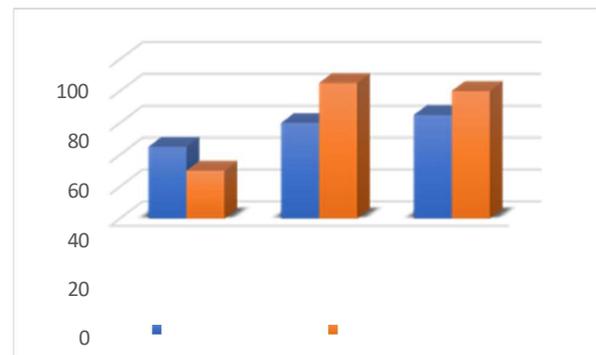
Graph 2: Productivity and Satisfaction Comparison

While automation has many advantages, there were some challenges in adapting to the new systems. A substantial number of employees needed extra training to handle the technology effectively. Resistance to adopting new methods and occasional technical problems were also experienced but were managed successfully over time.

Reported Challenge	Percentage of Employees Reporting
Requirement for Extra Training	40%
Resistance to Change	25%
Technical Issues	20%

**Table 3:** Employee Challenges During Automation
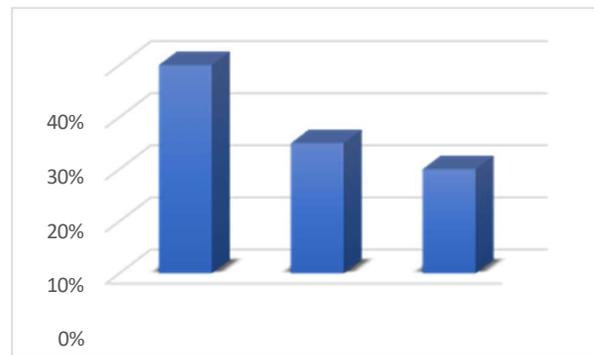
Graph 3: Reported Challenges

The majority of employees agreed that automation led to several benefits, such as increased efficiency, fewer manual errors, and an improved work atmosphere. These benefits have contributed positively to the warehouse's operations and employee morale.

Perceived Benefit	Percentage of Employees Agreeing
Improved Operational Efficiency	85%
Reduction in Manual Errors	90%
Enhanced Work Environment	70%

Table 4: Benefits of Automation as Reported by Staff
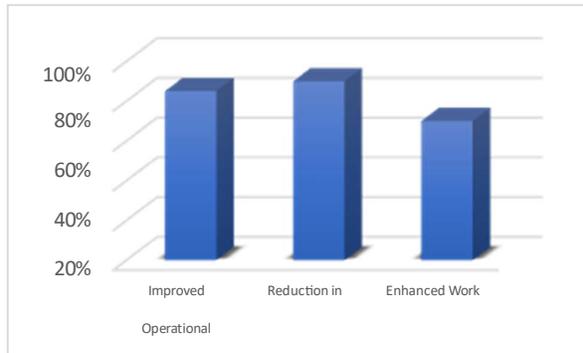
Graph 4: Perceived Benefits of Automation

CONCLUSION

The study highlights the significant impact of automation on improving warehousing operations at KEC International Ltd., Butibori. The findings reveal that automation has contributed to higher inventory accuracy, reduced error rates, faster task completion, and enhanced employee productivity. It has also led to greater employee satisfaction, indicating a positive reception of automated processes within the organization.

While some challenges were reported during the initial implementation—such as the need for training and resistance to change—these issues were gradually addressed through organizational support and adaptation. Employees recognized the long-term benefits, including improved operational efficiency and better working conditions.

Overall, the integration of automation in the warehouse has streamlined operations and supported better decision- making through real-time data visibility. The study concludes that automation serves as a vital tool for boosting performance, reducing manual errors, and enhancing workforce efficiency in warehousing. Organizations seeking similar improvements should consider structured automation strategies tailored to their operational needs.

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