Technology Adoption in Inventory Management Systems: Challenges and Impact on Supply Chain Performance in Healthcare Institutions

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Abstract—**This study investigates the adoption of technology in inventory management systems (IMS) and its impact on the supply chain performance of healthcare institutions. The research aims to identify the challenges healthcare institutions face in adopting IMS technologies and evaluate how these technologies influence supply chain performance. The researcher employed a descriptive-correlational research design and distributed a survey questionnaire to key personnel in selected healthcare institutions in the Philippines. Data were analyzed using statistical tools such as frequency distribution, mean, standard deviation, and correlation analysis. The findings revealed that healthcare institutions face significant challenges related to training, user acceptance, and the lack of infrastructure, which hinder effective IMS adoption. However, the study also found that successful IMS adoption leads to improved supply chain performance, including better inventory accuracy, reduced operational costs, and enhanced decision-making processes. The researcher found that these outcomes significantly improve operational efficiency in healthcare settings, leading to better service delivery. In conclusion, while the adoption of technology in IMS presents challenges, it offers considerable benefits that can enhance supply chain performance in healthcare institutions. It is recommended that healthcare institutions focus on addressing the barriers to technology adoption, particularly through training, infrastructure improvements, and fostering a culture of acceptance toward new technologies.**

Index Terms—**Automation, cost savings, data accuracy, decision-making, healthcare institutions, healthcare logistics, infrastructure challenges, Inventory Management Systems (IMS), IoT in healthcare, operational challenges in healthcare, operational efficiency, process automation, real-time inventory tracking, stock control, supply chain innovation, supply chain optimization, supply chain performance, supply chain resilience, technology adoption, technology driven, technology integration, training and skill development, user acceptance.**

1. Introduction

Healthcare institutions across the globe face increasing pressures due to globalization, evolving market demands, and rising expectations for high-quality service delivery. As these challenges intensify, the healthcare sector must adopt innovative solutions to improve operational efficiency and meet the growing needs of patients and healthcare consumers. In the Philippines, the adoption of technology-driven inventory management systems (IMS) has become a key strategy to optimize supply chain practices, especially in pharmaceutical management. These technologies, including RFID, AI, and blockchain, promise significant improvements in inventory accuracy, real-time tracking, and overall efficiency.

This study investigates the extent of technology adoption in inventory management systems within healthcare institutions, specifically focusing on the challenges faced by these organizations and their impact on operational performance in supply chain practices. By examining the relationships between technology adoption, the challenges encountered, and supply chain outcomes such as lead time, cost-saving, and product innovation, this research aims to provide actionable insights to enhance inventory management in healthcare settings.

By exploring these elements, the research seeks to identify key factors that influence the successful implementation of IMS, providing evidence-based recommendations to address the obstacles and optimize practices across healthcare supply chains. The findings from this study aim to contribute significantly to improving inventory management practices in healthcare, ultimately benefiting both healthcare institutions and patients through more efficient and reliable service delivery.

2. Literature Review

Recent studies highlight the transformative role of technologies like the Internet of Things (IoT) in inventory management. IoT enables real-time tracking and data collection, which significantly enhances inventory accuracy and operational efficiency. Research by Pooja et al. (2023) suggests that the integration of IoT reduces human error and improves stock-level management. Similarly, Singh and Adhikari (2023) explores the synergistic effects of combining IoT with AI, noting that these technologies facilitate real-time tracking and predictive analytics, which optimize decision-making and reduce delays in operations.

Moreover, cloud computing plays a crucial role by providing scalable and accessible systems that improve real-time data tracking. ANSI Information Systems (2024) emphasizes that cloud-based solutions enable better collaboration and inventory

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visibility across multiple locations, which helps minimize stockouts and ensures continuity in business operations.

Automation is another key advancement, significantly streamlining inventory management. Jenkins (2020) stresses that automation in tasks such as replenishment and tracking reduces manual errors, enhancing operational efficiency. Additionally, Saleem (2020) discusses the use of automated systems like RFID and ERP, which help minimize supply chain risks and increase inventory accuracy. In healthcare settings, these automated systems ensure the timely procurement, storage, and distribution of medical supplies, directly benefiting patient care by ensuring that critical resources are readily available.

However, despite these technological advantages, healthcare institutions face several challenges when adopting advanced inventory management systems. Al-Khatib et al. (2023) identify key barriers, such as high implementation costs and system compatibility issues, which hinder the full adoption of technologies like RFID and cloud-based solutions. Moreover, resistance to change and insufficient training are significant obstacles, as noted by Alzate et al. (2022), who highlight the importance of addressing user readiness and training gaps to ensure smoother transitions.

Training and skill development are essential to overcoming these challenges. According to Rawat (2023), continuous education and skill enhancement in supply chain management are vital for organizations to stay competitive. This is particularly important in healthcare institutions, where the adoption of new technologies like AI and predictive analytics is crucial for optimizing inventory management. In line with this, Baily et al. (2022) argue that addressing emotional and cognitive barriers through comprehensive training programs can improve user readiness and promote successful technology adoption. Therefore, focusing on improving user perceptions and providing adequate training is vital to facilitating the adoption of new inventory management technologies.

In conclusion, while the integration of technology in inventory management offers substantial benefits, addressing the challenges of cost, compatibility, and user readiness remains crucial. Future research should focus on enhancing system integration, improving training efforts, and lowering implementation costs to help healthcare institutions fully leverage the potential of these technologies, ultimately improving supply chain efficiency and patient care outcomes.

3. Methodology

This study utilized a descriptive-correlational research design to explore the adoption of technology in inventory management systems and its impact on supply chain performance in healthcare institutions. A survey questionnaire was used as the primary data collection tool, targeting key personnel involved in inventory management. The research was conducted at XYZ Company, a healthcare institution located in Muntinlupa City, NCR, Philippines. This location provided a relevant context for understanding the challenges and impacts of technology-driven inventory management systems in the healthcare sector.

The respondents of the study consisted of 50 employees from the inventory management and supply chain department of XYZ Company. Using the Raosoft sample size calculator, a sample size of 45 was determined to ensure statistical validity, with a 95% confidence level and a 5% margin of error. Simple random sampling was employed to select the participants, ensuring that every employee had an equal opportunity to be included and minimizing selection bias.

A researcher-made questionnaire was the primary instrument used to gather data. The questionnaire was divided into three parts: the first part focused on assessing the extent of technology adoption in inventory management systems, the second part identified the challenges faced in the current inventory management practices, and the third part evaluated the impact of technology adoption on supply chain performance. The instrument underwent validation by three experts, and a pre-test was conducted with 15 respondents to ensure reliability, with the results yielding a high internal consistency, as evidenced by Cronbach's alpha ranging from 0.86 to 0.98.

The data collection process involved distributing the survey via Google Forms after obtaining the necessary permissions from the institution. Participants were informed about the voluntary nature of their participation and were assured that their responses would be kept confidential. Data analysis was conducted using descriptive statistics, including the weighted mean and Pearson correlation analysis, to determine the relationships between technology adoption, the challenges encountered, and the impact on supply chain performance.

The study adhered to ethical guidelines throughout the research process. Informed consent was obtained from all participants, and confidentiality was strictly maintained. The data collected were stored securely and disposed of according to legal and institutional protocols, ensuring the integrity and privacy of the research.

This methodology provided a comprehensive approach to examining the adoption of technology in healthcare inventory management systems and its associated challenges while ensuring the accuracy and ethical integrity of the research process.

4. Results, Analysis and Discussion

A. The Extent of Technology Adoption in Inventory Management Systems

Table 1

	Indicators	Mean	Verbal Interpretation	Rank
1.	Inventory Tracking and Updates	3.24	Highly Effective	1
2.	Process Automation	3.20	Moderately Effective	3
3.	Integration with other Functions	3.20	Moderately Effective	3
4.	Ease of Use and Accessibility	3.20	Moderately Effective	3
5.	Reporting and Decision-Making	3.13	Moderately Effective	5
General Assessment		**3.18**	**Moderately Effective**	

Legend: 3.25 – 4.00 Highly Effective   1.75 – 2.49 Slightly Effective
            2.50 – 3.24 Moderately Effective   1.00 – 1.74 Not Effective

Table 1 presents a summary of the extent of technology adoption in inventory management systems among the respondents. As shown in the table, the overall weighted mean of 3.18 indicates that the respondents perceived that the extent

of technology adoption in the inventory management systems was moderately effective. Specifically, the levels of technology adoption were as follows: Inventory Tracking and Updates (3.24), Process Automation (3.20), Integration with other Functions (3.20), Ease of Use and Accessibility (3.20), and Reporting and Decision-Making (3.13). To sum up, while the technology adoption in inventory management systems is functional, there are still areas for improvement to enhance efficiency, automation, and decision-making.

B. The Challenges Encountered in the Current Inventory Management Practices

Table 2

Indicators	Mean	Verbal Interpretation	Rank
1. Training and Skill Development	3.06	Moderately Challenging	3
2. User Acceptance and Readiness	3.30	Extremely Challenging	1
3. Infrastructure	3.10	Moderately Challenging	2
General Assessment	**3.15**	**Moderately Effective**	

Legend: 3.25 – 4.00 Extremely Challenging   1.75 – 2.49 Slightly Challenging
2.50 – 3.24 Moderately Challenging   1.00 – 1.74 No Challenges Encountered

Table 2 summarizes the challenges encountered in the respondents' current inventory management practices. The overall weighted mean of 3.15 indicates that the respondents perceived these challenges as moderately challenging. Among the sub-variables examined, User Acceptance and Readiness emerged as the most significant challenge, with a mean score of 3.30 (ranked first), and was verbally interpreted as extremely challenging. This suggests that gaining user buy-in and ensuring preparedness for inventory management systems poses the most significant difficulty for organizations. Infrastructure ranked second with a mean score of 3.10, indicating that respondents found physical facilities, technology infrastructure, and related resources moderately challenging. Training and Skill Development ranked third with a mean score of 3.06, also interpreted as moderately challenging, suggesting that developing the necessary competencies among staff presents persistent but manageable difficulties.

To sum up, while the challenges in current inventory management practices are generally perceived as moderately challenging, user acceptance and readiness stand out as an extremely challenging area that requires particular attention. Organizations would benefit from improving strategies to increase user adoption and readiness while addressing Infrastructure and training needs to enhance overall inventory management effectiveness.

C. Operational Performance in Supply Chain Practices as Influenced by Technology Adoption

Table 3 presents a summary of the operational performance in supply chain practices as influenced by technology adoption among the respondents. As shown in the table, the overall weighted mean of 3.26 indicates that technology adoption has a significant influence on operational performance in supply chain practices. Among the sub-variables examined, Quick Response emerged as the most significantly influenced area with a mean score of 3.32 (ranked first) and was verbally

interpreted as having significant influence. Technology adoption has substantially enhanced organizations' ability to respond rapidly to changes and demands in the supply chain. Cost Quality or Cost Saving ranked second with a mean score of 3.27, also interpreted as having significant influence, indicating that technology adoption has made a considerable impact on reducing costs and improving cost efficiency. Lead Time ranked third with a mean score of 3.24, interpreted as having notable influence, suggesting that technology has moderately improved the time between ordering and receiving goods. Product Innovation ranked fourth with a mean score of 3.22, also showing notable influence, indicating that technology adoption has somewhat enhanced the ability to develop and implement new products.

Table 3

Indicators	Mean	Verbal Interpretation	Rank
1. Lead Time	3.24	Notable Influence	3
2. Cost Quality or Cost Saving	3.27	Significant Influence	2
3. Quick Response	3.32	Significant Influence	1
4. Product Innovation	3.22	Notable Influence	4
General Assessment	**3.26**	**Significant Influence**	

Legend: 3.25 – 4.00 Significant Influence   1.75 – 2.49 Minimal Influence
2.50 – 3.24 Notable Influence   1.00 – 1.74 No Influence

To sum up, technology adoption has significantly influenced overall operational performance in supply chain practices, with the greatest impact observed in quick response capabilities and cost savings. These findings suggest that strategic technology investments focused on these high-impact areas may yield the greatest returns for organizations seeking to enhance their supply chain performance.

D. The Relationship Between Technology Driven Inventory Management and Supply Chain Practices in Healthcare Institutions

Table 4

Technology Driven Inventory Management	Supply Chain Practices	R-Value	Degree of Correlation	P-Value	Conclusions
Inventory Tracking Updates	Lead Time	0.731	Strong Positive	<.00001	Significant
	Cost Quality and Cost Saving	0.638	Strong Positive	<.00001	Significant
	Quick Response	0.465	Moderate Positive	.00128	Significant
	Product Innovation	0.740	Strong Positive	<.00001	Significant
Process Automation	Lead Time	0.735	Strong Positive	<.00001	Significant
	Cost Quality and Cost Saving	0.671	Strong Positive	<.00001	Significant
	Quick Response	0.388	Moderate Positive	.00844	Significant
	Product Innovation	0.734	Strong Positive	<.00001	Significant
Integration with Other Functions	Lead Time	0.764	Strong Positive	<.00001	Significant
	Cost Quality and Cost Saving	0.687	Strong Positive	<.00001	Significant
	Quick Response	0.534	Strong Positive	.00015	Significant
	Product Innovation	0.806	Strong Positive	<.00001	Significant
Ease of Use and Accessibility	Lead Time	0.801	Strong Positive	<.00001	Significant
	Cost Quality and Cost Saving	0.755	Strong Positive	<.00001	Significant
	Quick Response	0.602	Strong Positive	<.00001	Significant
	Product Innovation	0.815	Strong Positive	<.00001	Significant
Reporting and Decision Making	Lead Time	0.787	Strong Positive	<.00001	Significant
	Cost Quality and Cost Saving	0.761	Strong Positive	<.00001	Significant
	Quick Response	0.609	Strong Positive	<.00001	Significant
	Product Innovation	0.791	Strong Positive	<.00001	Significant

*Significant Level=0.01

Table 4 shows the Test of the Relationship Between Technology Driven Inventory Management and Supply Chain Practices in Healthcare Institutions. The R-values range from 0.388 to 0.815 and are interpreted as moderate to strong positive correlations to indicate that improvements in technology-driven inventory management are closely related to better supply chain

practices in healthcare institutions. The computed p-values range from 0.0001 to 0.00844, which is less than the level of significance (P<0.01); thus, the null hypothesis is rejected. The results indicate that technology-driven inventory management has a significant positive relationship with supply chain practices, as evidenced by the strong correlations with Lead Time (from 0.731 to 0.801), Cost Quality (from 0.638 to 0.761), Quick Response (from 0.388 to 0.609), and Product Innovation (from 0.734 to 0.815). This finding suggests that as technology-driven inventory management improves, healthcare institutions experience improved supply chain practices, including reduced lead time, better cost quality, faster response times, and increased product innovation. This means that as the adoption of technology-driven inventory management improves, supply chain practices in healthcare institutions also enhance.

E. The Relationship Between Challenges in Inventory Management on Technology Adoption in Inventory Management Systems

Table 5

Challenges Encountered	Technology Adoption in Inventory Management	R-Value	Degree of Correlation	P-Value	Conclusions
Training and Skill Development	Inventory Tracking and Updates	0.678	Strong Positive	<.00001	Significant
	Process Automation	0.800	Strong Positive	<.00001	Significant
	Integration with Other Functions	0.831	Strong Positive	<.00001	Significant
	Ease of Use and Accessibility	0.816	Strong Positive	<.00001	Significant
	Reporting and Decision Making	0.822	Strong Positive	<.00001	Significant
User Acceptance and Readiness	Inventory Tracking and Updates	0.768	Strong Positive	<.00001	Significant
	Process Automation	0.746	Strong Positive	<.00001	Significant
	Integration with Other Functions	0.817	Strong Positive	<.00001	Significant
	Ease of Use and Accessibility	0.825	Strong Positive	<.00001	Significant
	Reporting and Decision Making	0.848	Strong Positive	<.00001	Significant
Infrastructure	Inventory Tracking and Updates	0.643	Strong Positive	<.00001	Significant
	Process Automation	0.788	Strong Positive	<.00001	Significant
	Integration with Other Functions	0.850	Strong Positive	<.00001	Significant
	Ease of Use and Accessibility	0.850	Strong Positive	<.00001	Significant
	Reporting and Decision Making	0.771	Strong Positive	<.00001	Significant

*Significant Level=0.01

Table 5 shows the relationship between challenges in inventory management and technology adoption in inventory management systems. The R-values range from 0.643 to 0.850, all categorized as strong positive correlations, indicating that greater challenges in inventory management are strongly related to higher technology adoption in inventory management systems. The computed p-values, ranging from 0.0001, are well below the significance level of 0.01 (P<0.01); thus, the null hypothesis is rejected. The results indicate that challenges in Supply Chain Practices such as Inventory Tracking and Updates (from 0.643 to 0.768), Process Automation (from 0.746 to 0.800), Integration with Other Functions (from 0.817 to 0.850), Ease of Use and Accessibility (from 0.816 to 0.850), and Reporting and Decision Making (from 0.771 to 0.848) all show a significant positive relationship with technology adoption in inventory management systems. These findings suggest that as challenges in inventory management practices increase, the adoption of technology in inventory management systems also rises significantly, emphasizing the importance of overcoming challenges to improve technological integration. As challenges in inventory management increase, the adoption of technology in inventory management systems also increases. This means that as organizations face more challenges in inventory management—such as inefficiencies, inaccuracies, delays, or high operational costs—they are more likely to adopt

technology-driven solutions to address these issues.

5. Conclusion

The findings of the study indicate that healthcare institutions generally hold a positive view regarding the adoption of technology in inventory management systems, particularly in relation to inventory tracking, process automation, and reporting. Respondents emphasized the effectiveness of real-time updates and accurate inventory monitoring; however, challenges related to system accessibility and ease of use were identified, suggesting the need for further improvements to optimize user experience and ensure seamless integration at all organizational levels.

The study also highlights significant challenges encountered in current inventory management practices, primarily concerning training and skill development, user acceptance, and infrastructure. Although training programs were available, concerns about their adequacy and frequency of updates impeded effective utilization of the systems. Resistance to change and difficulties in adapting to new technologies further exacerbated these challenges, while issues with infrastructure—particularly system integration and internet connectivity—created substantial barriers to the smooth adoption of technological solutions. Despite these obstacles, respondents showed a moderate level of preparedness to adopt technology-driven solutions and expressed willingness to engage in additional training and system integration. Furthermore, the study found a strong relationship between the extent of technology adoption in inventory management and improved supply chain performance, particularly in areas such as lead time management, cost reduction, and decision-making. These findings suggest that the adoption of technology in inventory management significantly enhances supply chain practices in healthcare institutions, with improved operational efficiency serving as a key driver for the integration of advanced technological solutions.

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