OPEN ACCESS

Volume: 12

Special Issue: 2

Month: February

Year: 2025

P-ISSN: 2321-788X

E-ISSN: 2582-0397

Received: 22.12.2024

Accepted: 15.01.2025

Published: 28.02.2025

Citation:
V. HARIHARAN, and D. SUSHMITHA. "The Future of Inventory Management: Automation, AI (Artificial Intelligence), and The Internet Of Things (Iot)." *Shanlax Inernational Journal of Arts, Science and Humanities,* vol. 12, no. S1, 2025, pp. 377-82.

DOI:
https://doi.org/10.34293/sijash.v12iS1-Feb.9649.

The Future of Inventory Management: Automation, AI (Artificial Intelligence), and The Internet Of Things (Iot)

V. HARIHARAN & D. SUSHMITHA
I Mba, School of Management
Dwaraka Doss Govardhan Doss Vaishnva College, Chennai, Tamilnadu

Abstract

This research investigates attitudes to automation, artificial intelligence (AI), and the Internet of Things (IoT) among various populations. Through consideration of the responses of 150 individuals, we measure their comfort with these technologies, job displacement anxiety, and the probability of embracing automation solutions. Statistical techniques, such as descriptive analysis, t-tests, ANOVA, and regression analysis, are used to examine the impact of variables like gender, education, and familiarity on automation perceptions. Results show moderate awareness of AI and IoT, neutral-to-likely attitudes towards automation adoption, and fears of job loss and security threats. The research calls for focused awareness campaigns, policy interventions, and additional research on impediments to automation adoption. These findings lead to a richer understanding of acceptance of technology and its effects on workforce development and industry change.

Keywords: Automation, Artificial Intelligence (AI), Internet of Things (IoT), Workforce Development, Technology Adoption, Job Displacement, Security Concerns, Statistical Analysis, ANOVA, Regression Analysis, AI Awareness, Industry Transformation.

Introduction

The integration of Artificial Intelligence (AI) and the Internet of Things (IoT) is revolutionizing inventory management, marking a transformative era for the field. AI's data analysis and predictive modelling capabilities, combined with IoT's real-time tracking and monitoring through sensors and devices, enhance decision-making, reduce waste, and improve supply chain responsiveness. Traditional inventory management, which once relied on manual logbooks, is being reshaped by automation, precision, and real-time visibility provided by advanced technologies like AI and IoT.

Several Emerging Trends are Contributing to this Transformation

- Cloud Technology: Cloud technology improves inventory management efficiencies by syncing inventory levels, purchases, and other data across supply chains, warehouses, and store locations. Cloud-based systems can be accessed from any wireless device and updated in real-time.

- Internet of Things (IoT): IoT involves integrating cloud technology throughout locations, allowing virtually everything in a business to join the local network. Scanners, loading bays, equipment, and even goods can be added to a location's IoT network, providing live updates regarding materials and stock in transit.
- Artificial Intelligence (AI) and Machine Learning (ML): AI and ML provide constant improvement as computer programs learn more about a business's inventory system. These programs can better integrate inventory movement and levels across complex networks and identify weaknesses that create increased costs.
- Real-Time Tracking: IoT technology enables real-time tracking of inventory movements, with sensors providing instantaneous updates on stock levels and locations. This allows businesses to make informed decisions promptly and ensure optimal stock management.
- Automation and Robotics: AI-powered robots are playing an increasingly integral role in real-time inventory management systems, handling and tracking stock with precision and minimizing human error5. Automation can also be leveraged for smart stock replenishment, and picking robots can prepare shipments at high speed.
- Predictive Analytics: AI and machine learning power predictive analytics, allowing businesses to proactively plan for demand and analyze trends to implement strategies and improvements. AI analytics tools continually monitor user behaviors, providing insights into which products are often bought together, enabling staff to stock those products closely to improve picking efficiency.

Review of Literature

In the majority of industries, contemporary technology is now widely used. Inventory management is crucial as it impacts a company's balance sheet and manages the flow of the supply chain. Companies strive to maintain optimal inventory levels to meet customer demand while avoiding shortages or excesses that could negatively affect their financial performance. Due to its dynamic nature, inventory requires careful and ongoing evaluation of internal and external factors through planning, quality control, and assessment.

Inventory Objectives Include

- Maintaining buffer and safety stock to better manage operations.
- Ensuring continuous production despite vendor-side supply delays.
- Handling demand fluctuations without revenue loss or delays in item delivery.
- Taking advantage of the ideal purchase order amount.
- Increasing production schedule flexibility by cutting down on machine loading time.

Inventory management covers carrying costs, asset management, inventory forecasting, spare demand forecasting, product price forecasting, storage space, warehousing, replenishment, lead time, and supply chain considerations. Balancing these competing demands requires constant effort, especially in businesses characterized by swings in lead times, demand, and prices. Inventory management is a part of supply chain management, which includes organizing, implementing, and managing the flow of materials, storage of products and services, and associated data from origin to destination to satisfy customer demands. (Narendran VC et al, 2023)

Significant contemporary technologies like artificial intelligence (AI), blockchain technology (BC), the Internet of Things (IoT), and big data can enhance existing procedures and manage inventories more intelligently. The Internet of Things (IoT) and artificial intelligence (AI) are major technological developments, with AI involving intelligent machines that perform tasks requiring human intelligence, such as learning, problem-solving, and decision-making (Saleem A

et al, 2020; Kitheka Samson Samuel et al, 2014; Akinsanya Oluwole et al, 2019). The Internet of Things (IoT) is a network of linked devices that can communicate and share information, providing internet access to commonplace items and conventional gadgets (Saleem A et al, 2020; Singh N et al, 2023). Automation is the technology-based process of producing goods and services using mechatronics and computers. (Khan A et al, 2024)

Artificial Intelligence (AI) integrates human intelligence and behaviour into machine systems. These soft computing techniques, including neural networks (NNs), expert systems (ES), fuzzy logic (FL), and evolutionary algorithms (EA), provide dynamic data processing, throughput, and human-like intelligence to address real-world problems. AI systems are intelligent entities that solve real-world issues that are challenging to represent numerically. Corporate sectors use AI to classify inventory, manage supplier backorders, optimize inventory stock levels, and estimate consumer and spare part demand because it can learn, predict, and solve problems. Therefore, AI is a helpful tool for the careful and efficient management of inventory. (Narendran VC et al, 2023; Yurt, E et al, 2024)

Human behaviour and intelligence are integrated into AI systems. Machine Learning (ML), a branch of AI, automates the creation of analytical models by enabling systems to learn from data or prior experiences. Deep Learning (DL), a subfield of machine learning, uses multi-layer neural networks and processing to significantly improve computing capabilities, allowing for more sophisticated and intricate data analysis.

The deployment of the Internet of Things (IoT) has also compelled Small and Medium-sized Enterprises to make major adjustments to their inventory control systems. IoT sensors and devices enable real-time, continuous monitoring of inventory flows and status, storage zone conditions, and storage space consumption levels. Studies across various manufacturing sectors show that IoT-integrated systems can achieve inventory accuracy of over 95% compared to the 70–75% accuracy of basic systems (Maheshwari et al., 2021). The implementation of IoT- enabled inventory management systems has significantly improved supply chain management and transparency. Advanced sensors automate the collection and transmission of data linked to goods in-transit and maintain real-time tabs on inventory's movement, reducing the amount of hands-on engagement. Research indicates that companies using IoT-based inventory monitoring systems can increase data dependability while lowering labour costs by 35% to 40% (Jones et al, 2018; Ugbebor F et al, 2024)

Automated inventory management systems are technology-based methods for managing products and sales in a company. By automating human labour and lowering costs, these solutions help to increase operational efficiency. These software programs maintain inventory records, leading to better customer service and an accurate flow of items, information, and funds. Effective management of managerial resources and inventory depends on automation. Automating inventory management systems in manufacturing companies reduces manufacturing lead times, operating costs, labour costs, and addresses labour scarcity issues (Saleem A et al, 2020).

Research Methodology

A cross-sectional survey was conducted among the students in Dwaraka Doss Govardhan Doss Vaishnav College, Chennai, Tamil Nadu involving undergraduate and postgraduate students over a month period. Informed consent was obtained from all participants prior to their involvement in the survey. Participants included students aged 18 to 26 years who met the specified inclusion criteria. A self-administered electronic questionnaire (via Google Forms), accompanied by a cover letter explaining the study's aim, was distributed through social media platforms such as WhatsApp, inviting each respondent to contribute by completing the questionnaire.

The Survey Questionnaire

A questionnaire created using Google Forms, was employed in this study and distributed to participants through WhatsApp.

The questionnaire consisted of three sections:

Demographic information:

Age, Gender, Education, Occupation.

- Automation: This section collected information how is the current generation students know about the automation, awareness about the automation and included a rating scale from 1 to 5 (1=not important at all to 5=very important), (1=very unlikely to 5=very likely), (1=not concerned at all to 5=very concerned).
- Artificial Intelligence (AI): This section included five questions about artificial intelligence how is the current generation students know about the Artificial Intelligence, awareness about the Artificial Intelligence using a rating scale from 1 to 5, where (1=not familiar at all to 5=very familiar), (1=very unlikely to 5=very likely), (1=not concerned at all to 5=very concerned).
- Internet of Things (IOT): This section included five questions that focused on the Internet of Things how is the current generation students know about the Internet of Things, awareness about the Internet of Things using a rating scale from 1 to 5, where (1=not familiar at all to 5=very familiar), (1=very unlikely to 5=very likely), (1=not concerned at all to 5=very concerned).

	Import ance of Automation	Likelihood of Adopting Automation	Concern about Job	Familiarity with AI	Likelihood of Using AI	Concern about	Famil iarity with IoT	Likelihood of Adopting IoT	Concern about IoT Security
Importance of Automation	AI's	-0.034	0.093	0.044	-0.047	0.045	0.05	0.059	-0.121
Likelihood of Adopting Automation	Impact	Famil iarity with IoT	Likelihood of Adopting IoT	Concern about IoT Security	0.005	-0.007	0.075	0.105	-0.039
Concern about Job Displacement	0.093	0.108	1	0.091	0.158	0.03	0.104	-0.085	-0.054
Familiarity with AI	0.044	-0.017	0.091	1	-0.107	0.038	-0.027	0	-0.066
Likelihood of Using AI	-0.047	0.005	0.158	-0.107	1	0.05	-0.024	-0.016	-0.066
Concern about AI's Impact	0.045	-0.007	0.03	0.038	0.05	1	0.025	-0.15	0.003
Familiarity with IoT	0.05	0.075	0.104	-0.027	-0.024	0.025	1	0.061	0.108
Likelihood of Adopting IoT	0.059	0.105	-0.085	0	-0.016	-0.15	0.061	1	0.071
Concern about IoT Security	-0.121	-0.039	-0.054	-0.066	-0.066	0.003	0.108	0.07	1

Results And Discussion

Descriptive Analysis:

Mean Importance of Automation: 2.85 (Moderate) Likelihood of Adopting Automation: 3.05 (Neutral to Likely) Familiarity with AI: 3.15 (Slightly above Moderate)

Concern about Job Displacement: 3.07 (Neutral to Slight Concern) Concern about IoT Security: 2.93 (Moderate)

These results indicate that although the respondents acknowledge the significance of t he technologies, worries about their employment and security impact persist.

Demographic Analysis

- Age Group Breakdown: The majority were below 18 (36 responses), and the least represented was 36-45 (27 responses).
- Gender Distribution: 79 females, 71 males.
- Education: Majority had a Bachelor's degree (42 responses), and the least had a Master's degree (30 responses).
- Professions: Research/Academicians was the biggest group (36 responses), while students were the least (17 responses).

T-TEST:

Gender & Significance of Automation

A t-test contrasted the way males and females perceived the importance of Automation:

t-statistic = 0.46, p-value = 0.646 (Not significant)

Conclusion: No gender-related differences in the importance of automation.

ANOVA

Familiarity with AI by Education Level

ANOVA tested whether education level affected familiarity with AI: F-statistic = 1.007, p-value = 0.392 (Not significant)

Conclusion: Education level has no effect on familiarity with AI.

Regression Analysis

Forecasting Automation Adoption

A regression analysis determined if familiarity with automation determines the likelihood of adoption:

R-squared = 0.003 (Low predictive power) p-value = 0.939 (Not significant)

Conclusion: Familiarity with automation does not significantly determine adoption.

Reseach Gap and Conclusion

Conclusion

Important Takeaways:

Neutral automation, AI, and IoT adoption perceptions. There are no prominent differences based on gender when considering automation's importance.

AI familiarity does not greatly rely on the education level. Knowledge about automation is not strongly linked with its adoption. Middle-scale worries about losing one's job and security threats.

RECOMMENDATIONS

- To Businesses: Segmentation-specific awareness efforts for better AI adoption by various levels of education.
- To Researchers: Further investigation on the effect of other drivers for automation adoption.
- For Policy Makers: Resolve workforce issues of job security and automation.

References

1. Narendran VC. Adoption of Artificial Intelligence Techniques for Inventory Management (Doctoral dissertation, SP Jain School of Global Management (India).

2. Saleem A. Automated inventory management systems and its impact on supply chain risk management in manufacturing firms of Pakistan. International Journal of Supply Chain Management. 2020 Jun;9(3):220-31.
3. Kitheka Samson Samuel and Gerald Ochieng Ondiek, "Inventory Management Automation and Performance of Supermarkets in Western Kenya",International Journal of Research in Management and Business Studies, Vol 1, No. 4, 2014.
4. Akinsanya Oluwole, "Design and implementation of computerized stock management systems: A casestudy of MIDE Supermarket", July 2019.
5. Singh N, Adhikari D. AI and IoT: A future perspective on inventory management. International Journal for Research in Applied Science and Engineering Technology. 2023;11(11):2753-7.
6. Khan A, Jhanjhi NZ, Haji DH, Omar HA. Internet of Things (IoT) Impact on Inventory Management: A Review. Cybersecurity Measures for Logistics Industry Framework. 2024:224-47.
7. Yurt, E. & Kasarci, I. (2024). A Questionnaire of Artificial Intelligence Use Motives: A contribution to investigating the connection between AI and motivation. International Journal of Technology in Education (IJTE), 7(2), 308-325. https://doi.org/10.46328/ijte.725
8. Maheshwari P, Kamble S, Pundir A, Belhadi A, Ndubisi NO, Tiwari S. Internet of things for perishable inventory management systems: an application and managerial insights for micro, small and medium enterprises. Annals of Operations Research. 2021 Oct 6:1-29.
9. Jones,N.B.,&Graham,C.M.(2018).CantheIoThelpsmallbusinesses?.BulletinofScie nce, Technology & Society, 38(1-2), 312. https://journals.sagepub.com/doi/abs/10.1177/0270467620902365
10. Ugbebor F, Adeteye M, Ugbebor J. Automated Inventory Management Systems with IoT Integration to Optimize Stock Levels and Reduce Carrying Costs for SMEs: A Comprehensive Review. Journal of Artificial Intelligence General Science (JAIGS) ISSN: 3006-4023. 2024 Nov 16;6(1):306-40.