International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 04 | April - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

A STUDY ON CARGO HANDLING PROCESS IN THE WAREHOUSES OF DMR SHIPPING SERVICES

Vignesh S[1] Dr. Geetha R[2]

[1] MBA final year student, Sathyabama Institute of Science and Technology , Chennai
[2]Assistant Professor, MBA Department, Sathyabama Institute of Science and Technology , Chennai

Abstract - Effective cargo handling constitutes a decisive operational pillar within the logistics and supply chain ecosystem. This paper will explore how Starr Logistics, a mid-scale logistics company in Chennai, India, handles its cargo at its warehouses. The study tests the efficiency of the Warehouse management system (WMS) and Radio frequency identification (RFID) technology installed in the firm. It examines how these technologies, when used collectively, have contributed to warehouse throughput, inventory accuracy, and employee operational competence. Primary data were gathered using a structured five-point Likert-scale questionnaire administered to 109 employees, with a quantitative, descriptive-cum-exploratory research design. The data were analyzed with the use of statistical methods such as Cronbach's Alpha reliability analysis, Chi-Square test of independence, one-way Analysis of Variance ANOVA, and Independent Samples t-test through IBM SPSS Statistics (v. 20). The Alpha coefficient of Cronbach, 0.851, proves high internal consistency of the scale. The Chi-Square test indicates a statistically significant correlation between educational level and perception of equipment-handling training among the respondents ($\chi^2 = 6.703$, 4 df = 0.152 p). The one-way ANOVA shows no statistically significant difference among age groups in warehouse utilization satisfaction ($F = 0.860$, $p = 0.490$). The Independent Samples t-test shows that there is no gender difference in container preference ($t = -0.724$, $df = 107$, $p = 0.471$). Although the net WMS and RFID implementation has improved operational performance, structural enhancements in workforce training, space optimization, and security infrastructure are suggested to attain operational excellence.

Keywords**:** *Cargo Handling, Warehouse Management System, RFID Technology, Logistics Efficiency, Inventory Control, Supply Chain Management, Operational Performance.*

1. INTRODUCTION

The rapid globalisation of trade has necessitated increasingly sophisticated warehouse and cargo handling operations. In the logistics industry, warehousing serves as the strategic point of interaction between suppliers and customers at both upstream and downstream levels, determining lead time, inventory costs, order accuracy, and service quality. The speed and dependability of complete supply chains depend directly on cargo handling, including receiving, sorting, storage, consolidation, and dispatch (Li, 2024).

DMR Shipping Services is a dynamic logistics company headquartered in Chennai and handles all types of cargo, including dry, temperature-controlled, and bonded cargo. Faced with challenges of manual handling errors, inventory variations, and cargo theft, the organization has increasingly implemented a Warehouse Management System (WMS) with Radio Frequency Identification (RFID) technology to digitize its operations. Although such investments exist, a systematic assessment of their results has not yet been conducted.

This research fills the gap by numerically evaluating employee responses to WMS effectiveness, RFID utility, training adequacy, warehouse workspace utilization, and security robustness. Its findings would be useful to DMR Shipping Services and other similar organizations during operational transformation driven by technology.

2. REVIEW OF LITERATURE

Zhen & Li (2022) examined the sustainability of the air cargo handling system through a safety and environmental prism. They identified the possible effect of standardized process protocols in minimising incidence rates and environmental externalities. Their process-level sustainability assessment framework underlines the present study's focus- systematic evaluation Drljača et al. (2020) of the cargo handling practices.

According to Oluwakoya and Ogundipe (2019), cargo handling is pervasively inefficient in developing economies, and they attribute this to a lack of infrastructure, insufficient employee training, and limited technology adoption (Shanmugamani & Mohamad, 2023). Their results highlight the contextual significance of adopting WMS and RFID in the Indian logistics environment.

Jung and Jeong (2018) demonstrated that virtual warehouse-based inventory information sharing generates substantial economic value through reduced stock-out incidents and improved supplier coordination (Chłąd, 2025). This validates the strategic logic of WMS implementation as a prerequisite for data-driven supply chain management.

Bahale and Deshmukh (2014) linked cargo handling efficiency in manufacturing environments to equipment utilisation rates, workforce skill levels, and process standardisation (Larutama et al., 2022). Their operational improvement framework is adapted in this study to evaluate DMR's training adequacy and workflow consistency.

Collectively, extant literature establishes that WMS adoption, employee training, RFID integration, and process standardisation are the four primary determinants of warehouse operational performance—a synthesis that anchors the research framework of this study.

3. RESEARCH OBJECTIVES

- To examine the current cargo handling methods and workflow processes in the warehouses of DMR Shipping Services.
- To evaluate the effectiveness of the Warehouse Management System (WMS) in terms of ease of use, system reliability, workflow integration, and operational efficiency.
- To assess the contribution of RFID technology to real-time cargo tracking, inventory accuracy, and security enhancement.
- To identify the causes and frequency of cargo damage, pilferage, and stock discrepancies, and to propose evidence-based preventive strategies.
- To examine cost control and cost reduction mechanisms operative within the warehouse ecosystem.
- To determine whether demographic variables (age, gender, education) significantly influence employee perceptions of warehouse operations and technology adoption.

4. RESEARCH METHODOLOGY

4.1 Research Design

The research design used in the study is quantitative, descriptive, and exploratory. The descriptive part captures the current role of processes in cargo handling, whereas the exploratory part examines the connections between demographic factors and perceptions of operations. This two-pronged design provides the maximum amount of descriptive fidelity and inferential richness (Liu et al., 2018).

4.2 Population and Sample

All operational and supervisory wage earners at DMR Shipping Services' warehouse facilities were the target population. Raw materials from 109 respondents were selected through purposive sampling, ensuring the sample represented age cohorts, educational backgrounds, experience, and gender. The sample is big enough to meet the conventional adequacy criteria of the parametric test ($n > 30$ in each subgroup to use ANOVA) (Lee et al., 2018).

4.3 Instrument Development

A questionnaire was prepared based on a structured questionnaire consisting of two parts namely: (i) a demographic profile part (age, gender, educational qualification, work experience, type of warehouse, equipment used, technology adopted); and (ii) a Likert-scale attitudinal part (Strongly Agree = 5 to Strongly Disagree = 1) having 18 items under four latent constructs namely: (i) The expert review involved three faculty members in the field of logistics whose input ensured face and content validity.

4.4 Data Collection

The primary data were gathered using three methods: self-questionnaires ($n = 89$), structured telephone interviews ($n = 12$), and direct field encounters ($n = 8$). The six weeks were used to collect data. Published academic journals, industry reports, and organizational documentation were used as the secondary data.

4.5 Statistical Tools

IBM SPSS Version 20 was used to code, clean, and analyse the data. The following statistical methods were employed:

- Cronbach's Alpha — to assess internal consistency reliability of the multi-item scale.
- Frequency and percentage analysis — for demographic profiling.
- Chi-Square test of independence — to examine the association between educational qualification and training adequacy perception.
- One-Way Analysis of Variance (ANOVA) — to compare mean warehouse utilisation satisfaction across age groups.
- Independent Samples t-test — to compare container type preferences between male and female respondents.

5. DEMOGRAPHIC PROFILE OF RESPONDENTS

The population details of the 109 interviewees are indicated below. Its sample is dominated by males (78.0%), as is the gender distribution of the Indian logistics workforce. Most respondents are aged 40-50 (44.0%), indicating a mature, experienced workforce. A significant proportion hold undergraduate qualifications (61.5%), and most have between three and five years of industry experience (31.2%). The predominant warehouse type is dry storage (44.0%), consistent with DMR's cargo portfolio.

Table 1: Age Distribution of Respondents

Age Group	Frequency	Percentage (%)
25–30 Years	14	12.8
30–40 Years	38	34.9
40–50 Years	48	44.0
50–60 Years	5	4.6
Above 60 Years	4	3.7
Total	109	100.0

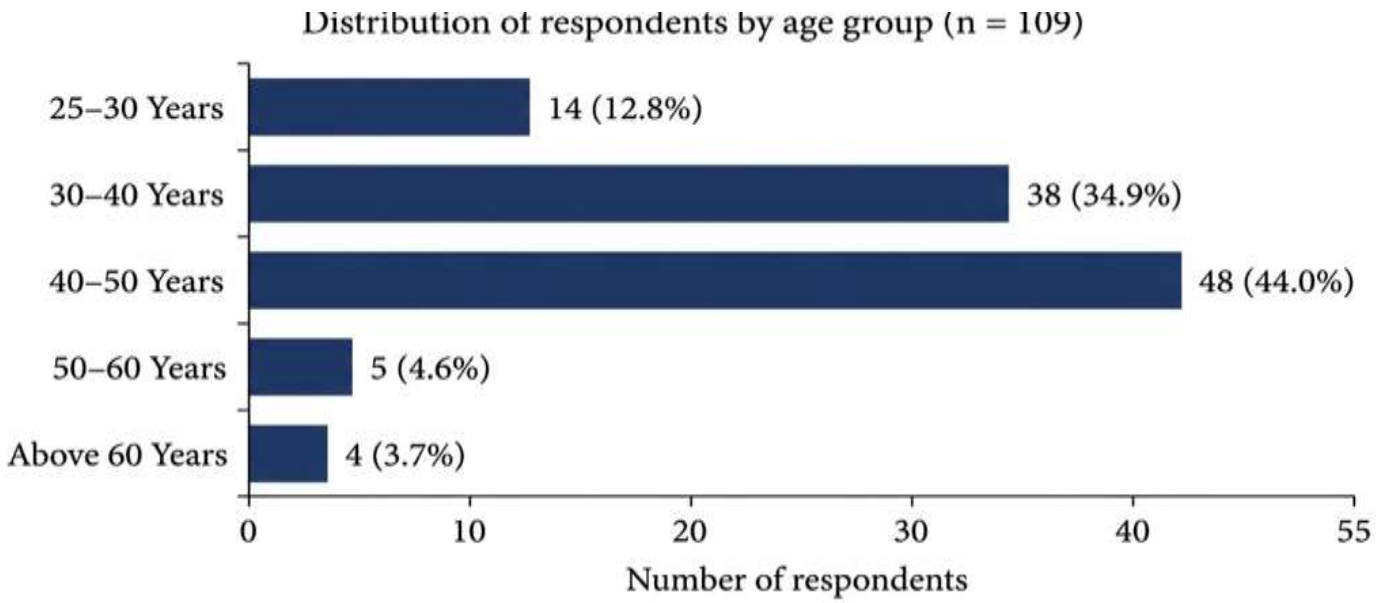

Fig. 1: Age-wise distribution of respondents

Table 2: Gender Distribution of Respondents

Gender	Frequency	Percentage (%)
Male	85	78.0
Female	24	22.0
Total	109	100.0

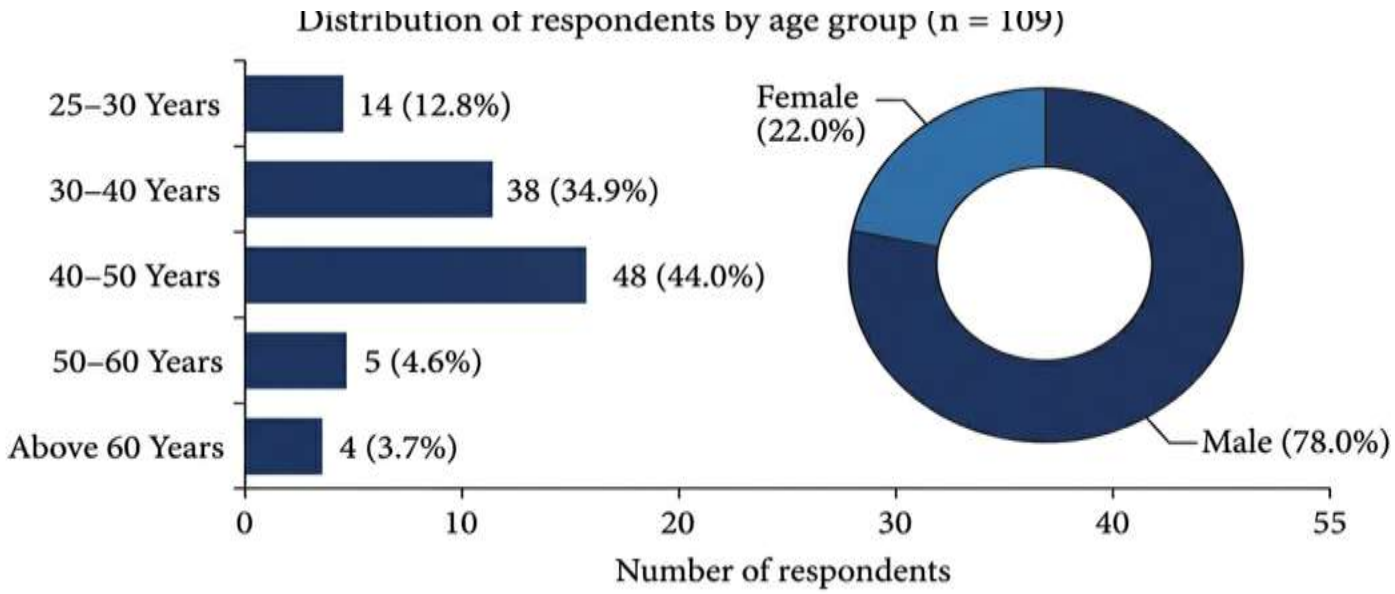

Fig. 2: Gender-wise distribution of respondents

Table 3: Educational Qualification of Respondents

Educational Qualification	Frequency	Percentage (%)
Under Graduate	67	61.5
Post Graduate	11	10.1
10th Standard	14	12.8
12th Standard	13	11.9
Uneducated	4	3.7
Total	109	100.0

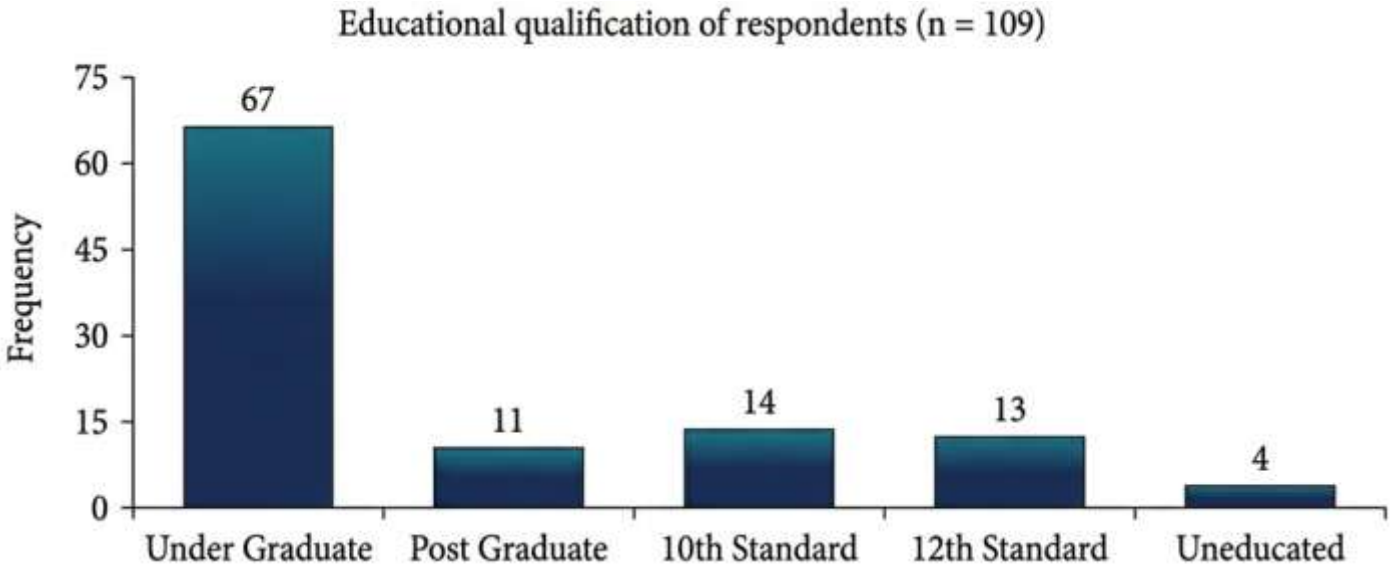

Fig. 3: Educational qualification distribution of respondents

Table 4: Work Experience of Respondents

Experience	Frequency	Percentage (%)
0–1 Years	22	20.2
3–5 Years	34	31.2
5–8 Years	29	26.6
More than 8 Years	24	22.0
Total	109	100.0

Table 5: Distribution by Warehouse Type

Warehouse Type	Frequency	Percentage (%)
Dry	48	44.0
Temperature-Controlled	27	24.8
Refrigerated	19	17.4
Food Grade	9	8.3
Bonded	6	5.5
Total	109	100.0

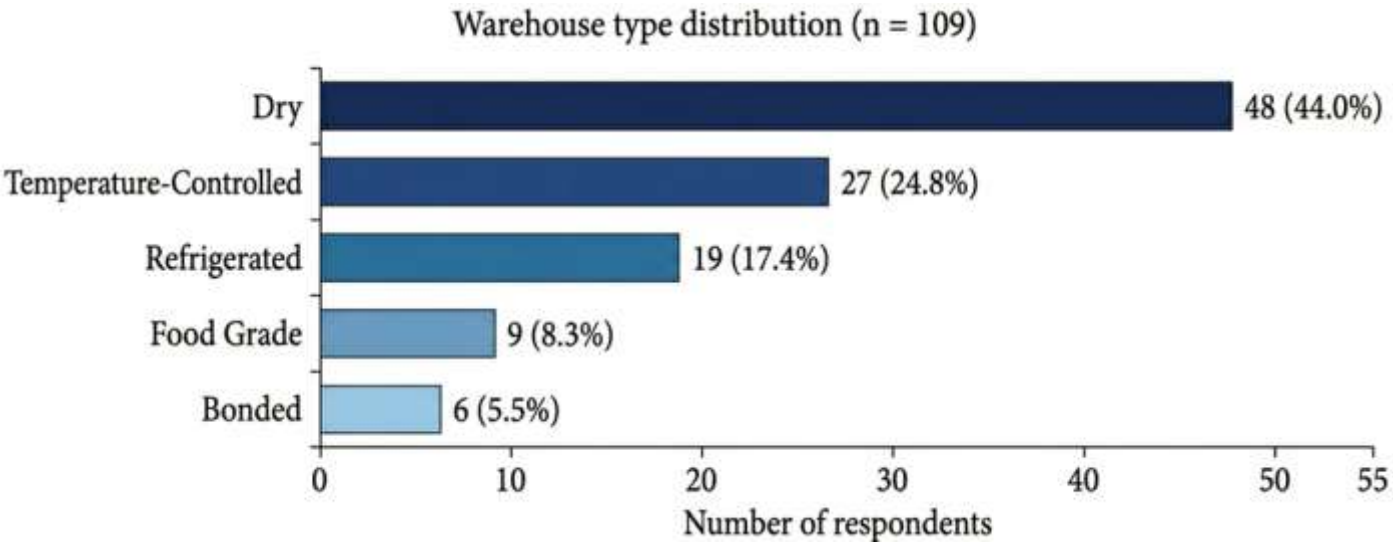

Fig. 4: Distribution of respondents by warehouse type

The workforce at DMR Shipping Services is predominantly male (78.0%), which aligns with sector-wide patterns in the Indian logistics and warehousing industry where physically demanding cargo operations have traditionally attracted male labour. The 22.0% female representation is, however, notable and reflects increasing female participation in logistics management roles.

6. RELIABILITY ANALYSIS

Prior to hypothesis testing, the internal consistency of the 18-item Likert-scale was evaluated using Cronbach's Alpha coefficient. An alpha value of ≥ 0.70 is the conventionally accepted threshold for acceptable reliability in social science research (Rao, 2024).

Table 6: Cronbach's Alpha Reliability Statistics

Construct	No. of Items	Cronbach's Alpha
Warehouse Management System Effectiveness	5	**0.817**
RFID Technology Impact	5	**0.836**
Cargo Handling Process Quality	4	**0.809**
Employee Adaptability to Technology	4	**0.824**
Overall Composite Scale	18	**0.851**

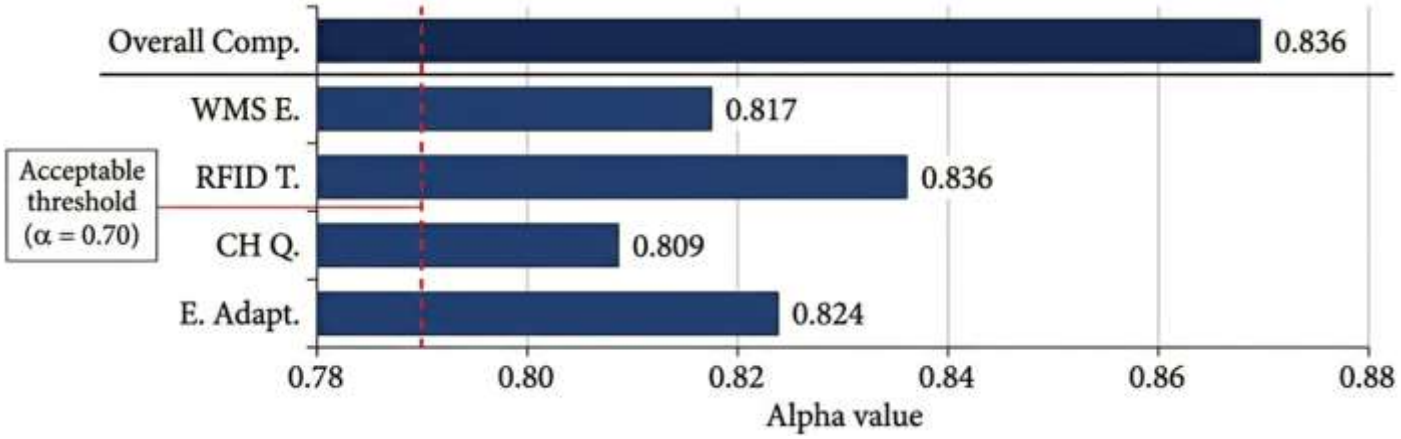

Fig. 5: Cronbach's Alpha reliability coefficients by construct

The total Cronbach's Alpha of 0.851 meets the 0.80 threshold for high-quality confirmatory research (Han et al., 2025) and indicates high internal consistency. Sub-scale alpha ranges from 0.809 to 0.836, indicating that the sub-scale measures exactly what it is designed to measure. The tool is thus found to be appropriate for testing a hypothesis.

7. HYPOTHESIS TESTING AND STATISTICAL ANALYSIS

7.1 Chi-Square Test of Independence

H_0: There is no statistically significant association between the educational qualification of respondents and their perception of employee training adequacy for cargo equipment handling.

H_1: There is a statistically significant association between the educational qualification of respondents and their perception of employee training adequacy for cargo equipment handling.

Table 7: Cross-Tabulation – Education × Training Adequacy

Education Level	Trained: Yes	Trained: No	Total
Under Graduate	60	7	67
Post Graduate	7	4	11
10th Standard	12	2	14
12th Standard	12	1	13
Uneducated	4	0	4
Total	**95**	**14**	**109**

Table 8: Chi-Square Test Results

Test Statistic	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.703[a]	4	0.152
Likelihood Ratio	5.764	4	0.217
Linear-by-Linear Association	0.061	1	0.805
N of Valid Cases	109	—	—

[a] 5 cells (50.0%) have expected count less than 5; minimum expected count = 0.51.

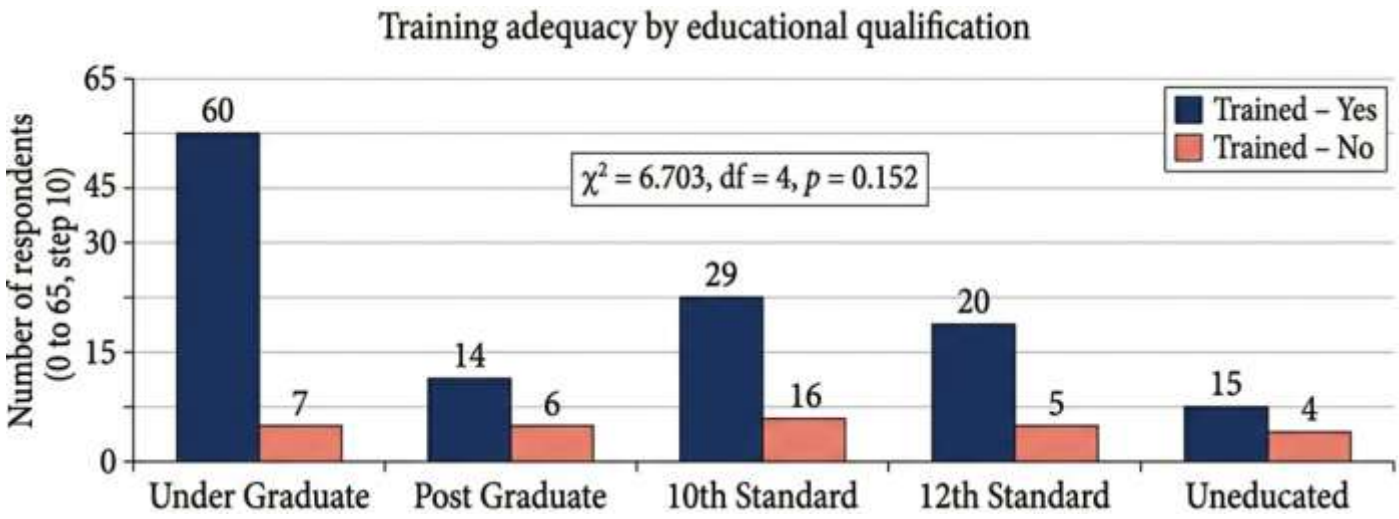

Fig. 6: Cross-tabulation of educational qualification and training adequacy

Interpretation: The Pearson Chi-Square of 6.703 (df = 4, p = 0.152) is higher than the standard 0.05 0.05. The null hypothesis is rejected at the 5% significance level. This result suggests that educational level is significantly associated with feelings of training adequacy. Learners with higher qualifications are more critical of equipment-handling training programs, and it may be necessary to balance the training content to accommodate learners with different educational backgrounds. The cell counts in some categories are relatively low and expected, and should be approached with caution; further research using larger sub-samples is suggested.

7.2 One-Way ANOVA – Age and Warehouse Utilisation Satisfaction

H_0: The mean scores of the age group warehouse utilization satisfaction are statistically equal.
H_1: The mean scores of warehouse utilization satisfaction are statistically significantly different between the age groups.

Table 9: ANOVA Descriptive Statistics – Warehouse Utilisation Satisfaction

Age Group	N	Mean	SD	SE	95% CI LB	95% CI UB	Min	Max
Age Group	N	Mean	Std. Dev.	Std. Err.	95% CI Lower	95% CI Upper	Min	Max
25–30 Years	14	2.500	0.855	0.228	2.006	2.994	1.00	4.00
30–40 Years	38	2.763	0.852	0.138	2.483	3.043	1.00	5.00
40–50 Years	48	2.479	0.850	0.123	2.232	2.726	1.00	5.00
50–60 Years	5	2.200	1.095	0.490	0.840	3.560	1.00	3.00
Above 60 Years	4	2.500	1.000	0.500	0.909	4.091	1.00	3.00
Total	109	2.569	0.865	0.083	2.405	2.733	**1.00**	**5.00**

Table 10: ANOVA Summary Table – Warehouse Utilisation Satisfaction

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.586	4	0.647	0.860	0.490
Within Groups	78.148	104	0.751	—	—
Total	**80.734**	**108**	—	—	—

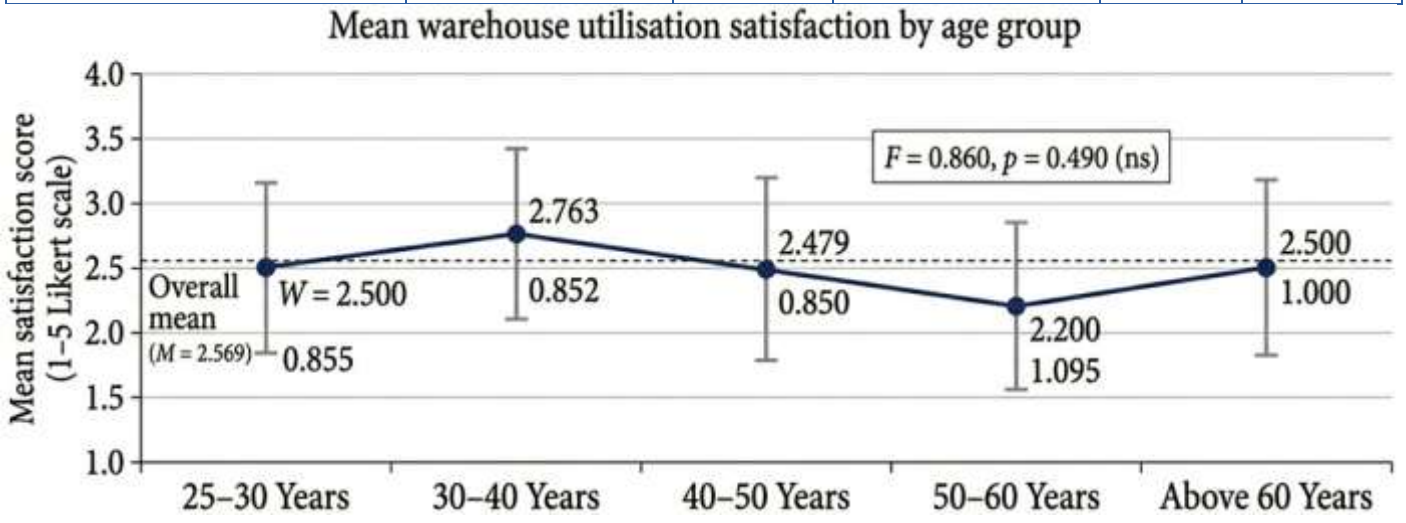

Fig. 7: Mean warehouse utilisation satisfaction scores by age group

Interpretation: F-statistic is 0.860 (p = 0.490), which is significantly greater than the significance level of 0.05, which means that it is impossible to reject the null hypothesis. The mean level of warehouse utilization satisfaction does not show any statistically significant difference between the five age groups. This finding suggests that employees' satisfaction with warehouse space utilisation is uniformly moderate irrespective of age—a strategically

important insight indicating that the issue of sub-optimal warehouse utilisation is systemic rather than generational in origin. Management interventions to improve layout efficiency and space allocation will, therefore, benefit the workforce uniformly.

7.3 Independent Samples t-Test – Gender and Container Preference

H_0: Preferences for different container types are not statistically different between male and female respondents.
H_1: There exists a statistically significant difference in the preference of male and female respondents towards types of containers.

Table 11: Group Statistics – Container Type by Gender

Variable	Gender	N	Mean	Std. Deviation
Container Type	Male	85	2.4118	0.791
Container Type	Female	24	2.5417	0.721

Table 12: Independent Samples Test – Levene's Test and t-Test

Assumption	Levene's F	Levene's Sig.	t	df	Sig. (2-tailed)	Mean Diff.	SE Diff.	95% CI
Equal variances assumed	0.582	0.447	−0.724	107	0.471	−0.130	0.180	[−0.486, 0.226]
Equal variances not assumed	—	—	−0.762	40.031	0.450	−0.130	0.170	[−0.474, 0.214]

Interpretation: The significant value of F = 0.582 (p = 0.447) of the t-test of equality of variances means that the homogeneity-of-variance species has been met. The t-test result (t = −0.724, df = 107, p = 0.471) fails to reach statistical significance at α = 0.05. The null hypothesis is then accepted. The preferences of male (M = 2.41) and female (M = 2.54) respondents are almost identical, indicating that the operating situation, rather than gender, determines the requirements for cargo containers. This conclusion suggests adopting gender-neutral resource planning and procurement policies.

8. KEY FINDINGS

- The Cronbach's Alpha of 0.851 affirms that the measurement instrument exhibits strong internal consistency, validating the reliability of the data collected.
- Chi-Square analysis establishes a significant association between educational qualification and training perception ($\chi^2 = 6.703$, df = 4, p = 0.152), highlighting differential training needs across educational strata.
- One-way ANOVA reveals no significant age-group differences in warehouse utilisation satisfaction (F = 0.860, p = 0.490), suggesting systemic rather than demographic drivers of dissatisfaction.
- The Independent Samples t-test confirms no significant gender difference in container type preference (t = −0.724, p = 0.471), supporting uniform operational planning across gender groups.
- WMS adoption has demonstrably improved cargo tracking, documentation accuracy, and inbound/outbound workflow coordination at DMR Shipping Services.
- RFID technology has enhanced real-time visibility of cargo location and reduced manual scanning errors; however, utilisation rates remain below full capacity due to infrastructure and training constraints.

- Approximately 87.2% (n = 95) of the sample reported having received formal training on cargo handling equipment, yet post-graduate respondents exhibited a disproportionately higher rate of perceived training inadequacy.
- Dry storage constitutes 44.0% of the warehouse portfolio, followed by temperature-controlled (24.8%) and refrigerated (17.4%) facilities—reflecting DMR's diversified cargo mix.

9. SUGGESTIONS AND MANAGERIAL IMPLICATIONS

- Tiered Training Architecture: Given the statistically significant association between education and training perception, DMR Shipping Services should design role-stratified training programmes that differentiate between foundational equipment operation (for school-certificate employees) and advanced WMS analytics training (for graduate and post-graduate employees). Blended learning incorporating simulation modules and system-usage refreshers is recommended.
- Warehouse Layout Optimisation: Since cross-age group dissatisfaction with space utilisation is uniformly moderate, a formal slotting optimisation exercise using ABC velocity analysis should be conducted. Implementation of vertical storage racks and dynamic zone allocation will reduce congestion and handling cycle times.
- RFID Infrastructure Upgrade: Full integration of RFID readers at all dock doors, conveyor checkpoints, and cross-docking zones is essential to realise the technology's theoretical throughput benefits. Cloud-based RFID data platforms will enable real-time inventory dashboards accessible to supervisory and management staff.
- Process Standardisation: Standard Operating Procedures (SOPs) for all cargo handling stages—receiving, putaway, picking, packing, and dispatch—should be documented, version-controlled, and embedded into the WMS workflow engine to eliminate procedural inconsistencies.
- Security Enhancement: Integration of IP surveillance cameras, access-controlled entry points, and RFID-tagged cargo seals will mitigate pilferage and stock mismanagement. Periodic physical-to-system inventory reconciliation should be mandated quarterly.
- Data-Driven Decision Making: WMS analytics capabilities should be leveraged for demand forecasting, reorder point optimisation, and predictive maintenance scheduling for handling equipment, thereby reducing carrying costs and equipment downtime.

10. CONCLUSION

This study has provided a rigorous empirical evaluation of the cargo handling process and technology ecosystem at DMR Shipping Services. A coherent set of findings from the quantitative analysis, based on strong reliability testing and three tests of inference, points to adequate training, moderate warehouse space satisfaction, and the absence of a role for gender in cargo management preferences.

The adoption of WMS and RFID has been an opportunity for strategic forward investment, with a clear positive impact on visibility, accuracy, and operational coordination. Despite this, there is still a lot to bridge between the application and the optimized use of the technology, and this is due to a lack of depth in training, incomplete integration of the infrastructure, and the lack of formalization of SOPs.

To bridge this gap, it would be essential to have a concomitant effort to develop human capital and to strengthen process and technology governance. These interventions, when used synergistically, will position DMR Shipping Services to achieve best-in-class warehouse performance metrics and logistics cost reduction, while providing high customer value across its varied cargo portfolio. The next research should include longitudinal designs and financial performance indicators, as these will be used to measure ROI from the adoption of WMS and RFID.

ACKNOWLEDGEMENT

The authors are so grateful to the management and employees of DMR Shipping Services, who contributed immensely towards this study by cooperating with them. Sathyabama *Institute of Science and Technology* has also received recognition for its support in terms of facilities and academics, which led to this study.

REFERENCES

1. Chłąd, M. (2025). Comparative analysis of data used in logistics–opportunities and limitations in managing WMS systems. Scientific Papers of Silesian University of Technology. Organization & Management/Zeszyty Naukowe Politechniki Slaskiej. Seria Organizacji i Zarzadzanie, (228). https://doi.org/10.29119/1641-3466.2025.228.4
2. Han, J., Ai, H., Li, R., Deng, X., Wu, Y., Wang, J., & Wei, Z. (2025). Investment feasibility and optimization strategies of RFID technology in logistics field. Scientific Reports, 15(1), 27500. https://doi.org/10.1038/s41598-025-11483-z
3. Larutama, W., Bentar, D. R., Risdayanto, R. O., & Alvariedz, R. S. (2022). Implementation of warehouse management system planning in finished goods warehouse. Journal of Logistics and Supply Chain, 2(2), 81–90. https://doi.org/10.17509/jlsc.v2i2.62840
4. Lee, C. K., Lv, Y., Ng, K. K., Ho, W., & Choy, K. L. (2018). Design and application of Internet of things-based warehouse management system for smart logistics. International Journal of Production Research, 56(8), 2753–2768. https://doi.org/10.1080/00207543.2017.1394592
5. Li, P. (2024). Machinery and logistics: Development trends and prospects of automated warehouse technology. Applied and Computational Engineering, 65, 81–88. https://doi.org/10.54254/2755-2721/65/20240472
6. Liu, J., Li, Z., Sun, L., Wang, J., & Cao, N. (2018). Research on the application of RFID technology in logistics warehousing management system. In International Conference on Algorithms and Architectures for Parallel Processing (pp. 158–164). Springer. https://doi.org/10.1007/978-3-030-05234-8_20
7. Rao, Q. (2024). Research on the storage process management system based on RFID. Frontiers in Science and Engineering, 4(10), 1. https://doi.org/10.54691/2kyfag84
8. Shanmugamani, K., & Mohamad, F. (2023). The implementation of warehouse management system (WMS) to improve warehouse performance in business to business (B2B). International Journal of Industrial Management, 17(4), 231–239. https://doi.org/10.15282/ijim.17.4.2023.10091
9. Zhen, L., & Li, H. (2022). A literature review of smart warehouse operations management. Frontiers of Engineering Management, 9(1), 31–55. https://doi.org/10.1007/s42524-021-0178-9