

Warehouse Pigmentation Systems and their Role in Safety and Operational Efficiency: A Study at DCW Limited, Tamil Nadu

Mohamed Hasan SHB¹ | Dr. G. Amutha^{2*}

¹MBA Student (Logistics and Supply Chain Management), Department of Management Studies, School of Management Studies, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai, Tamil Nadu, India.

²Associate Professor, Department of Management Studies, School of Management Studies, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai, Tamil Nadu, India.

*Corresponding Author: amuthag.sms@velsuniv.ac.in

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Abstract

Warehouse pigmentation — the system of industrial floor coatings, paints, and colour-coded markings applied to warehouse surfaces — plays a functional role in industrial facilities that extends well beyond appearance, influencing safety, durability, and operational efficiency. This study examines warehouse management practices and warehouse pigmentation systems at DCW Limited, a chemical manufacturing company in Tamil Nadu, India, based on a one-month internship and a structured survey of 40 warehouse employees. The study assesses employee perceptions of warehouse operations (receiving, storage, material handling, and dispatch), inventory control practices, chemical safety measures, and the quality and effectiveness of floor coating systems. Findings show that 95% of respondents rate the overall warehouse management system as Excellent or Good, over three-quarters express confidence in inventory tracking and resource adequacy, and 74.3% report satisfaction with the existing warehouse pigmentation system, while 76.9% support wider adoption of eco-friendly industrial coatings. The study concludes that structured warehouse management practices, reinforced by durable and appropriately selected floor coatings, meaningfully improve workplace safety, reduce maintenance costs, and strengthen overall supply chain performance, and it offers practical recommendations for inventory digitisation, employee training, chemical safety reinforcement, and sustainable coating adoption.

Keywords: Warehouse Pigmentation, Industrial Floor Coatings, Warehouse Management, Inventory Control, Chemical Safety, DCW Limited.

Introduction

Warehousing occupies a central position in logistics and supply chain management, linking production and consumption by storing raw materials and finished goods until they are needed. Modern warehouses have evolved from simple storage facilities into integrated logistics centres combining inventory management, order processing, packaging, and transportation coordination — a shift accelerated by the growth of e-commerce, retail, manufacturing, and international trade.

An often-overlooked dimension of warehouse performance is the physical condition of the facility itself, particularly its floor coatings and pigmentation systems. Industrial floor coatings protect warehouse surfaces from chemical exposure, corrosion, and heavy traffic, while colour-coded markings organise storage areas, delineate walkways, and separate hazardous zones. This study explores warehouse management practices at DCW Limited with specific focus on how pigmentation systems and

related maintenance practices contribute to safety and operational efficiency, drawing on direct observation and survey data gathered during a one-month internship.

Need for the Study

- To understand how DCW Limited manages the receiving, storage, handling, inventory, and dispatch of materials.
- To examine how the company maintains accurate stock records and prevents shortages, excess inventory, and material losses.
- To assess the safety practices followed for storing and handling chemical materials and products.
- To identify warehouse-related problems such as delays, space-utilisation issues, and material-handling difficulties.
- To understand how effective warehouse operations, supported by appropriate floor coatings, contribute to smooth production, timely delivery, cost reduction, and customer satisfaction.

Objectives of the Study

- The overall warehouse management system at DCW Limited
- The overall warehouse management system at DCW Limited
- The company uses an effective inventory management system to track stock accurately

Scope of the Study

The study covers warehouse operations (receiving, storing, handling, picking, packing, and dispatch), inventory management practices, warehouse layout and material-handling equipment, safety and regulatory compliance for chemical storage, documentation and technology use, and the role of industrial floor coatings and pigmentation systems — along with operational challenges observed during a one-month internship and suggestions for improvement.

Literature Review

Research on industrial coatings and pigment technologies offers several insights relevant to warehouse infrastructure. Rossi, Calovi, Fedel and colleagues (2020) examined the influence of near-infrared (NIR) reflective pigments on the thermal behaviour of coil coatings, finding that such pigments reduce surface heat absorption and improve durability under high-temperature conditions — a finding with direct application to warehouse roofing and wall coatings in hot climates. Maile (2021) reviewed pigment and colorant technologies used across industrial coating systems, emphasising the growing importance of environmentally friendly formulations for durability and corrosion resistance.

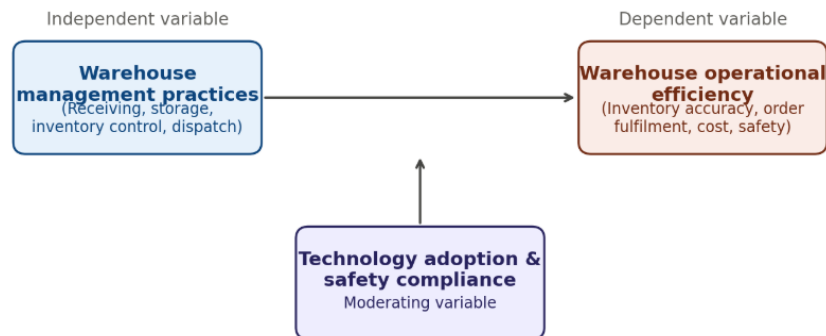
Bibliometric work by Islam, Al Mamun and colleagues (2022) traced global research trends in pigment coloration, identifying sustainable pigments as a rapidly growing research area. Li, Song and colleagues (2020) reviewed pigment-based barrier coatings for packaging applications, noting improvements in moisture resistance and protective performance relevant to warehouse packaging and storage systems. Xia, Zhang, Li and colleagues (2026) examined photodegradation and anti-ageing strategies for wood coatings, with implications for UV-resistant treatments of wooden pallets and storage fixtures.

Wood (2023) outlined broader challenges and opportunities in coatings, dyes, and interface engineering, highlighting smart and sustainable coatings as priorities for industrial facilities. Mohamed, Ahmed and Samir (2023) developed sustainable, antimicrobial core-shell pigment coatings suited to hygiene-sensitive storage environments, while Calovi and Rossi (2024) evaluated sepiolite-based bio-pigments as environmentally friendly alternatives for primer coatings. Randhawa (2024) reviewed the synthesis and environmental impact of hybrid pigments, noting improved colour stability and reduced environmental pollution relative to conventional pigments, and recommended their use in warehouse floor and wall coatings.

Korniy, Danyliak and Zin (2024) assessed zeolite-based anti-corrosion pigments as safer alternatives to toxic chromate pigments for steel structures such as warehouse racking. Nie, Jia, She and Li (2025) reviewed pigment-dispersion technologies, finding that proper dispersion improves coating uniformity, appearance, and durability. Wärmheim and colleagues (2025) used multiscale analysis to examine how pigments influence the weathering resistance of polyester coatings, relevant to warehouse exteriors exposed to sunlight and moisture. Abd El-Gawad, Mohamed and colleagues (2025) developed cost-effective core-shell nanopigment coatings offering enhanced corrosion resistance and reduced maintenance requirements for industrial flooring and machinery.

Collectively, this literature indicates that pigment and coating technologies — spanning thermal reflectivity, corrosion resistance, antimicrobial properties, dispersion quality, and UV stability — offer practical, low-cost interventions for improving the safety, durability, and maintenance economics of warehouse infrastructure. On the management side, foundational texts by Richards (2022), Waters (2019), Sople (2012), Ballou and Srivastava (2007), Chopra, Kalra and Dwivedi (2024), and Baisya (2024) frame warehouse management as a core enabler of supply chain performance, informing the conceptual framework adopted in this study.

• Conceptual Framework



Research Methodology

The study adopts a descriptive research design to capture the current state of warehouse pigmentation systems and management practices at DCW Limited, examining how floor coatings and paint systems contribute to warehouse safety, durability, and maintenance requirements. It follows a predominantly quantitative research approach, supplemented by qualitative insights gathered through direct observation and informal discussion during the internship.

A simple random sampling technique was used to select respondents from among warehouse employees involved in maintenance, operations, and safety management, giving all eligible employees an equal chance of participation. The final sample comprised 40 respondents, spanning Warehouse Managers, Supervisors, Safety Officers, Maintenance Staff, and Warehouse Operators.

Data were collected through a structured questionnaire divided into two sections: Section A captured demographic information (age, gender, work experience, designation, and income), while Section B used a five-point Likert scale (Strongly Agree to Strongly Disagree) covering warehouse operations, inventory management, safety practices, and specific floor-coating attributes — coating quality, pigment durability, clarity of safety markings, slip resistance, ease of maintenance, chemical resistance, and overall employee satisfaction with the pigmentation system. Primary data collection also included direct observation of warehouse activities during the internship. Secondary data were drawn from company records, academic textbooks and journals, and the company's official website and annual reports.

Data Analysis and Interpretation

Percentage analysis was used to interpret the survey responses. Key results across the demographic profile, warehouse operations, and pigmentation-specific perceptions are summarised below.

• Demographic Profile

Category	Percentage
Male	87%
Female	13%
Below 25 years	35.9%
25–35 years	30.8%
36–45 years	28.2%
Above 45 years	5.1%
Postgraduate	48.7%
Undergraduate	30.8%
Diploma	12.8%
Higher Secondary	7.7%

The respondent base was predominantly male (87%), relatively young (two-thirds under 35 years), and well-educated (nearly 80% holding undergraduate or postgraduate qualifications). By designation, Warehouse Managers accounted for the largest share of respondents (31.6%), followed by Supervisors (23.7%), Maintenance Staff (18.4%), and Safety Officers and Warehouse Operators (13.2% each); by work experience, most respondents had between 1 and 6 years in their roles (28.9% with 1–3 years, 26.3% with 4–6 years), and by income, the largest group (36.8%) fell in the ₹60,000–₹80,000 range.

• **Warehouse Operations and Inventory Management**

Statement	Positive response (Agree/ Strongly Agree or equivalent)
Overall warehouse management system rated Excellent or Good	95%
Effective inventory management system tracks stock accurately	79.4%
Materials properly received and verified on arrival	74%
Materials stored using appropriate storage methods	78.9%
Material handling carried out efficiently	64.1%
Materials checked for quantity/quality before dispatch	74.4%
Physical stock verification conducted regularly	73.7%
Warehouse has necessary resources and practices for efficient operations	76.9%
Overall warehouse operations rated Very Efficient or Efficient	74.4%

Across nearly all warehouse-operations statements, a strong majority of respondents expressed agreement or a positive rating, indicating that core processes — receiving, storage, handling, dispatch verification, and stock control — are generally perceived as well managed. The lowest (though still majority) agreement was recorded for the efficiency of material handling, suggesting this is a relatively higher-priority area for improvement.

• **Chemical Safety and Warehouse Pigmentation**

Statement	Positive response (Agree/Strongly Agree)
Adequate safety measures followed for storing/handling chemical products	66.7%
Proper safety practices followed while handling chemical products	69.3%
Eco-friendly industrial coatings should be adopted to improve safety and sustainability	76.9%
Satisfied with quality and effectiveness of the warehouse pigmentation system	74.3%

Three-quarters of respondents (74.3%) reported satisfaction with the existing warehouse pigmentation system, and a similar proportion (76.9%) supported wider adoption of eco-friendly industrial coatings — indicating both a positive baseline perception of current floor coatings and clear employee appetite for more sustainable coating solutions going forward.

Findings

- The workforce is predominantly male (87%), relatively young (two-thirds under 35 years), and well-educated (nearly 80% with undergraduate or postgraduate qualifications), with broad representation across managerial, supervisory, safety, maintenance, and operator roles.
- The overall warehouse management system is positively perceived, with 95% of respondents rating it Excellent or Good.
- Inventory management practices — including stock tracking, physical verification, and record accuracy — are generally regarded as effective, with strong majority agreement across related statements.
- Core warehouse operations (receiving, storage, material handling, and dispatch verification) are perceived as being carried out according to proper procedure, though material-handling efficiency shows relatively more room for improvement.

- Chemical safety practices are viewed positively by roughly two-thirds to three-quarters of respondents, indicating generally sound but not universal adherence to safety procedures for chemical storage and handling.
- A strong majority of employees (74.3%) are satisfied with the current warehouse pigmentation system, and an even larger majority (76.9%) support adopting more eco-friendly industrial coatings — signalling both current adequacy and appetite for improvement.

Suggestions

DCW Limited should reinforce its inventory management system through regular physical stock verification, periodic stock audits, and timely updating of inventory records to minimise discrepancies.

Regular review of warehouse layout and storage arrangement can improve material flow and space utilisation, directly addressing the relatively lower agreement recorded for material-handling efficiency.

Structured training on warehouse operations, inventory management, material handling equipment, and chemical safety procedures would help raise consistency across roles and experience levels.

Continued investment in proper PPE, labelling, safe storage procedures, emergency equipment, and safety-awareness programmes would help close the gap between current safety perceptions (roughly two-thirds to three-quarters positive) and universal compliance.

Given strong employee support (76.9%) for eco-friendly industrial coatings, DCW Limited should evaluate durable, chemical- and corrosion-resistant, sustainable coating systems for warehouse floors and surfaces — improving surface protection, reducing maintenance costs, and supporting the company's environmental sustainability goals.

Conclusion

This study examined warehouse management practices at DCW Limited, with particular attention to the contribution of industrial floor coatings and pigmentation systems to workplace safety and operational efficiency. Survey results indicate a generally positive employee perception across warehouse operations, inventory management, and chemical safety, with strong majorities affirming the effectiveness of current practices.

Warehouse pigmentation was found to play a functional role beyond aesthetics: proper floor coatings and colour-coded markings help organise storage areas, identify walkways, separate hazardous zones, and guide the movement of materials and equipment, while protecting floors from wear, chemical exposure, corrosion, and heavy traffic — thereby reducing maintenance costs and extending the service life of warehouse infrastructure. Selecting coating materials suited to operating conditions — accounting for durability, slip resistance, chemical resistance, ease of cleaning, and environmental sustainability — along with regular inspection and maintenance, further enhances their effectiveness.

Overall, the findings support the view that structured warehouse management, reinforced by appropriate and increasingly eco-friendly protective coatings, materially strengthens safety outcomes and supply chain performance. These insights offer a practical foundation for continued improvement at DCW Limited and for further research into the intersection of warehouse management and industrial coating technologies.

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