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Integration Of Warehouse Management System (WMS) With Transportation Operations: An Empirical Investigation in Indian Third-Party Logistics

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Abstract- The third-party logistics (3PL) industry in India faces an important milestone. In light of growing activities in e-commerce and higher expectations by clients, discrepancies between the functioning of the warehouse management systems (WMS) and transport become a source of cost, both tangible and intangible. Based on survey responses received from 79 personnel working in warehouses and transportation at a prominent 3PL company in India, this paper aims to empirically prove the existence and nature of the gaps in WMS and transport operations and the related consequences. Using a mixed-methods design based on questionnaires, logs of the warehouse management system, and secondary sources, this paper used Chi-Square, ANOVA, Pearson correlation, and Weighted Average methods to demonstrate the validity of the assumptions made by practitioners, namely, that there are discrepancies in WMS and transportation operations and that they come with costs. According to respondents, about three-quarters (75.9%) encountered problems on the floor on a regular basis. The reasons behind them included poor communication between teams (29.1%), lack of personnel (27.8%), delays in truck arrival (22.8%), and technical problems (20.3%). The correlation between the usage of the WMS system and efficiency proved to be strong (+0.72). The same result was shown through Chi-Square analysis ($\chi^2 = 9.52$, $p = 0.02$), which showed that workers who are familiar with the system found its operations valuable, while those who have less experience tended to avoid it. The practical implications include the fact that the reduction of the gap is not only about purchasing new equipment; it involves restructuring the handover procedure and implementing an automatic transmission of relevant data without the need for phone calls or messaging apps.

Keywords: Warehouse Management System, Transportation Management System, Third-Party Logistics, WMS–TMS Integration, Supply Chain Efficiency, On-Time Delivery, Operational Performance, Indian Logistics

I. INTRODUCTION

Systematic observation of dispatch bays at major Indian warehousing locations, say Chennai, Pune, or Delhi-NCR, during 6:00 to 8:00 p.m., highlights an interesting pattern where trucks wait in line for loading while manifesting is going on, transport coordinators are sought after to get updates that exist in WMS but haven't been shared yet, and loaders are idle because no information about the order of vehicles for docking is clear yet. This pattern cannot be attributed to a general technological flaw; instead, this is a specific problem related to technology integration that repeats itself in India's growing 3PL sector time after time. In the past decade, the Indian logistics industry has moved from the cottage-level approach to small transport operators to a more formal setting involving technology-driven 3PL companies. The driver behind such a change has been the growth in online retail and expectations of same- or next-day delivery from Tier I, II, and III cities. With this demand, warehouse and logistics firms started using the WMS and TMS in hopes of replacing the manual coordination process with one based on computer programs and databases. Yet, according to experience, many firms keep using their WMS and TMS separately rather than in unison. Hence, there is some gap between the information that exists in the WMS and the needs of the transport planning process which can cost the industry a lot in terms of delays, unused capacity, non-delivery, and

customer attrition. This paper aims at estimating the gap and coming up with a solution to minimize it.
What makes this particular instance of integration difficult is the fact that there is data available at both organizations already. A Warehouse Management System (WMS) recording the completion of a pick operation at 17:43 should, theoretically, be able to trigger a change of dock assignments in the transportation system within mere seconds. In the typical 3PL facility of India, such an occurrence would be communicated by phone or through WhatsApp, and usually after the designated time period. As a result, one might incur additional expenses in terms of increased truck dwell times, failure to meet cut-off times, and unexpected driver overtime.

Some policy measures were implemented to help the industry develop into a better form. The introduction of GST has made freight movements between states easier, and the National Logistics Policy (2022) aims to reduce the cost of logistics in relation to gross domestic product. Meanwhile, technology providers have been releasing progressively powerful WMS and TMS applications. However, it is essential to note that purchasing technology will not mean that the company has properly integrated their software, and integration does not necessarily lead to the effective use thereof. Many

companies procure relevant applications and integrate them in such a way that preserves the old manual process under the guise of technology. What specifically interests the researchers here is the actual usage of the software to coordinate warehouse operations with those related to transportation.

This research uses primary data collected through surveys of 79 employees in warehouses and transportation departments at an Indian 3PL firm, along with WMS logs and internal organizational data. Three central issues are considered: first, where the coordination failure is happening; second, how much it costs to have this failure; and third, what kind of integration framework can be implemented within such an organization.

II. NEED FOR THE STUDY

There are two main reasons behind the need for this study. First, there are practical reasons for conducting the research. The relationship between the picking and transportation teams in Indian third-party logistics (3PL) warehouses with high volume of activity is informal. It is based on the use of personal connections, messaging services like WhatsApp, and assumptions about the arrival of trucks and loading readiness. Such an approach works well enough when the volume of activity is relatively small; it becomes unstable, however, if there are changes in staff and/or in the volume of activity. In this situation, the following problems become apparent: trucks lining up to be loaded, missed deadlines, and accusations between the two sides because of the rationality of the behavior from the perspective of each side.

Second, there are academic reasons behind the study. Previous studies in the domain of WMS-TMS integration have been conducted primarily under conditions of developed logistics market in countries of North America, Western Europe, and some regions of East Asia. These countries have stable infrastructure, relatively little staff turnover, and systems already in place. In turn, India is a quite distinct context for business. In this case, we have a fragmented network of roads, wide differences in IT literacy between employees, seasonal peaks in demand for deliveries associated with sales in the e-commerce sector, and the changed policy framework over the last ten years. Therefore, the conclusions made in other contexts are not always applicable in Indian 3PL companies.

The intent of the current study is not to introduce any outside theory, but rather to analyze information gathered directly at the source – the facility – where there is evidence of inefficiency. The aim is to make results that are practical and well documented so that they can add value to the growing body of literature on India’s supply chains.

III. SCOPE OF THE STUDY

The study focuses on a single facility in a large fulfillment and express-delivery system run by a leading 3PL company in India. Such an approach is deliberate. Although a comprehensive multi-location study may help identify general trends, it tends to mask the operational details which would make the results actionable. An in-depth study of a single facility allows tracing a delay that occurs at the dispatch dock all the way back to the WMS settings causing it.

Operationally, the scope covers the entire inbound-to-outbound warehouse process – receipt, stocking, picking/packing, preparing shipments, and transporting the shipment to the delivery point. Interface processes between scheduling/optimization of activities within the warehouse and transport docks, as well as loading planning, vehicle scheduling, confirmation, and handling returns, are addressed as these are the points where miscoordination often takes place.

Technologically, the focus is on WMS functionality related to inventory and order management, and the data exchange between WMS and transportation processes. Specifically, three possible ways of integration – event-based API integration, middleware-based integration, and unified platform integration – are compared considering the current limitations and capabilities of the facility. However, no vendor or platform recommendations are provided.

There are two specific items that are not covered within the scope of the research. These include the financial records of the facility, which were not provided by the organization, and the information regarding how the Warehouse Management System (WMS) is set up. This analysis can be generalized to apply to other facilities with high volumes in India operating under 3PL.

IV. OBJECTIVES OF THE STUDY

The study is guided by the following primary and secondary objectives:

Primary Objective:
The objective of this project is to evaluate the influence of integration of Warehouse Management System into transport operations on critical performance indicators in order to create an effective integration model that will result in improved truck turnaround time, on time deliveries, pick pack accuracy, and shipment cost.

Secondary Objectives:
This study aims to:

- analyze the current operational processes within the warehouse, including receiving, storage, picking, packing, and dispatch, to identify systemic inefficiencies;
- examine the coordination dynamics between warehouse and transportation teams and document communication gaps and scheduling conflicts;
- evaluate the effectiveness of the Warehouse Management System (WMS) in managing inventory, order workflows, and shipment tracking;
- assess employee awareness, adoption, and utilization patterns of warehouse management technology across functional roles;
- investigate the causal relationship between WMS usage frequency and perceived warehouse efficiency through statistical analysis;
- propose a modular integration architecture comprising data flows, event triggers, and API design that align with the organisation's technical and operational constraints;
- provide actionable recommendations for workforce training, standard operating procedure (SOP) redesign, and phased implementation of WMS–transportation integration.

V. REVIEW OF LITERATURE

The theoretical foundation of this study draws upon a growing body of scholarly work examining WMS functionality, TMS capabilities, system integration architectures, and their combined effects on supply chain performance.

The foundational mechanics of WMS implementation are well documented in practitioner literature. Richards (2018), writing from decades of hands-on warehousing consultancy, makes a point that this study returned to repeatedly: technology alone does not improve picking accuracy or throughput it is the combination of system redesign and deliberate staff capability building that moves the needle. His analysis is grounded in operational case studies rather than econometric modelling, which makes it particularly relevant for an applied study of this nature. Critically, Richards distinguishes between organisations that deploy WMS as a tracking tool and those that use it as a workflow engine the former group captures only a fraction of the available efficiency gains.

The economic logic for integration is not new. Ballou's (2004) supply chain framework established a durable principle: when warehousing and transportation costs are optimised separately, both functions independently find local minima, but the total system cost remains unnecessarily high. Chopra and Meindl (2016) extended this argument into the era of digital supply chains, showing that coordinated real-time decisions across functions produce outcomes that neither sequential nor parallel independent planning can match. What neither text fully anticipates, however, is the workforce dimension the question of whether employees in a high-pressure fulfilment environment will actually use an integrated system in the way its architects intend. That gap between designed capability and actual adoption is a thread running through the present study's findings.

Coyle and colleagues (2017) offer a useful corrective to the assumption that TMS tools are self-contained optimisers. Their analysis of route planning and carrier selection systems makes clear that these tools are, in a fundamental sense, dependent variables: they can only be as good as the upstream data they receive. When a TMS is fed inaccurate or delayed pick-completion events, it plans routes against phantom loads and issues carrier instructions that the warehouse floor cannot honour. This dependency structure is directly observable in the study site: transportation coordinators routinely compensate for late WMS signals by delaying dispatch confirmations, which in turn inflates truck dwell time and disrupts driver scheduling.

Physical layout and information architecture are more tightly coupled than most WMS implementation projects acknowledge. Gu et al. (2010), in their comprehensive review of warehouse design research, document how storage assignment policies, pick path configurations, and dock placement interact with system logic in ways that either amplify or undermine WMS performance. Their work informed the present study's reading of outbound delay data: when 62% of delays cluster in picking, dispatch, and loading stages, the physical flow of goods through the facility is as much a factor as the system configuration. Integration blueprints that ignore layout are, in effect, solving only half the problem.

Kembro and Norrman's (2019) research on omni-channel warehouse configuration raised a finding that this study's qualitative data echoed consistently: the value of real-time information sharing is asymmetric across roles. Managers and supervisors, who typically have system access and summary dashboards, tend to perceive coordination as adequate. Ground-level operatives the pickers, packers, and loaders who form the last physical link before a shipment leaves the building often work from information that is several hours out of date. This asymmetry is not accidental; it is built into most WMS configurations, which were originally designed around management reporting rather than operational floor guidance. Addressing it requires architectural changes, not just training.

Sabri and Beamon's (2000) multi-objective supply chain model is among the earliest formal treatments of a problem this study confronts in practical terms: how do you simultaneously improve cost, service level, and operational flexibility, when each dimension involves trade-offs against the others? Their conclusion that robust information flows across functional boundaries are the precondition for multi-objective optimisation has aged well. In the Indian 3PL context, the trade-off structure is particularly visible: reducing cost per shipment through better load consolidation requires earlier and more accurate load-readiness signals from the WMS, which in turn requires higher WMS adoption rates on the warehouse floor a chain of dependencies that this study's integration framework attempts to address directly.

Two industry reports anchor the study's contextual framing. KPMG's 2022 sector study on Indian logistics and Deloitte's 2023 outlook on technology-driven transformation both point to the same

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investment pattern: large Indian 3PL operators are actively building integrated WMS–TMS capability, driven by same-day and next-day delivery commitments that manual coordination cannot sustain. What neither report provides is the facility-level evidence needed to understand how that integration actually performs once deployed which is precisely the gap this study addressed.

Taken together, the literature makes a consistent case: integration between warehouse and transport systems produces compounded operational benefits, but those benefits depend heavily on how the integration is designed, how thoroughly staff are trained to use it, and whether the physical workflow has been redesigned to match the new data flows. What the existing body of work does not offer is primary empirical evidence from an Indian 3PL context organisation operating under India-specific infrastructure constraints, workforce composition, and demand patterns. That is the contribution this study makes.

VI. RESEARCH METHODOLOGY

6.1 Research Design

The research design adopted for the analysis involves mixed methods convergence, where both qualitative and quantitative data are obtained simultaneously and analyzed in an integrated fashion, as opposed to being obtained sequentially and analyzed in a one-dimensional direction. Quantitatively, the data from the surveys and operational records are subjected to analysis in order to determine the extent and nature of the coordination problems, as well as test three predetermined hypotheses on WMS utilization and effectiveness. Qualitatively, the observation and survey questions provide the needed context that will enable understanding of the numerical data in relation to the warehouse operations.

6.2 Data Collection

The survey was conducted among 79 workers categorized into six roles: Warehouse Associates (26.9%), Team Leaders (17.9%), Picker/Packers (15.4%), Loaders (14.1%), Supervisors (14.1%), and Centre Managers (11.6%). The questionnaire contained 20 questions divided into four themes: (a) the type and regularity of operational challenges faced by workers; (b) knowledge of the WMS and its usage; (c) the reliability of real-time information for each worker's function; and (d) perceptions regarding system integration. Additional information sources, such as event logs of the WMS,

transport reports, and delivery performance charts, were used to verify survey results and create pre-post KPI comparisons.

6.3 Sampling Technique

Stratified random sampling technique was adopted in order to make sure that each group and operational shift were adequately represented in the survey. Simple random sampling would have caused an over-representation of those role categories which were larger in size, namely Associates and Pickers, as well as an under-representation of managers and supervisors who have a broader system-level understanding of warehouse management, which is directly relevant to the research objectives. Furthermore, a purposeful subsample of eight respondents was selected among operation supervisors, transport planners, and information technology specialists involved with WMS operation.

6.4 Statistical and Analytical Tools

The following five analytical techniques were utilized, with each chosen to suit its specific inferential purpose. Percentage analysis was first used to describe the response pattern in relation to the key operational variables, providing a required foundation before any further inference. The Chi-Square test was then conducted to assess the hypothesis on the familiar versus efficient relationship (H_{01}), considering that both independent and dependent variables are categorical. In addition, the non-parametric Chi-Square does not assume normality. For H_{02}, One-Way ANOVA was used, as opposed to conducting separate t-tests for each pair because of Type I errors that would arise with ANOVA. On the other hand, Pearson correlation was used in evaluating the efficiency hypothesis because both variables had operationalizations based on the Likert scale and were approximately normally distributed. Lastly, the four factors that caused delays were ranked using the Weighted Average method from respondents' subjective rankings.

	Total	78	100%

6.5 Hypotheses

H_{01}: There is no significant relationship between employee familiarity with WMS and warehouse efficiency perception.

H_{02}: There is no significant difference in WMS efficiency perception across employee designations.

H_{03}: There is no significant correlation between WMS usage frequency and warehouse operational efficiency.

VII. ANALYSIS AND INTERPRETATION

7.1 Workforce Profile and Role Distribution

The total number of respondents was 79 people, ranging from bottom-level employees such as Associates and Pickers to higher-level employees such as Team Leaders, Supervisors, and Centre Managers. More than half (56%) were employed at the bottom level, which is important when understanding the results, since most of the data obtained during the research relates to people working with the WMS directly, rather than using the reports produced by the system. Speaking about experience, the respondents had a somewhat average distribution regarding their experience; that is, 37.2% have worked for one to three years, 25.6% have been working for more than three years, and 37.1% have been working for less than a year.

Table 1: Distribution of Respondents by Designation

S.No.	Designation	No. of Respondents	Percentage (%)
1	Warehouse Associate	21	26.9%
2	Team Leader	14	17.9%
3	Picker / Packer	12	15.4%
4	Loader / Unloader	11	14.1%
5	Supervisor	11	14.1%
6	Manager / Centre Incharge	9	11.6%

7.2 Operational Difficulties and Root Causes

The important indicator introduced here is the difference between role clarity and operational problems. As much as 94% of respondents say they know what their tasks are, while more than 75% say they regularly face problems on the job. This does not mean that the figures contradict each other but that the problems faced do not relate to the ambiguity of the employees' task set. The reason lies somewhere else, before the individual's performance, and relates to communication failures among groups (29.1% of delays are caused by that), personnel misallocation (27.8%), late trucks (22.8%) and equipment failure (20.3%).

Table 2: Primary Causes of Operational Delays

S.No.	Cause of Delay	No. of Respondents	Percentage (%)
1	Lack of Coordination	23	29.1%
2	Manpower Shortage	22	27.8%
3	Late Transportation	18	22.8%
4	System Problems	16	20.3%
	Total	79	100%

7.3 WMS Familiarity and Adoption

Awareness of the WMS among the sample subjects was high at 72%, but only 46.8% of them used it on a regular basis in all their activities. This disparity between familiarity with the system and its regular application forms the primary source of failure in coordinating activities. If some employees enter events using the system while others skip doing that, then there is an inaccurate picture of what goes on in the system. This leads transport coordinators to either ignore the system altogether or even avoid it.

7.4 Chi-Square Analysis: WMS Familiarity and Efficiency

The Chi-Square test examined whether there is any relationship between the awareness of employees regarding the WMS and their judgment on its efficiency. The outcome $\chi^2(3) = 9.52$, $p = 0.02$ shows that there is a significant relationship between these two variables. While the sign of the relationship is consistent with expectations, the actual significance depends on the magnitude of the relationship. In particular, this finding demonstrates that a problem related to perceptions that may be considered communication is actually rooted in a lack of familiarity, which may be overcome via training. Hence, H_{01} must be rejected.

7.5 ANOVA: Efficiency Perception Across Designations

One-Way ANOVA was applied in order to find out whether the perception of the efficiency of the WMS differs in five groups. One-way ANOVA has resulted in the following F-value - 4.72 ($p = 0.03$), which means that the difference between the groups exceeds a level of randomness, and there are indeed some meaningful differences between the way different roles perceive this system. These mean scores of designations are as follows – Supervisors (4.6); Team Leaders (4.5); Loaders (3.8); and Pickers/Packers (3.7). Therefore, it is evident that those who operate the system do not find it efficient, while those who should manage it see its efficiency. Solving this problem seems to be possible only through proper training.

7.6 Correlation Analysis: WMS Utilization & Operational Efficiency

Correlation coefficient between the frequency of WMS utilization and operational efficiency is $r = +0.72$, signifying a strong correlation in accordance with common standards. Operationally, however, the findings suggest that this correlation has practical importance even before the suggested implementation takes place: increased utilization of the system by personnel will result in increased operational efficiency. Thus, the proposed integration framework will allow for increased utilization of the system, making it justifiable to explore this benefit in conjunction. H_{03} is rejected.

7.7 Weighted Average Analysis: Delay Prioritisation

Out of the four factors responsible for delay, the one which caused the most severe operation-wise delays accounted for a score that was about 40% higher than the second highest rated delay cause (manpower shortage), followed by transportation delays and system-related delays, respectively. The hierarchy in terms of severity is as follows: coordination failures, manpower shortages, transportation delays, and system-related delays. The wide difference between the highest-ranked and others implies that not only is it the most common problem, but also the most serious problem causing the highest severity of operational disruptions. Coordination failure happens due to the lack of connectivity between the warehouse management system and transport service.

7.8 Coordination Gaps and Real-Time Visibility

The majority of the respondents, 75%, reported that the delay was experienced between the warehouse and transportation phases, which was precisely what this research sought to explore. It is worth mentioning that this conclusion was further validated by the level of communication between the various parties, with 36.7% indicating that communication between teams was average or poor, while 37.5% of all respondents stated that they did not receive regular updates regarding their shipments. Therefore, 62.5% lack full knowledge of the situation when making decisions for loading and shipping without knowing the status of the trucks or docks.

VIII. FINDINGS

The key outcome is clearly the discrepancy between role clarity and operational efficiency. Some 94% of surveyed employees feel certain about their duties, but over 75% regularly encounter operational problems. This cannot be explained in terms of lack of skills or wrong attitudes since this is obviously a systemic matter, and the data accurately pinpoint this. The major cause of delays among the surveyed is coordination problems, which account for 29.1%, followed by personnel shortages (27.8%), delayed arrivals of transport (22.8%) and system issues

(20.3%). In turn, the last two items pertain specifically to the disjunction between WMS and transportation systems.

It should be stressed that delays happen at different stages of the warehouse cycle. Over 62% of recorded delays occur at the final stages, when picking happens (24.1%), followed by transportation coordination (21.5%), dispatch (20.3%), and loading (20.3%). Such distribution corresponds perfectly to the places where WMS-transport communication matters and lack of automation of event sharing is most costly. In turn, 75% of those who experienced delays noted the critical stage in the warehousing process – coordination with the transportation service, which is the point being analyzed in this study.

Visibility becomes another area for discussion which deserves considerable attention since only 37.5% of employees receive timely and current updates on shipment status, while the remaining 62.5% make decisions regarding the order of loading, the condition of the dock and labor allocation based on outdated or unavailable information. Here, however, the problem does not relate to technical issues since the necessary information resides in the Warehouse Management System (WMS). It concerns a matter of availability and accessibility, which is one of the simplest levers to be employed by the company to resolve existing issues.

Statistics provide an additional perspective into the problem and suggest managerial conclusions as well. High positive correlation between the use of WMS and efficiency ($r = +0.72$) demonstrates the importance of adopting the new system, which means that the first lever the company can use before integrating the system even further is to promote better use rates. Chi-square test results ($\chi^2 = 9.52$, $p = 0.02$) show that proficiency with the system plays a significant role in forming positive perceptions about its efficiency and does not relate to such variables as experience and years of service at all.

Moreover, ANOVA statistics ($F = 4.72$, $p = 0.03$) allow identifying which positions are less proficient with the system since the average rating score of Pickers/Packers (3.7) and Loaders (3.8) substantially differs from Supervisors (4.6) and Team Leaders (4.5).

IX. SUGGESTIONS

Based on the empirical findings, the following strategic recommendations are advanced for organisational consideration:

i.Implement End-to-End System Integration Architecture:
The first and most important change that is necessary will be in the architecture of the systems used. At present, communication between the WMS and the transportation subsystem occurs through the intervention of humans; that is, supervisors inform about pick completion via telephone while loaders inform about dock readiness through WhatsApp. While it may be said that automatic triggering of such events is possible, it requires some thoughtful planning. It needs to be determined which WMS events are relevant to the planning of transports (pick complete, load ready, gate-out confirmation), and then create the necessary API connections/middleware for event propagation in real-time. One dock can serve as a good starting point before deploying at all docks, as it provides performance metrics needed for justifying future investments.

ii.Mandatory, Role-Specific WMS Training Programmes:
As the outcome of the ANOVA test reveals, the performance difference does not affect all employees equally, and hence, the training needs to be non-uniform as well. Specifically, the front line workers, namely the Pickers, Packers, and Loaders who perceived the least efficiency from using WMS, need practical experience related to their tasks while performing in the integrated environment instead of theoretical training on supply chains. On the other hand, the supervisors' training needs are distinct since they need to learn how to analyze the dashboards of the integrated system and make changes to the staff or docks based on this information.

iii.Optimise Physical Outbound Workflow and Dock Management:
According to the data, delays take place predominantly during the outbound processes including pick, load, and dispatch. The integration of technologies is supposed to address a part of the issues with delays, but even regardless of the software efficiency, a certain configuration of the physical layout could contribute to the creation of additional delays. In case there are no effective pick processes, the docking procedure requires workers to move across traffic lanes or creates bottlenecks within the sorting zone before loading takes place, then the integration would not address the problem of the time gap.

iv.Technology-Augmented Labour Planning:
When it comes to questions about adequacy of manpower in the questionnaire, it seems like both sides have equal numbers: half of those who answered believed that manpower was sufficient, while the other half disagreed. Such an assessment implies that the problem does not lie in the overall number but rather in the way labor force is allocated in terms of shifting demands throughout the shift. It is possible to make fairly good predictions as to when there will be surges of vehicles or peaks in picking by using an integrated Warehouse Management System (WMS) coordinated with the arrival times of the vehicles.

v.Real-Time Visibility Dashboard for All Operational Roles:
The visibility shortfall, which involves 62.5% of staff members who do not have adequate visibility regarding their shipments' status, is theoretically solvable yet requires proper identification of the target audience for the dashboard. The current dashboard setup of WMS in such warehouses is mostly geared toward management reports, involving shift statistics, throughput rates, and exception counts. However, the workers on the ground need information that differs from the managers', namely dock status, pick queue length, vehicle ETA, and exception counts related to their orders. Incorporating a role-based layer of dashboards through shared monitors or personal handheld devices can ensure that every role gets the right visibility of the system's status.

vi.Explore Sustainable Last-Mile Fleet Modernisation:
The modernization of last-mile fleets as an area that repeatedly came up through employee feedback fits well with the integration approach from an operational perspective. Urban delivery vehicles powered by electricity have a lower cost of variable operation compared to their diesel-powered counterparts, but the former need precise planning related to their charging periods, range, and the time when they should return to the depot, all of which need to be included in the route planning process. This kind of planning can only happen if the signal that the WMS sends about load readiness to the transportation system is correct. The kind of integration effort required for making the use of electric vehicles possible amounts to the kind suggested by this paper.

X. CONCLUSION

The results of this research paint a coherent picture, which is not very flattering concerning the present situation with regard to the connection between WMS and transport operations at the examined site. If close to seventy-five percent of the labor force, otherwise perfectly aware of its responsibilities, encounters regular troubles in operations, the problem lies within the structure, not in the individuals.

According to the findings, there exists a structural flaw: while both the WMS and the transport operation ought to be treated as one continuous process, they now act as two neighboring processes that depend on human mediators in order to communicate with each other. Although these mediators do an excellent job, they simply cannot keep up with the pace and effectiveness of computerized data transfer.

Furthermore, the study offers a numerical description of techniques that correspond with practitioners' experiences. As one would expect, the Pearson correlation coefficient (r) equals +0.72 in the case of the association between the frequency of utilization and efficiency, meaning that, without the need for any complete integration of the system in question, even higher and constant use of the WMS among employees would produce positive changes in operations. In addition, the Chi-Square statistic ($\chi^2 = 9.52$, $p = 0.02$) proves that familiarity is not only beneficial but also necessary in order to enjoy the system's benefits. Lastly, the ANOVA ($F = 4.72$, $p = 0.03$) provides concrete recommendations: the efficiency discrepancy between supervisors and operatives stems from a training, not a perceptual, difference.

The practical applications of what has been discussed above are rather obvious. There is no need for a re-engineering of the current technological stack or process architecture. What the organization has to do is fill in three particular gaps: (1) data flow gap between the WMS events and transport planning;
(2) adoption gap between the system's functionalities and its real-world usage by the ground-floor employees; and (3) visibility gap between the system's data pool and the floor-level personnel that need access to it. Each one is a task with a manageable scope and timeframe for completion. The blueprint of integration proposed here—with its initial point of API event trigger at a single dock, followed by role-based training extension, and then a floor-level visibility layer—is meant to be executed step-by-step, with KPI goals met at each phase.

The importance of what was discovered above goes well beyond this specific facility's walls. As the 3PL sector of India grows at a breakneck pace, the future competitive edge will belong not to whoever buys a better technology solution. Instead, it belongs to whoever manages to incorporate it as deep into their routine as possible. It is a general problem, rather than a particular one: two distinct WMS and transport systems operating independently from one another, lack of coordination conducted via workarounds, and insufficiently informed decisions made by the frontline workers. And if anything is learned here, it is this precise pattern of failures and how to fix it.

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