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Operational Analysis of Damaged Shipments and Prevention Strategies at Delhivery: A Problem-Solving Team Study at the Pune Sudhawadi Hub

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Abstract **- For parcel logistics, shipment damage is another exception, along with scanning error, misroute, delayed client confirmations, etc., that can increase handling, investigation and delay in parcel logistics, and thus need to be avoided and resolved quickly to maintain service quality. The present study is an applied research of operational exceptions, specifically on damaged shipment and associated processes involved in its identification, reporting and resolution at Delhivery Limited's Sudhawadi Hub, Pune. The goals were based on elements from the supply chain management, quality management and Lean and the Six Sigma Define–Measure–Analyse–Improve–Control (DMAIC) methodology, which involved analysing the operational causes of damaged shipments, identifying the handling factors responsible, evaluating the available identification, reporting, and resolution processes, analysing root causes using DMAIC, and recommending preventive measures. The study used a descriptive, exploratory and mostly qualitative design of direct participation, systematic observation of inbound, sorting, outbound and last mile activities, interaction with Problem-Solving Team (PST) members and supervisors, process analysis and secondary research with a purposive sampling of the cases encountered at a single hub, between 13 May and 13 July 2026.**

The following percentages were approximate based on the operational problems observed: Client response delays – ~40%, Scanning errors – ~25%, Misroutes – ~20%, Manual tracking delays – ~15%. Using structured ticketing, the average time taken to resolve scanning errors was reduced from 6 to 2 hours, manual tracking reduced from 12 to 3 hours, misroutes reduced from 10 to 4 hours, and client response delays reduced from 48 to 24 hours. When weighted for the issue share the total reduction is estimated to be from 24.5 to 11.4 hours. The most expensive option were misroutes, which required additional cross-hub re-sorting as well as additional transport, but also client delays could not be preemptively controlled by Delhivery. It is found that structured ticketing and precise scanning and team coordination lead to better exception resolution; however, manual work and external dependencies remain. Delhivery is recommended to incorporate client communication with the main ticketing platform, have clear client-response SLAs, automate tracking and verification, and educate the PST team before busy hours. Findings are indicative as they are based on the approximate observations from one hub.

Keywords— Damaged Shipments, Exception Management, Problem-Solving Team (PST), Six Sigma DMAIC, Ticketing System, Hub Operations, Delhivery

I. INTRODUCTION

Logistics plays a vital role in ensuring the flow of products between manufacturers and end customers, and has become increasingly relevant as e-commerce, digitalisation and customer expectations for swift, reliable delivery have increased. Although India's logistics sector is still largely unorganised and is gradually transitioning into becoming more organised and technology-driven, it has grown significantly with investments in infrastructure, policy initiatives like the National Logistics Policy, and the introduction of analytics, automation and warehouse and transport management systems [9] and [10]. A shipment encounters numerous handling points during parcel logistics and every one of these represents a potential risk for physical damage, scanning errors, mis-routing or loss of visibility.

Founded in 2011 and based in Gurugram, India, Delhivery Limited is one of India's premier, comprehensive logistics service providers that offers express parcel, part and full truckload freight, warehousing and supply-chain services, cross-border logistics and technology. It generated approximately ₹8,932 crore from customers during FY25 of which express parcel accounted for approximately 59.5% and FY26 revenue from services was approximately ₹10,486 crore with approximately one billion parcels handled [8]. A small proportion of damaged or mishandled shipments, at this scale, can bring high aggregate costs in terms of repacking,

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investigation, claims, reverse logistics and customer dissatisfaction.

This research study focusses on defective shipments and related operational exceptions at Delhivery's Sudhawadi Hub in Pune. The author was introduced to the inbound and outbound operations, scanning and sorting, loading and unloading, planning, Problem-Solving Team (PST) for damaged, missing, untraceable shipments, barcode problems, scanning errors and misroutes, as well as to the activities of Process Control (PC), IPC and ADOC. The study identifies the operational causes of shipment damage, evaluates the way in which shipment damage, along with other exceptions, is identified, reported and addressed, and finally the Six Sigma DMAIC framework is used to make recommendations for prevention.

II. LITERATURE REVIEW AND THEORETICAL BACKGROUND

A. Literature Review

Mentzer et al. [1] provided a review of definitions of supply chain management and demonstrated that performance is reliant on the coordination of activities between functions and organisations. Srinivasan et al. [2] analysed the application of DMAIC and believe that it can be implemented in manufacturing as well as service and other operational areas and can be extended to the logistics industry in areas that are not common. In a systematic review of Lean and Six Sigma logistics, carried out by Carvalho et al. [3] it was found that transportation was a significant application field and motion was a common studied waste. On packaging, Silva and Pålsson [4] analysed 98 journal articles and showed the relation between packaging and the efficiency and sustainability of the supply chain and explained that drop is an important source of damages to parcels, which is also at high risk in delivery due to many handling events. AlMazrouei and Demir [6] surveyed 138 studies related to value creation in parcel delivery, and identified innovation capabilities, management capabilities and scale. Much of this literature focus on aspects of "last-mile" delivery, on sustainability, on packaging design and optimisation – and relatively little on ground-level damage and exception handling that occurs in an individual hub, as observed during sorting and loading, unloading and problem solving. This is the space that is explored in this research.

B. Theoretical Background

The study is based on the areas of supply chain management [1, 7], logistics and quality management, Lean and Six Sigma. Quality in parcel logistics is defined as the parcel is delivered in the desired quality, at the desired time and in minimal damages, meaning that damage is not just a warehouse problem, but it is an issue related to delivery performance, claims, reverse logistics and operating cost. According to lean, any activity that does not add value is waste, and a spoilt shipment is waste because it needs to be repacked, cause investigation and reverse flows [3].

Six Sigma's DMAIC cycle (Define, Measure, Analyse, Improve, Control) provides a structured path from symptom to root cause [2]. In this case, the problem is defined as shipment damages and exceptions during the hub operations, measurement is based on the observed cases and operational information, analysis is based on observation, discussion with personnel and root cause reasoning (handling, placement, packaging and movement, while loading and unloading), improvement proposes preventive measures, and control is standardising and monitoring them with exception tracking and process-control reports. The use of technology, such as scanning, ticketing, tracking platforms, and new AI, machine learning, and IoT tools aids in faster detection and response [6].

III. MATERIALS AND METHODS

A. Research Objectives

The study has five objectives: (1) to analyse the operational causes of damaged shipments at Delhivery's Pune Sudhawadi Hub; (2) to identify the major factors responsible for damage during handling, sorting, loading, unloading and transportation; (3) to evaluate existing processes for identifying, reporting and resolving damaged shipments; (4) to analyse root causes using the Six Sigma DMAIC approach; and (5) to recommend practical preventive measures that improve operational efficiency and shipment quality.

B. Research Design and Data Collection

The descriptive and exploratory design was used, with a predominant qualitative approach and supplemented with operational information. The descriptive part reported what was happening in the processes, and the exploratory one reported problems, causes and improvement areas. Primary data were obtained through participation and systematic observation of shipment handling, scanning, sorting, loading, unloading, damaged/untraceable shipments, misroutes and delayed responses, and from informal discussions with PST members, supervisors and operational personnel. Secondary data was collected from academic literature, books, industry reports and company guidelines [1]–[10] and operational information from within the company [11]. The project was done in phases: Understanding hub structure and flows, observing inbound and outbound work, identifying recurring issues, observing damaged shipments and exceptions, implementing DMAIC and finally making recommendations.

C. Sampling and Analytical Framework

A purposive sampling as a non probability sampling was utilized in one hub. The activities and exceptions observed at Sudhawadi Hub were the sampling frame and the sampling unit was the shipment or shipment related exception (damaged, misrouted, missing or untraceable shipment, scanning or barcode issue). No specific number of samples or statistical formula was used because the objective was not to measure the parameters of the population, but to learn how to understand processes and recurrent causes. Observations were broken down by type of issue and stage in the process and interpreted using supply chain, quality and DMAIC concepts. Limitations are single-hub scope, the short time that did not allow for seasonal patterns to be studied, limited access to confidential performance data, and lack of access to external clients and subjectivity in the observation-based work.

IV. DATA ANALYSIS AND DISCUSSION

Profile the Operational Issues Handled by the PST

TABLE I.
PERATIONAL ISSUES OBSERVED AT THE PUNE SUDHAWADI HUB

Issue Type	Share (approx.)	Impact on Operations
Client response delays	40%	Shipments remain in the PST area for long periods

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Issue Type	Share (approx.)	Impact on Operations
Scanning errors	25%	Manual correction; slower workflow
Misroutes	20%	Parcels rerouted; added workload and delay
Manual tracking delays	15%	Time-consuming; reduced efficiency

Client Response Delay was the most common problem (40%) as indicated in Table I. As parcels required prior approval or confirmation from client companies, bottlenecks could not be avoided on the client side, which Delhivery could not control. A failure of the scan or a wrong scan (25%) made it impossible to track it, and PST members had to manually search and fix the entries. Misroutes (20%) delivered to wrong hubs or delivery centres, which caused delays in delivery and sometimes complaints or cancellations. Manual tracking (15%) was slow as it was sometimes difficult to locate one misrouted parcel in a lot of thousands.

Assess the Effect of Structured Ticketing

TABLE II.
VERAGE RESOLUTION TIME BEFORE AND AFTER THE TICKETING SYSTEM

Type of Issue	Before (hrs)	After (hrs)	Reduction
Client response delays	48	24	50.0%
Scanning errors	6	2	66.7%
Misroutes	10	4	60.0%
Manual tracking issues	12	3	75.0%
Share-weighted overall*	24.5	11.4	53.7%

[a.] *Computed from the issue shares in Table I and the resolution times above; it is an indicative estimate, not a recorded figure.

As seen in Table II, structured ticketing reduced resolution time for each issue type, with the majority of reductions for manual tracking (12 to 3 hours) and scanning errors (6 to 2 hours). The introduction of ticketing ensured that responsibility was clearly delegated, and that escalation could be made in a timely fashion, as well as providing transparency and communication within the PST. Though, client response delays still would take 24 hours after the change, as it is partly dependent on external parties. Taking the issue shares into account, the overall mean resolution time decreased by approximately 54%, with no figures reported for on-time delivery customer satisfaction, with the hub reportedly improving on both.

Interpret Cost, Peak Load and Teamwork

The misroutes were the most expensive long-term as they had to be transported, man-handled for re-sorting and in some cases, repaid or compensated, and were usually in need of cross-hub coordination not required for scanning errors. On busier days like Diwali and Big Billion Days, volumes doubled, tripled, misroutes increased, scanning errors increased, the PST had to work longer hours and manual processes meant delays in resolving issues. The teamworking aspect proved to be the key factor, as PST members put misrouted parcels into a holding bin, escalated unresolved cases and updated tickets, preventing small problems from turning into bigger issues. Not everything could be solved with technology—external client delays were not under any of the technology's control.

Apply the DMAIC Framework to Damaged Shipments

TABLE III.
MAIC APPLIED TO SHIPMENT DAMAGE AT THE HUB

Phase	Application in the Study	Output
Define	Shipment damage and related exceptions during logistics operations	Problem statement and scope
Measure	Observed cases, shipment information and operational exceptions	Issue mix and resolution times
Analyse	Observation, discussion with staff, root cause review: improper handling, placement, packaging, movement during loading/unloading	Root cause list
Improve	Better handling and placement, stronger packaging control, training, improved scanning and tracking	Preventive measures
Control	Standardise practices; monitor via exception tracking and process-control reports	Ongoing monitoring

Table III provides a relationship between the observations and DMAIC. Damage is believed to result from multiple contributing factors: harsh handling, wrong stack and location (especially when loaded and unloaded as heavy loads or liquids), packaging failure, and transit during loading and unloading operations. Delayed reporting and weak shipment visibility extends the impact of each case. Damage case counts were not provided with the report, so the A issue shares in Table I are not just damage issues, but are issues about the PST workload in general; and the findings for damage were not quantitative.

Link Findings to Recommendations

TABLE IV.
INDINGS LINKED TO RECOMMENDED ACTIONS

Finding	Recommended Action	Expected Effect
Client delays are the largest issue (40%)	Integrate client communication into central ticketing; set client-response SLAs	Fewer shipments stagnating at the hub
Scanning errors and misroutes under high volume	Automate scanning and tracking; dashboards and alerts; PST training before peaks	Fewer errors, better visibility
Manual tracking is slow	Digital tracking and verification; analyse ticket data	Less physical searching
Ticketing cuts resolution time	Add issue categories, priorities, owners, escalation timelines, closure tracking	Accountability and quicker closure

Each finding is associated with an action in Table IV. Implementation may be phased in; first of all, review the historical data of tickets to identify the most common and time-consuming issues, then enhance the ticket workflow, incorporate client communication, establish response and resolution SLAs, intensify training, and implement automation step-by-step, beginning with repetitive and high-volume activities.

V. FINDINGS, CONCLUSIONS AND SUGGESTIONS

A. *Findings*

The most common operational problems were client response delay (around 40%), scanning error (25%), misroute (20%) and manual tracking delay (15%). The resolution time decreased for all four, from 6 to 2 hours (scanning errors), 12 to 3 hours (manually tracking), 10 to 4 hours (misroutes), and 48 to 24 hours (client delays). It was determined that the PST is a key link in the uninterrupted flow of shipments. Manual methods—like physical verification and finding misrouted parcels—still present a challenge, particularly during peak volumes, and technology isn't enough without coordination among people and departments.

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B. *Conclusions*

Timely shipment issue identification and resolution are the key factors to operational efficiencies. While the measurable improvement in resolution with structured ticketing and accurate scanning and coordination with PST does offer significant benefits, external dependency on clients and manual effort can constrain further improvements. To maintain logistics reliability, a combination of technology, competent staff, communication and constant process improvement is required. Since the evidence is observational, the results are indicative and can only be interpreted as such, as the evidence was collected from one hub.

C. *Suggestions*

Ticketing and client integration: Improve the centralised ticketing system with possibly integrated access for client coordinators to ticket information or automatic notifications.

Client SLAs: Determine response times for approvals and address discrepancies, Return-to-Origin cases and other exceptions, review SLA performance regularly.

Technology: Automated scanning, dashboards and data-driven alerts to minimize manual tracking, verification and system updates – starting with repetitive high-volume tasks.

Train PST staff in exception handling, routing, scanning and communication and decision making under pressure, and refreshers before peak demand.

D. *Implications of the study*

- Hub management: Ticket data and issue categories give a basis for prioritising effort and tracking accountability.
- Clear workflow and training minimize rework and stress to PST and operations staff during peak hours.
- Client companies have set up response SLAs, and visibility of tickets has been shared, reducing the waiting time for shipments to get confirmation.

E. *Future Scope of the study*

Future work can involve comparing multiple hubs of Delhivery over a longer time frame that encompasses festive peaks; gathering case information related to the damage, including category, stage, packaging type, shipment weight and value; and testing AI-driven prediction of misroutes and ticket prioritisation. A cost benefit analysis of automation and standardised PST dashboard which records ticket volume, issue type, response time, resolution time, SLA compliance and hub-wise performance would provide quantitative support.

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REFERENCES

[1] J. T. Mentzer, W. DeWitt, J. S. Keebler, S. Min, N. W. Nix, C. D. Smith, and Z. G. Zacharia, “Defining supply chain management,” J. Bus. Logist., vol. 22, no. 2, pp. 1–25, 2001.

[2] K. Srinivasan, S. Muthu, S. R. Devadasan, and C. Sugumaran, “Six Sigma through DMAIC phases: A literature review,” Int. J. Productivity Quality Manage., vol. 17, no. 2, pp. 236–257, 2016.

[3] E. R. Carvalho, A. E. A. M. Simões, G. M. S. Martins, L. S. L. Bastos, and A. C. S. Melo, “The current context of Lean and Six Sigma logistics applications in literature: A systematic review,” Brazilian J. Oper. Prod. Manage., vol. 14, no. 4, pp. 586–602, 2017.

[4] N. Silva and H. Pålsson, “Industrial packaging and its impact on sustainability and circular economy: A systematic literature review,” J. Cleaner Prod., vol. 333, Art. no. 130165, 2022.

[5] P. Böröcz and Z. Németh, “Review paper on the field measurement of parcel packaging drop for testing purposes,” Packag. Technol. Sci., vol. 38, no. 5, pp. 345–357, 2025.

[6] W. AlMazrouei and E. Demir, “Value creation in parcel delivery: A systematic literature review and research agenda,” Sustain. Futures, vol. 10, Art. no. 101557, 2025.

[7] S. Chopra and P. Meindl, Supply Chain Management: Strategy, Planning, and Operation, 6th ed. Harlow, U.K.: Pearson Education, 2016.

[8] Delhivery Limited, “Annual report 2024–25,” Gurugram, India, 2025.

[9] NITI Aayog, “Transforming India’s logistics sector,” Government of India, New Delhi, India, 2022.

[10] India Brand Equity Foundation (IBEF), “Indian logistics industry report,” 2023. [Online]. Available: https://www.ibef.org

[11] Delhivery Limited, Pune Sudhawadi Hub, “Operational information, processes, observations and internal records collected during on-the-job training,” internal source, 2026.

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