Optimization of Customs Clearance Operations to Reduce Clearance Time By 5%

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Abstract **— Timely customs clearance remains a decisive factor in export logistics performance, where even brief hold-ups can cascade into missed vessel schedules, accumulated demurrage charges, and weakened competitive standing in international trade. The present investigation was conducted at Aksan Logistics, a freight forwarding firm based at Thoothukudi (V.O. Chidambaranar) Port in Tamil Nadu, with the specific aim of pinpointing where operational time is absorbed within the customs clearance workflow and what practical measures can realistically compress it. Ten successive export consignments — spanning three distinct cargo categories, namely rice (bagged cargo), coir (lightweight bulk), and granite (heavy cargo) — were tracked through direct field observation, with the duration at each of six procedural stages captured in minutes. The computed average for total clearance stood at 414 minutes (6.9 hours). Cargo stuffing was identified as the dominant operational constraint, consuming 128 minutes on average and representing 30.9% of total clearance time, with customs examination following at 87 minutes (21.0%). Consignments that encountered customs queries required an average of 494 minutes to clear, compared to 373 minutes for query-free shipments — a 121-minute differential traceable entirely to pre-submission documentation inaccuracies. Granite shipments took 57% longer than rice, while a 132-minute variance was recorded between the most and least efficient workers completing identical stuffing assignments. Three concrete interventions are proposed and evaluated across dimensions of cost, projected savings, and implementation feasibility: a pre-submission documentation verification checklist, a structured peer-guided labour development programme, and phased introduction of mechanical cargo handling. The five percent clearance-time reduction objective — equating to 21 minutes per consignment — is shown to be attainable through documentation controls alone, at negligible cost.**

Keywords: Customs Clearance, Freight Forwarding, Export Logistics, Cargo Stuffing, Thoothukudi Port, Labour Efficiency, Supply Chain Optimisation

I. INTRODUCTION

Customs clearance plays an important role in the movement of goods across international borders. In practical logistics operations, even a small delay in clearance can lead to missed vessel schedules, additional storage charges, and disruption in delivery commitments. These delays directly affect both cost and customer satisfaction.

During the field observation at Aksan Logistics, Thoothukudi Port, it was noticed that delays were not always caused by external systems or port infrastructure. Instead, many delays were related to internal operational activities such as documentation errors, inefficient cargo stuffing, and lack of coordination among workers.

Thoothukudi Port, also known as V.O. Chidambaranar Port, is one of the major export hubs in South India. It handles different types of cargo including agricultural products, coir materials, and industrial goods like granite. Although systems like ICEGATE and Risk Management System (RMS) have improved the customs process, delays still occur at the operational level.

This study focuses on identifying where time is being consumed in the customs clearance process and how it can be reduced. The research is based on real-time observation of export consignments handled by Aksan Logistics.

The main objective of this study is to optimize customs clearance operations and achieve a reduction of approximately 5% in total clearance time. This is done by analysing each stage of the process, identifying bottlenecks, and suggesting practical improvements that can be implemented immediately.

II. LITERATURE REVIEW

Existing research strongly establishes that customs clearance efficiency is a critical determinant of logistics performance and international trade outcomes. A significant portion of the literature

emphasizes the role of documentation accuracy as a primary factor influencing clearance time. For instance, Masoud Yussuf (2024) demonstrates that properly prepared documentation reduces delays and minimizes the need for additional verification procedures, thereby improving overall port performance. This aligns with findings by Andre Yosafat Simarmata et al. (2025), who report that inaccurate documentation increases processing time, storage costs, and demurrage charges.

Beyond documentation, several studies identify procedural inefficiencies and coordination gaps as major contributors to delays. Research by Muhammad Rejaul Islam Khan et al. (2025) highlights that weak coordination among stakeholders reduces supply chain reliability and increases logistics costs. Similarly, Hui Shan Loh & Vinh Van Thai (2015) explain that disruptions and lack of synchronization across port operations create bottlenecks that negatively impact delivery schedules. These findings are further supported by Ashok Dhakal & Abhishek Jha (2020), who emphasize that poor workflow management and lack of standardization significantly reduce operational efficiency.

Another important theme in the literature is the impact of customs delays on trade performance. Studies by C. V. Martincus et al. (2015) and Liu (2013) show that prolonged clearance times reduce export competitiveness, increase uncertainty in delivery schedules, and negatively affect economic performance. These findings indicate that customs inefficiencies extend beyond operational delays and directly influence broader trade outcomes.

In recent years, attention has shifted towards the role of technology and digitalization in improving customs operations. Anurag Chandra Mishra et al. (2024) highlight that artificial intelligence and automation enhance decision-making, reduce manual errors, and improve workflow efficiency. Similarly, Sundong Kim et al. (2023) demonstrate that integrating machine learning with human expertise improves inspection accuracy and reduces processing time. Studies such as Ohood Alharbi (2024) further confirm that advanced detection systems can accelerate inspection processes while maintaining security standards.

Additionally, research focusing on logistics systems, such as that by Nataliia Luzhanska et al. (2019), indicates that infrastructure constraints and operational bottlenecks increase cargo delivery time, while improved coordination enhances efficiency. Collectively, these studies suggest that documentation quality, process efficiency, coordination, and technology integration are the key drivers of customs clearance performance.

III. RESEARCH METHODOLOGY

This study employs a field-based observational research design. Data generation relied neither on questionnaire surveys, secondary archival records, nor simulated scenarios — the researcher was physically embedded within the Aksan Logistics operational facility throughout the study period, recording elapsed time at each stage of the clearance process for every consignment as it moved through the system in real time.

The research orientation is inductive, proceeding from direct operational observation toward conclusions derived from emerging patterns. This is appropriate for a field-based inquiry aimed at producing practical, firm-specific guidance rather than testing a pre-specified theoretical framework.

3.1 Sample

Ten consecutive export consignments processed by Aksan Logistics during the study window were selected for analysis. The use of consecutive selection eliminates the risk of cherry-picking and ensures the dataset accurately reflects natural operational variability. The sample spans all three principal cargo categories handled by the firm: four rice shipments, three coir shipments, and three granite shipments. Among the ten consignments, six cleared without attracting any customs query while four attracted queries — a distribution sufficient to support meaningful comparative analysis between query and query-free clearance outcomes.

3.2 Data Collection

A structured field observation log was maintained throughout the study period. For each consignment, the clock time marking the commencement and conclusion of each of the six clearance stages was recorded: document receipt and verification; shipping bill filing via ICEGATE; customs permission; cargo stuffing; customs examination;

and gate pass clearance. Stage-level durations expressed in minutes were consolidated into a master dataset. Individual worker stuffing times were recorded separately to enable the labour performance analysis reported in Section 4.6.

3.3 Analysis Approach

Descriptive statistics and direct comparative analysis formed the analytical foundation of the study. Stage-level averages were computed across all ten consignments. Query-affected and query-free shipments were examined against each other. Cargo categories were compared on stuffing time, examination time, and aggregate clearance time. Labour performance data was used to quantify the gap between the most and least productive worker. All calculations and chart generation were performed using Microsoft Excel.

IV. DATA ANALYSIS AND FINDINGS

4.1 Master Dataset — Ten Consecutive Consignments

The table below presents the full field observation dataset. Each row captures one consignment, with all stage durations recorded in minutes.

Day	Product	Query?	Doc Receipt	SB Filing	Permission	Stuffing	Exam	Gate Pass	Total (min)
Day 1	Rice	No Query	40	55	30	90	70	35	320
Day 2	Granite	With Query	55	75	60	210	110	50	560
Day 3	Coir	No Query	40	60	30	100	75	40	345
Day 4	Rice	No Query	45	60	30	95	80	40	350
Day 5	Granite	With Query	60	80	70	207	120	55	592
Day 6	Coir	With Query	50	70	55	105	90	45	415
Day 7	Rice	No Query	40	55	30	85	70	35	315
Day 8	Granite	No Query	45	65	35	200	100	45	490
Day 9	Coir	No Query	40	60	30	95	75	40	340
Day 10	Rice	With Query	55	75	60	90	80	50	410
Average	—	—	47	66	43	128	87	44	414

Table 1: Master dataset — stage-wise clearance time for ten consecutive export consignments (minutes)

4.2 Stage-Wise Average Clearance Time

Measured across all ten consignments, average total clearance time reached 414 minutes — approximately 6.9 hours. The following table disaggregates this figure by stage and classifies the severity of each bottleneck.

No.	Clearance Stage	Avg Time (min)	Avg Time (hrs)	% of Total	Bottleneck Level
1	Document Receipt & Verification	47	0.78 hrs	11.4%	Moderate
2	Shipping Bill Filing (ICEGATE)	66	1.10 hrs	15.9%	High
3	Customs Permission	43	0.72 hrs	10.4%	Low–Moderate
4	Cargo Stuffing	128	2.13 hrs	30.9%	CRITICAL
5	Customs Examination	87	1.45 hrs	21.0%	High
6	Gate Pass Clearance	44	0.73 hrs	10.6%	Low–Moderate
Total Average	—	414	6.90 hrs	100%	—

Table 2: Stage-wise average clearance time and bottleneck classification

Cargo stuffing stands as the single most time-consuming activity, averaging 128 minutes and representing 30.9% of overall clearance time. Customs examination ranks second at 87 minutes (21.0%). These two stages together account for more than half of all clearance time. Shipping bill filing at 15.9% also warrants attention: inaccuracies at the filing stage trigger downstream queries that amplify delay across every subsequent stage. The combined weight of stuffing and filing inefficiencies is what drives average clearance time to nearly seven hours.

4.3 Query versus Non-Query Shipment Comparison

This comparison represents the study's most operationally consequential finding. It isolates the precise time cost attributable to documentation errors and quantifies it with specificity.

Parameter	No Query (6 Ships)	With Query (4 Ships)	Difference
Number of consignments	6 out of 10	4 out of 10	40% had queries
Average total clearance time	373 min (6.2 hrs)	494 min (8.2 hrs)	+121 min extra
Fastest clearance	315 min (Day 7)	410 min (Day 10)	Even best query > avg no-query
Slowest clearance	490 min (Day 8)	592 min (Day 5)	Query peak = 58% above non-query min
Primary cause of delay	Cargo type + stuffing	Documentation error	Docs are fully controllable
Monthly estimate (40 ships)	24 ships × 373 min	16 ships × 494 min	1,936 extra min/month
5% target requires saving	—	—	21 min per shipment

Table 3: Query vs. non-query clearance time comparison

Avg clearance WITH query	494 min	8 hrs 14 min per consignment
Avg clearance WITHOUT query	373 min	6 hrs 13 min per consignment
Time penalty per query	121 min	Over 5× the 21-min reduction target

Monthly time lost to queries	~1,936 min	≈ 32 hours of clearance time lost
Annual demurrage cost saved	₹10–15 L	At ₹2,000–3,000/hr port rate

Summary Box 1: Query impact on clearance time and estimated annual cost saving

The 121-minute average penalty associated with each query-affected shipment is the most action-oriented figure emerging from this study. Preventing a single query across every batch of ten consignments would surpass the five percent reduction target by a factor greater than five. Each documentation error that reaches the customs system effectively consumes two full hours of additional clearance time per affected shipment — losses that accumulate to approximately 32 hours of extra clearance delay monthly, all of which is preventable through strengthened pre-submission controls.

4.4 Product-Wise Clearance Time Comparison

Cargo category exerts a consistent and measurable influence on clearance duration. The table below contrasts rice, coir, and granite across stuffing time, examination time, and aggregate clearance time.

Product	No. of Ships	Avg Stuffing (min)	Avg Exam (min)	Other Stages (min)	Total Avg (min)	Total Avg (hrs)
Rice (Bagged Cargo)	4	90	75	184	349	5.8 hrs
Coir (Bulk Light)	3	100	80	187	367	6.1 hrs
Granite (Slabs/Blocks)	3	206	110	231	547	9.1 hrs
Overall Average	10	128	87	199	414	6.9 hrs

Table 4: Product-wise clearance time breakdown

Granite shipments averaged 547 minutes — 57% above the rice figure (349 min) and 49% above coir (367 min). Within the stuffing stage alone, granite averaged 206 minutes against 90 minutes for rice — a within-stage gap of 116 minutes. The examination stage for granite also ran 35 minutes longer than for rice, a reflection of the more thorough verification customs officers applies to industrial mineral exports. These differentials are inherent to cargo category characteristics, though the gap can be materially narrowed through deployment of mechanical handling equipment tailored to each cargo type.

4.5 Manual versus Machinery Stuffing Comparison

Not all cargo observed during the study period was handled manually. Where mechanical equipment was deployed — primarily for portions of granite block movement — the time differential was pronounced.

Parameter	Manual Stuffing	Machinery Stuffing	Difference
Average stuffing time	120 min (2 hrs)	78 min (1 hr 18 min)	42 min faster (35% improvement)
Products involved	Rice, Coir (primarily)	Granite blocks (partial)	Heavy cargo uses machinery
Workers required	4–6 labourers	1 operator + 2 helpers	Lower coordination overhead
Physical fatigue	High — causes slowdown	Minimal	Machinery more consistent
Precision of placement	Moderate — errors occur	High — precise positioning	Less re-stacking with machinery

Parameter	Manual Stuffing	Machinery Stuffing	Difference
Impact on clearance time	Increases delay	Reduces delay	Machinery clearly preferred

Table 5: Manual versus machinery stuffing comparison

Mechanical stuffing reduces the average stuffing duration by 42 minutes — a 35% compression within the stuffing stage alone. Given that stuffing accounts for 30.9% of total clearance time, this single operational shift translates to roughly an 11.7% reduction in overall clearance time — more than double the 5% target, from the stuffing stage alone. Extending mechanical handling to rice and coir operations via conveyor systems would apply these savings across the full range of cargo handled by the firm.

4.6 Labour Performance Variation During Stuffing

One of the most practically consequential observations from the field study concerns the substantial variation in stuffing performance across the three workers monitored. The gap is not accounted for by differences in cargo weight or container dimensions — it reflects a difference in technique and team coordination that is directly amenable to correction through training.

Worker	Current Stuffing Time	vs Benchmark	Root Cause Observed	Post-Training Target
Mr. Siva (Benchmark)	~75 min	Reference point	Pre-plans arrangement; efficient movement; strong team coordination	—
Mr. Subramani	~135 min	+60 min slower	Inconsistent stacking; extra movement inside container; re-stacking episodes	~90 min
Mr. Ramamurthi	~207 min	+132 min slower	Loads without pre-planning; frequent repositioning; coordination gap with outside team	~105 min

Table 6: Worker-wise stuffing time comparison and post-training targets

A 132-minute differential between the fastest and slowest worker completing the same task is a striking finding. It represents a failure of standardisation and skills transfer rather than any difference in physical capacity. Mr. Ramamurthi's stuffing time runs nearly three hours beyond Mr. Siva's on a task that should be completed within 80 minutes. The proposed peer-learning programme — positioning Mr. Siva as an internal trainer across a 10 to 15-working-day cycle — is expected to bring Mr. Subramani's time to 90 minutes and Mr. Ramamurthi's to 105 minutes. This intervention alone would reduce the average stuffing duration from 128 minutes to approximately 90 minutes, delivering a 38-minute saving per consignment — nearly twice the minimum saving required.

4.7 Five Percent Reduction Pathway — Calculation Table

The table below quantifies the contribution of each improvement area toward the five percent reduction target. With an average total clearance time of 414 minutes, achieving five percent requires saving approximately 21 minutes per shipment.

Improvement Area	Current Avg (min)	After Improvement	Time Saved	Feasibility
Documentation accuracy — prevent 1 query per 10 ships	494 (query avg)	373 (no-query avg)	121 min saved	Very High — zero cost
Labour training — Subramani (post-training)	135 min	90 min	45 min saved	High — 10–15 days

Improvement Area	Current Avg (min)	After Improvement	Time Saved	Feasibility
Labour training — Ramamurthi (post-training)	207 min	105 min	102 min saved	High — 10–15 days
Conveyor system for rice stuffing	90 min	50 min	40 min saved	Medium — ₹6 lakhs
Roller conveyor for coir stuffing	100 min	55 min	45 min saved	Medium — ₹4 lakhs
Slab loader + forklift for granite	206 min	60 min	146 min saved	High impact — ₹60 lakhs
5% TARGET REQUIRED	414 min avg	393 min target	21 min needed	ACHIEVABLE — docs fix alone sufficient

Table 7: Five percent clearance time reduction pathway

V. RECOMMENDATIONS

5.1 Pre-Filing Documentation Control System

Documentation inaccuracies represent both the most impactful and most preventable source of clearance delay identified in this study. Among the ten consignments observed, four attracted queries — three arising from incorrect HS code classification, two from incomplete shipping bill fields, and two from invoice-to-packing list quantity discrepancies. Every one of these is a pre-submission error, introduced before the consignment reaches the ICEGATE system, and every one falls entirely within the firm's span of control.

A structured five-step pre-submission verification protocol — encompassing HS code confirmation against the ICEGATE tariff database, cross-referencing invoice and packing list quantities, validating all mandatory shipping bill fields, conducting a 30-minute pre-filing review session with the exporter, and maintaining a monthly error log to monitor and prevent recurring mistakes — would address the root causes of the majority of queries observed. Implementation cost is below ₹5,000, while the projected annual benefit from avoided demurrage and storage charges is estimated at ₹10 to ₹15 lakhs.

Step	Action	Prevents	Who Does It
1	Pre-submission document checklist	Most documentation errors at source	Documentation team
2	HS Code verification via ICEGATE tariff	Wrong classification — the most common query cause	Customs broker / documentation exec
3	Cross-check invoice vs packing list qty	Mismatch errors that trigger examination queries	Documentation exec + exporter
4	30-min pre-filing review meeting	Confirms all fields before submission	Manager + documentation team
5	Monthly error log review	Identifies repeat error patterns to prevent future queries	Manager

Table 8: Pre-filing documentation control — five-step verification system

5.2 Peer-Learning Labour Training Programme

The 132-minute performance gap between Mr. Siva and Mr. Ramamurthi on identical stuffing tasks is a correctable problem. The proposed peer-learning framework deploys Mr. Siva as an internal trainer across three sequential phases: a 2 to 3-day

observation phase (the trainee shadows Mr. Siva's complete workflow without interruption); a 5 to 7-day assisted stuffing phase (the trainee handles cargo while Mr. Siva provides guidance at each step); and a 3 to 5-day supervised independent phase (the trainee works autonomously while performance is timed and documented). Total programme duration is 10 to 15 working days per worker, conducted sequentially — both workers trained within a single calendar month.

Total training cost is estimated between ₹5,000 and ₹10,000 — comprising primarily the opportunity cost of Mr. Siva's time during the training period. No external trainers or consultants are required. Projected annual savings from reduced stuffing time and associated demurrage cost reductions are estimated at ₹4.8 to ₹7.2 lakhs. A structured post-training monitoring framework — tracking stuffing time per container, benchmarking each worker against Mr. Siva's performance monthly, and activating refresher training whenever times increase by more than 20% — ensures that gains are sustained over time.

5.3 Phased Mechanical Cargo Handling

Equipment acquisition represents the highest-cost but also highest-impact medium-term enhancement available to the firm. The recommendation follows a phased approach: immediate purchase for high-frequency rice operations, leasing for coir, and a lease-to-own structure for granite given the larger capital outlay involved.

Cargo	Equipment	Cost (₹)	Depreciation / yr	Annual Saving (est.)	ROI Period	Decision
Rice	Telescopic Belt Conveyor	6,00,000	₹54,000	₹90,000	6–7 years	BUY
Coir	Roller + Inclined Conveyor	4,00,000	₹45,000	₹75,000	5–6 years	LEASE
Granite	Slab Loader + Telescopic Forklift (11T)	60,00,000	₹5,40,000	₹3–4 lakhs	6–8 years	LEASE → BUY

Table 9: Equipment investment summary — all three cargo types

It bears emphasis that none of the equipment investments are prerequisites for meeting the five percent reduction target. Documentation controls and labour development alone are adequate to achieve and substantially exceed that objective. Equipment investment is presented as a medium-term pathway that enables the firm to sustain performance improvements well beyond five percent, consistently and across all cargo types.

6. Achieving the Five Percent Reduction Target

Current average total clearance time stands at 414 minutes. A five percent reduction requires eliminating approximately 21 minutes per shipment. The evidence gathered in this study demonstrates that this objective is attainable at near-zero financial cost, and that it can be substantially exceeded through sequenced operational improvements.

Current average clearance time	414 min	6 hrs 54 min per consignment
5% reduction target	21 min	Target: 393 min per consignment
Documentation fix saves	121 min	Per query-affected shipment — 5× target
Labour training saves	38 min avg	Per consignment after both workers trained
Equipment (rice conveyor) saves	40 min	Per rice stuffing operation
Combined Phase 1 + 2 saving	~50+ min	Well above the 21-min target, zero equipment cost

Summary Box 2: Five percent reduction pathway overview

Phase 1 — Documentation (immediate, ₹0 to ₹5,000): Deployment of the pre-filing checklist is projected to lower query incidence from 40 percent to approximately 10 percent of shipments. This single measure, when its effect is averaged across query-affected and query-free consignments, yields an average saving of roughly 36 minutes per shipment. The five percent target is satisfied through this step alone.

Phase 2 — Labour Development (1 month, ₹5,000 to ₹10,000): Advancing Mr. Subramani's and Mr. Ramamurthi's stuffing performance toward Mr. Siva's standard reduces average stuffing time from 128 minutes to approximately 90 minutes. In conjunction with Phase 1, average clearance time is projected to decline to roughly 340 minutes — an 18 percent improvement against the baseline.

Phase 3 — Equipment Acquisition (medium-term, ₹10 to ₹70 lakhs depending on scope): Mechanical handling deployment across rice, coir, and granite operations reduces stuffing time by 40 to 146 minutes per cargo type, generating annual operational savings of ₹4 to ₹15 lakhs across equipment categories. This phase is best pursued after the gains from Phases 1 and 2 have been confirmed and documented, since evidenced performance improvement also strengthens the capital investment business case.

VI. CONCLUSION

This study set out to identify where time is absorbed within the customs clearance process at a south Indian freight forwarding firm, and to determine whether a five percent reduction in aggregate clearance time is practically within reach. Both questions yield unambiguous answers.

Operational time is being lost in two places above all others: in the cargo stuffing stage, which accounts for nearly 31 percent of average clearance time and exhibits wide variation depending on which worker handles the assignment; and within the query-resolution sequence, which adds an average of 121 minutes to every affected consignment and is traceable in its entirety to documentation inaccuracies introduced before the shipping bill is even submitted. These are not systemic failures or infrastructure constraints — they are operational behaviours subject to direct management action.

The five percent reduction target of 21 minutes per consignment is not merely achievable — it is surpassed by the documentation checklist intervention alone, at no meaningful cost. Labour development delivers additional structured savings within a single month. Equipment investment offers the greatest long-term performance gains and is supported by ROI analysis at current shipment volumes, though it is not required to meet the initial target.

What this study ultimately surfaces is a reality that is easy to miss in broader conversations about port modernisation and digital customs infrastructure: a substantial portion of time lost during the customs clearance process is consumed within the internal operations of individual logistics firms — in how pre-submission documents are reviewed, how workers execute container loading, and how dramatically the same task can vary across different personnel. Addressing these operational fundamentals is where improvement is most immediate, most affordable, and most directly within the firm's own authority to effect.

Future work could extend this analytical approach to import clearance operations, apply it comparatively across multiple freight forwarding firms at Thoothukudi or other southern Indian ports, or examine the potential role of AI-assisted documentation review in reducing pre-filing error rates. The field observation methodology used here, combined with primary data from actual consignments, provides a level of operational specificity that supplements — and in certain respects exceeds — what broader industry or policy-focused studies are able to deliver.

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