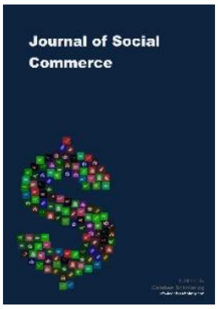

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Reducing Waste in the Delivery System through Lean Distribution: Implications for Social Commerce Logistics

Melinda Dwi Agustin[1], Dira Ernawati[1]

[1]The National Development University "Veteran" of East Java, Industrial Engineering, Surabaya, Indonesia

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Abstract

This paper explores structural inefficiencies that have been engrained into the delivery procedures, a distributor of industrial gas products, in the context of wastage reduction and improvement on logistic responsiveness, by means of adopting lean distribution. An initial inspection identified extended lead time and operational delays based on delays based on waiting and transport inefficiencies as well as redundant motion, which signified a tangled and non-integrated workflow that was document dependant. Combining Process Activity Mapping (PAM), root cause analysis and 5W+1H technique, the work produced vital, non-value-added activities and recommended focused interventions to reinstate process flow and timing purity. The endeavours of the implementation of the lean-based redesign served to cut down the total time of lead by 14.6 per cent largely through removing the actual bottlenecks in the procedure and also making coordinated handovers on a digital platform. In addition to enhancing efficient stages, the research illustrates that lean distribution serves as a form of structural redesign, which shifts the delivery process out of the series of sequential activities to an integrated, real-time, and demand-oriented system. Such findings validate the view that to enhance the logistics performance in this kind of time-sensitive environment, a reduction of waste is not a sufficient condition but rather a planned transition to digitally-assisted, flow-based process configurations.

Introduction

The world of globalization and digitalization has completely changed the distribution management dynamics. The current environment in which businesses conduct operation is a very dynamic one where efficiency, responsiveness, and flexibility in logistics are no longer operational targets but are strategic necessities. Such expansion of digital channels of commerce- particularly those, which heavily depend on fast communication with customers and the feedback on the delivery services, requires a development and adjustment of the distribution systems to meet the new conditions (Guru et al., 2023; Reardon et al., 2021; Lee

[1]Corresponding Author: Melinda Dwi Agustin, Email: 21032010125@student.upnjatim.ac.id, Address: Jl. Rungkut Madya, Gn. Anyar, Kec. Gn. Anyar, Surabaya, Jawa Timur 60294

& Jung, 2021; Suali et al., 2024). Ability to reduce delays, complexity management in real-time and customer expectation fulfilment accuracy are increasingly becoming a determinant of the success of a business. Distribution no longer operated as merely back-end service; it has become front-line driver of competitive advantage, and directly affects customer satisfaction and market positioning (Sheth et al., 2020; Brady & Cronin, 2001). In that regard therefore, optimization of distribution processes to eradicate inefficiency is of essence in creating supple and customer sensitive supply chains.

The delivery services act as the spine on which products move between the producers and final users and it plays a key role in ensuring the purity of transactions and its punctuality. Nevertheless, even with recent improvements concerning infrastructure and technology, delivery systems are frequently susceptible to delays like waiting times, bottlenecks in the processes, and disruptive logistics (Omoegun et al., 2024; Paul et al., 2019). These inefficiencies may cause serious losses in operations performance and lose consumer confidence especially where the services provided do not match their expectations. Setiawan (2023) points out that late deliveries weaken the whole process of supply and particularly in those industries where time is crucial in completing the delivery process. According to Mojumder et al. (2021), supply chain integration such as merger of suppliers, manufactories, warehouses, distributors, and retailers into a unified chain is essential in optimising the delivery process of products. In a business where the rate of fulfillment is fast, it is necessary to coordinate such elements. By making every involved component in the chain respond with as little delay as possible, reliability and perceived worth of the service as a whole can be increased substantially (Stanley & Wisner, 2001; Maull et al., 2001).

Furthermore, excellent distribution management has been identified as a strategic goal that companies want to achieve so that they could stay in the market that is becoming highly competitive. As shown by scholars such as Dhamija et al. (2020) and Dumitrascu et al. (2020), organizational agility and profitability can only be enhanced by the efficiency with which the supply chain is executed. The distribution is considered one of the major touchpoints that influence customer experience in modern commerce models when time is expected to be the only factor of delivery and not transparency or reliability during delivery process. According to Kotler & Keller (2017), distribution is the aspect of moving goods, organizing its planning, implementation, and control, a process that when mishandled, may make an operation experience inconsistencies and low profit margins. Said planning should no longer focus on mere physical movement; the change in planning should also involve incorporation of real-time tracking systems, communication systems as well as feedback systems. Distribution strategy in this respect is moving beyond a standing logistical practice to an active value added element in business competitiveness (Christopher, 2011; Jayaraman & Lou, 2007; Magee & Copacino, 2007).

Effective management of logistics is also anchored at the strategic choice of distribution channels (Paksoy et al., 2012; Kiessling et al., 2014; Lancaster & Massingham, 2017; Tsey et al., 2022). According to Muchlisa & Surianto (2021), the distribution paths selection should demonstrate the equilibrium of efficiency, reach to the customers, and quality provided. The necessity to execute on the products promptly and with high precision and to factor the regulatory frameworks of this field, desires of the customers, and the limitations of the business necessitate the determination of businesses to re-evaluate their logistics systems continually (Buyko, 2022). Nurlaela & Riza (2022) also add to this discussion because they make a distinction between primary and auxiliary distribution roles, demonstrating that effective logistics mechanisms should not be confined to moving goods. They should be able to assist real-time inventory correctness, order personalization and cost-efficient routing. Traditional distribution models are usually inadequate in situations where the customers have their expectations formed based on speed and service personalization (Olayinka, 2021; Nguyen & Nguyen, 2024; Yuan et al., 2023). Newer paradigms of logistics should hence be able to assist in flexible delivery networks, dynamic routing and quick order fulfillment. These abilities are turning out to be core to competitiveness in customer based markets (Wu et al., 2023; Posen et al., 2023; Knudsen et al., 2021).

Distribution is not an isolated process and is a critical aspect as far as cost performance and service performance is concerned as it forms part of a broader supply chain strategy. Another area that Rafi et al. (2024) emphasise revolves around delivery timeliness, logistical responsiveness and how this can keep the cost-service rate in balance. When there are operational lags caused by the lack of a proper communication flow, theft of equipment, or by overworking manual processes, the cost can surpass the limit and the customer loyalty could be lost also. Kusmayadi & Vikaliana (2021) supports this by saying that the distribution systems should be in place, which can be dynamically responsive to changes in the demand and those industries with high order variability. According to the study by Demilza et al. (2024), Lean Distribution is presented as a systematic approach to dealing with those obstacles through waste identification and removal through the delivery process. Lean principles can be used to shorten lead time and to improve the accuracy of the delivery through redesign of delivery networks, increasing resource utilisation and using digital technology. Furthermore, Kusmayadi & Vikaliana (2023) claim that lean distribution facilitates the companies to align logistics activities better to consumer requirements and, consequently, supports responsiveness by not negatively affecting cost-efficiency.

Lean Management is a term of the Toyota Production System under which the value of the customer should be maximized by reducing non-value-added (NVA) operations (Liker, 2021; Dara et al., 2024; Reddy, 2024). It is centred on its philosophy to minimise wastes of all types including waiting, inefficiency in transport, over-processing and defects which do not add direct value to a customer. Liker & Convis (2022) classify these inefficiencies into seven forms of waste that would be a potential waste of performance and profitability. In fast changing commercial settings where service speed and flexibility tends to be a major determinant of customer loyalty, detection and removal of such wastes becomes a strategic need. Inefficient logistic practices are no longer isolated within the organization: the wastage patterns including vehicle idling, excessive paper work or slow approvals no longer provide internal logistic inefficiencies but rather constitute externally significant customers feelings and competitiveness in the market. Up to this point, lean distribution is partially not the only technique of technical improvement but a new method of the strategic positioning of operational processes to be consistent with contemporary customer demand (Reichhart & Holweg, 2007; Agustian et al., 2023).

The current research problem is dedicated to PT XYZ, an industrial gas company headquartered in Indonesia and ranking among the leaders in its region that has been facing critical problems regarding a substantial lack of efficiency in the delivery process. The company has also recorded a significantly long distribution lead time despite a well developed distribution network average of 1, 270 minutes as compared to the target of 960 minutes in 2024. Such wastes have been blamed upon waiting wastes, inefficiencies in transportation of goods, and administrative bottlenecks. The insights obtained by resolving this set of inefficiencies have relevance beyond the context of PT XYZ operation, which is in the B2B environment. Delays caused by carlines, untuned routes, and paperwork is a typical logistical problem that most firms can relate to in the current digitally connected economies. According to Abdirad & Krishnan (2021), logistics systems in contemporary industries are required to embrace intelligent and particularly adaptive approaches to coping with complexity and cut turnaround times.

Methods

The proposed study is a mixed and exploratory academic case study comprising both qualitative and quantitative methodologies that will address inefficiencies in the liquid gas delivery process of PT XYZ which is an industrial company based in Gresik, East Java. The study was carried out until quantitatively and enough representative data was obtained. The aim was to outline and classify process waste in the distribution system in the company and to deliver some systematic approaches improvement based on Lean distribution methods. Case study approach is especially appropriate in providing a comprehensive analysis of the actual time knowledge about logistics of one organization that may give contextual information about the waste and process inefficiencies.

This study will use the level of waste as a dependent variable in its delivery process in PT XYZ. The independent variables include the seven types of waste found in lean approach namely waiting, transportation, inventory, motion, overproduction, over processing and defects. The indicators during the operational activities reflected the presence of each of the categories. As an example, the term "waiting" was recorded by means of observed periods of idle time because of queuing as well as preparation of documents or inspections. On the same note, they discovered ineffective route planning and frequent returns as their source of transportation waste. Classification and evaluation of these variables was therefore vital in estimating the comparative contribution of both types of wastes on the general delivery performance.

The field work was the method used to gather primary data, this involved direct observation, structured interviews and questionnaire distribution. Observations enabled the researcher to capture real time durations of each stage of delivery and to know non-value added activities firsthand. A sample of operational staff was subjected to structured interviews to record an experience perspective and test the observation results. Nine respondents were also sampled to give their views on a questionnaire whereby purposive sampling was used and the sampled respondents were directly involved in the distribution process. These consisted of the representatives of production, quality control, security, distribution and administration. This method of sampling allowed the participation of people who have the experience of several steps of the work process. The respondents were presented with the seven types of waste to be rated on a 5- point scale on the basis of their degree of occurrence and magnitude. The most critical categories of waste were ranked with the help of the weighted scoring.

The secondary data were acquired by searching literature and company records and related documentation on the study. Such materials were used to situate research findings and support observed performance challenges with regard to best practices in lean logistics and distribution management.

Such analysis was carried out using sequential and structured approach. To start with, a contemporary delivery process was originally visualized with the help of the Current State Mapping that would provide a clear picture of every stage of the process, its timing, and its sequencing. Thereafter, the Process Activity Mapping (PAM) was applied, which required assigning one of the three tags to each of the activities: Value-Added (VA), Necessary but Non-Value-Added (NNVA), or Non-Value-Added (NVA). We also coded each activity by type of activity: operation (O), transportation (T), inspection (I), storage (S) or delay (D). This enabled one to break down the losses of time on a micro level.

After mapping the activity, the results of the questionnaire were combined and analyzed in an attempt to conclude on the relative weight of each waste category. Among the waste, waiting was the most prominent and thus an extensive root cause analysis was done via Fishbone Diagram (Ishikawa method). The causes were investigated in the 6M approach: manpower, methods, machines, materials, measurement, and environment. The whole set of improvement strategies was then suggested in accordance with the root cause analysis that took into consideration the 5W+1H (What, Why, Where, When, Who, How) approach. This strategy made sure that the suggested solutions not only had a technical validity but further were operational feasible and responsible to a certain member of the organization. A Future State Mapping was developed to envisage how likely the improvements will be after waste reduction measures. This mapping was a projection of streamlined delivery system pointing out the prospects of time saving and efficient flow of processes. The benefits of the proposed efforts were measured by the estimated effects on decreasing NVA time, in particular, stages of document handling and vehicle inspection, and overall administration of returns.

Results and Discussion

The present part of the analysis will commence by establishing the Current Stream Mapping, which is used to lay out the real-time span of delivery activities in the distribution process of PT XYZ. It is used as a mapping tool to diagnose the structure of workflow and individual work stages (time). Mapping the activities as the Value-Added VA, Non-Value-Added NVA, and Necessary but Non-Value-Added NNVA parts permits one to identify inefficiencies systematically. In modern logistics environments where responsiveness, predictability, and speed are paramount excessive time spent on NVA or NNVA activities can directly undermine the company's ability to meet market demands. For businesses aiming to align their operations with customer expectations for faster delivery, real-time tracking, and consistent reliability, identifying these delays is essential not only for internal optimization but also for sustaining competitive relevance.

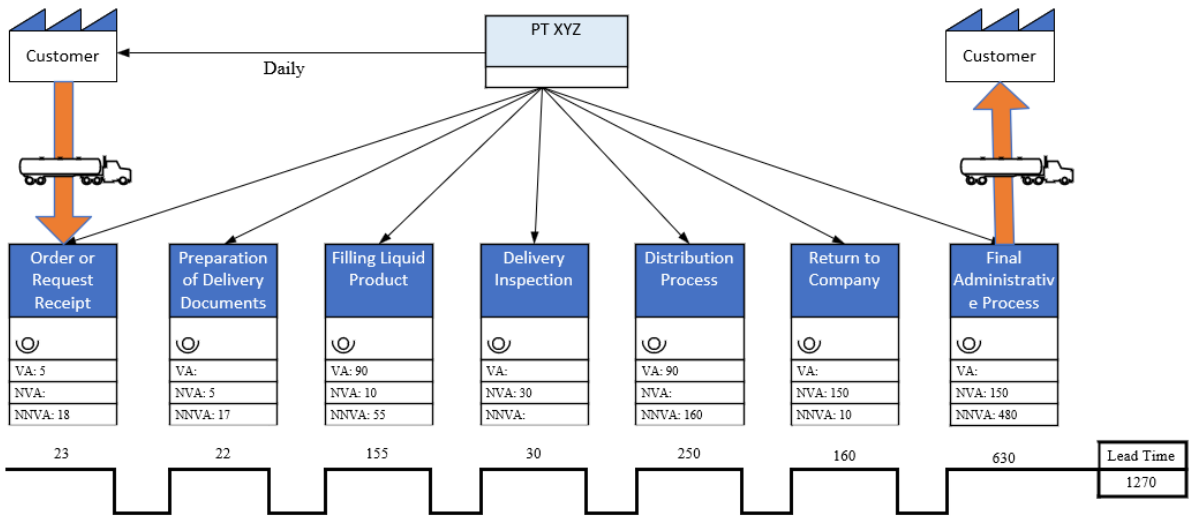

Figure 1. Current Stream Mapping Product Delivery

This mapping documents the end to end flow, all the way start to finish order, through to final invoice processing, and differentiates activities by value added contribution, which are categorised as Value-Added (VA), Non-Value-Added (NVA), and Necessary but Non-Value-Added (NNVA). Albeit the total process time devoted to VA activities is only a minor proportion of the overall process time, the rest of time is consumed by NNVA and NVA steps, including document processing, vehicle examination, administrative transition, and deliveries back, etc.

A crucial weakness in operational dexterity is stressed on these findings. Having the full process taking 1,270 minutes, with a high portion of delays incorporated in both administrative and transportation parts, the existing delivery structure is too heavy to be used with a substantial amount of tasks that do not contribute to the customer-perceived value directly. In situations where speed of delivery, fast response to orders and smooth coordination of logistics play out, such inefficiencies become bottlenecks that decrease the capacity of the system to respond quickly to customer demands. Furthermore, hard departmental handovers and time-consuming manual processes undermine the real-time readiness and scalability of distribution performance, which are of particular significance in the industries where customer demand is highly time sensitive. Consequently, the Current Stream Mapping points not only to the aspect as to where lean can be applied but also reflects the structural shortcomings in the responsiveness to delivery at PT XYZ. Identifying those delays allows the company to focus interventions that maximize internal workflow efficiency and externally perceived service reliability that is typical of modern and high velocity supply chains.

Table 1. Process Activity Mapping

Process Stages	**Activity**	**Activity Type**			**Category**					**Time (Minutes)**
		VA	NVA	NNVA	O	T	I	S	D	
Order Reception	Customer contacts sales counter.	VA			O					5
	Sales monitors customer tank via telemetry to predict refilling needs.			NNVA			I			5
	Sales creates Delivery Order (DO).			NNVA	O					8
	Sales creates Sales Order (SO) based on DO and forwards it to dispatch.			NNVA	O					5
Delivery Document Preparation	Distribution receives Sales Order (SO).		NVA						D	5
	Delivery Note (Surat Jalan/SJ) creation.			NNVA	O					10
	Delivery Instruction (SPK) creation.			NNVA	O					7
Liquid Product Filling	SPK document handed to production.		NVA			T				10
	QC checks liquid product purity.			NNVA			I			30
	Purity result used to prepare Certificate of Analysis (COA).			NNVA	O					15
	If QC passed, product is filled into vehicle tank.	VA			O					90
	Product is weighed for accuracy.			NNVA			I			10
Delivery Inspection	Security checks document		NVA				I			10

Process Stages	Activity	Activity Type			Category					Time (Minutes)
		VA	NVA	NNVA	O	T	I	S	D	
	completeness (SJ, SPK).									
	Security inspects vehicle condition.		NVA				I			20
	Vehicle departs for customer location.			NNVA		T				150
Distribution Process	Liquid product is transferred to customer tank.	VA			O					90
	Product amount is recorded in Delivery Note (SJ).			NNVA	O					10
Return to Company	Vehicle returns to plant after delivery.		NVA			T				150
	Final weighing is done to ensure delivery accuracy.			NNVA			I			10
Final Administrative Process	Delivery Note (SJ) handed to distribution department.		NVA			T				90
	SJ data entered into Epicore system.			NNVA	O					240
	Distribution compiles delivery data and cost report.			NNVA	O					180
	Sales Administration prepares sales invoice.			NNVA	O					60
	Invoice sent to billing department for customer billing.		NVA			T				60

The revelations generated by this process mapping do not only provide an image of time usage, but of the priorities where interventions should be made. Much of the process time is consumed by the routine and the sequential work such as the documents production, repetitive document checking, administrative transfer, and input of data into the Epicore system being an operational requirement but not contributing to customer satisfaction and delivery rate. These parts are expressions of entrenched layers of processes which over time have been building up and serve as an anchor to system dexterity. Such activities might be accepted as a matter of compliance/ internal controls in the conventional environment, however, in a more time bound, service based, delivery model they bring a lot of rigidness and lag.

Since the objective of PT XYZ would be to have a competitive delivery system working under an environment pulsating with high service demands, the company would need to re-design its logistics process to shift the orientation of the delivery system, presently focused on a functional complete and temporal inefficient model to one that appreciates flow, integration and responsiveness in operations. As an example, automating the SPK handovers, centralizing the inspection procedures through sensor information, and introducing real-time delivery dashboards should cut the idle time and free up the bottleneck that restricts the company in terms of its ability to complete the orders with the necessary speed and accuracy. These shifts should not merely be about doing things faster, but having the ability to alter the system in order to respond dynamically to changes in scheduling, urgent customer demands, and higher rates of distribution which all become standard avenues in the world of business today that exists in a digitally-mediated realm.

Further, a shift beyond tool implementation is needed, a lean thinking attitude that challenges the need and order of each one activity. Every hour released in a non value add operation not only cuts down on the operational cost, but the Company is in a position to deliver more volumes without pro rata increasing resources. Specifically, this is especially sensitive to an environment where immediacy, convenience and delivery reliability are the motivating factors behind purchase decisions and where delays in fulfillment could easily cause loss of trust or lost transactions. In this sense, the role of lean principles in such application goes beyond the internal process efficiencies; here lean will act as a strategic generator of delivery system credibility.

Thus, the Process Activity Mapping is more than an inventory of the current dispensation of time: it is a structural guide to change. It assists the company in shifting towards a logistics model that would enable delivery performance that is timely, traceable and flexible enough to meet customer expectations without compromising internal control and reliability of delivery services. When lean distribution is smartly deployed, it serves as a bridge between present legacy process in the organization and the flexibility it should maintain in the operations of the modern supply chains, including those that occur on the basis of high-frequency customer-driven delivery cycles. By doing this, process redesign does not only constitute a cost reduction project but it is actually an investment in the long term relevance and competitiveness of the system.

Table 2. Frequency and Time Percentage

Type	Frequency	Percentage	Time	Percentage
Operation	12	50%	720	56,7%
Transportation	5	21%	460	36,2%
Inspection	6	25%	85	6,7%
Storage	0	0%	0	0%
Delay	1	4%	5	0,39%
Total	24	100%	1270	100%
VA	3	13%	185	15%
NVA	7	29%	345	27%
NNVA	14	58%	740	58%
Total	24	100%	1270	100%

The breakdown of the distribution process is detailed in Table 2 using two analytical points of view; the frequency of type of activities and the total time contribution of activities. On the function perspective, the figures presented indicate that the operations are predominant both in respect to number (50%) and time (56.7%) and support the original statement that there is a lot of focus on the delivery system of PT XYZ that is based on achieving tasks within the company. But a better examination will show that not every operation is a value creating one; there are administrative or procedural ones like document preparation, or data reporting functions that utilize time but not to speed up the process of fulfilling customers.

Although less frequent (21%), transportation activities represent an outsized portion of the overall time, totalling to 460 minutes or 36.2% of it. Such disparity is indicative of an organisational inefficiency in which time-intensity is not correlated with task volume, which taken on its own is indicative of inefficient route planning, excess idle returns and/or inefficient dispatching. Such inefficiencies are especially dangerous when the delivery timing is directly linked to customer satisfaction or user service-level agreements. Over one-third of the cycle being spent on transportation without speed or precision is an indication that it is time to modernize route allocation and scheduling using dynamic tools such as real-time GPS, load balancing or predictive traffic systems.

The third category that is remarkable is the inspection that comprises 25% of activity frequency but only 6.7 percent of total time. It is not as time consuming as the other categories but due to its frequency i.e. being high at every point of the workflow i.e. production, security and weighing, it poses the question of redundancy. By having inspections in multiple points without a strict coordination, one introduces not only procedural delays but also makes the system less agile. Quality control within the framework of modern delivery is best achieved not through successive organizational of the process but through adding it to the workflow. The efficiency of this modular integration is that it enhances reliability without reducing the speed of delivery. The subsequent division into VA, NVA and NNVA activities confirms earlier results: only 15 percent of all time is dedicated to the value-adding processes, 27 percent is devoted to the non-value adding activities, and not a single but complete 58 percent is required yet non-value adding. The inability of the support processes, that is, administrative validation, security checks, or ERP data entry, to absorb just about six out of every ten minutes, sheds light on an inherent slackness in the receptiveness to delivery. When it comes to operations, the service competitiveness is based on swift fulfillment cycles, and these numbers illustrate how pressing lean interventions and computerization are.

Table 3. Critical Waste Ranking

No.	Type of waste	Respondents									Scor	Weight	Rank
		1	2	3	4	5	6	7	8	9			
1.	Waiting	5	5	5	4	5	5	5	5	5	44	0,18	1
2.	Transportation	5	5	4	5	5	5	4	5	5	43	0,17	2
3.	Inventory	4	4	5	4	4	4	5	4	4	38	0,15	4
4.	Motion	5	4	4	5	4	5	4	5	4	40	0,16	3
5.	Overprocessing	4	4	3	5	4	4	4	4	4	36	0,14	5
6.	Defects	3	4	3	3	3	4	2	3	3	28	0,11	6
7.	Overproduction	2	3	3	2	3	2	3	2	2	22	0,09	7

The table 3 gives the ranking of type of waste that was identified by a structured questionnaire done to nine respondents who were directly involved in the delivery operations. The results were then weighted so that they portrayed both the perceived frequency and the resultant operational impact producing the results that gave a prioritized list of waste types categories which interfere with the efficiency of the system. Waiting, transportation, and motion were shown as the three most critical types of waste in the analysis (18 per cent, 17, and 16 per cent, respectively); the three together totaling more than half of the reported existing inefficiencies in the operations.

The neatness of the waiting waste especially speaks volumes. It contains system delays because of documents preparation, release queues of vehicles, and idle time among successive activities. When end-to-end delivery time is a primary performance indicator of your operations the impact of waiting waste directly reduces throughput and restricts the number of orders which can be completed. Such kind of waste is usually indicative of inefficient work processes and handover dependencies among departments. It indicates a demand towards synchronized schedules, parallelization of processes, and coordination of tasks digitally in order to substitute with sequential, paper work based operations.

Transportation waste is second-ranked, and it is basically due to inefficient route planning, poor utilization of capacity and unproductive long returns. In cases where distribution vehicles run on fixed routes and do not allow a real-time optimization of the routes and fleet, even fleets that are well maintained are likely to experience a timing mismatch or non-optimal vehicle loading. This type of waste does not only increase the cost of logistics, but this also limits the scope of dynamically responding to urgent shipments or demand changes at a moment, which is an essential constraint in any fulfillment ecosystem that values responsiveness. The third ranked category motion waste comes as a result of repetitive movement of products orergonomic tasks like manual manipulation of the hose, delivering documents manually and people movements. Motion waste, unlike waiting or transportation waste, is not so easy to notice, but they do affect the overall performance of the workers, the progression of their processes and the number of errors associated with the workers being tired. Elimination of unwanted movement through layout rearrangement, automation, and simple standard operating procedures may earn a company important time and uniformity profits.

Surprisingly, inventory, overprocessing, defects and overproduction are ranked as having a lesser weight score, although their existence also indicates a space that can be resolved. Another example is defects, which occur less often, but might cause the necessity of reworking delivery, resource wasting, and loss of customers. Overproduction, though more arduous to see in PT XYZ because of the B2B scenario, yet has a risk of premature shipment and/or insufficient demand harmony. The results of the questionnaires provide a strategic diagnosis because it combines both the information about the employees with that of the processes as a model of ensuring that the inefficiencies are not tackled randomly.

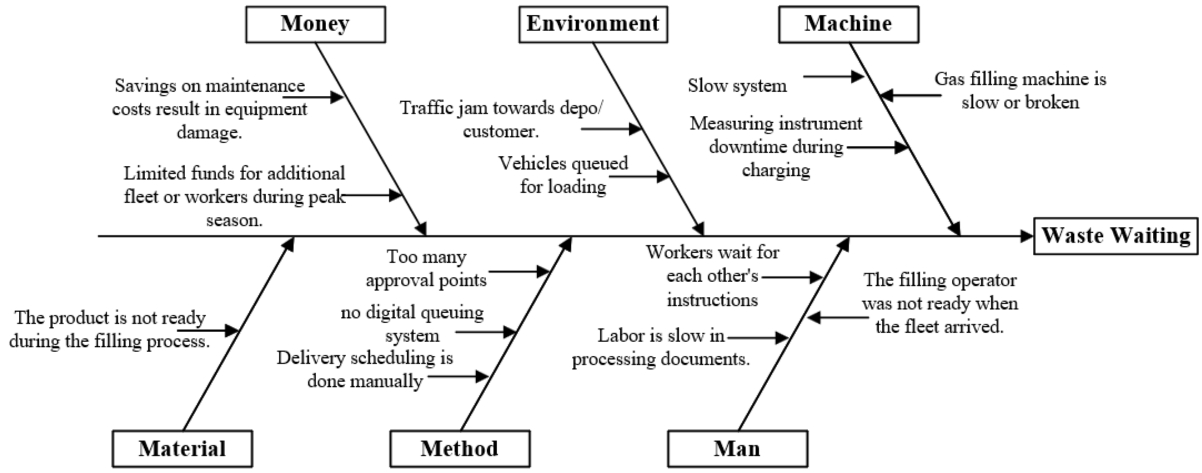

Figure 2. Waste Waiting Fishbone Diagram

Figure 2 presents the Fishbone Diagram (Ishikawa analysis) to explore the causes of most predominant type of waste which is wait. This tool breaks down the problematic complexity of delays into six dimensions that are examined with references to reasons, Manpower, Methods, Machines, Materials, Environment and Measurement (6M). By way of such a structured visualization, this diagram provides a complete overview of the way in which procedural, organizational, and systemic elements can lead to idle time in the delivery cycle.

Under Manpower dimension, delays are associated with poor discipline in the scheduling and uncoordinated tasks executions. Not having proper time benchmark or accountability system in place, even a small show of laxity can snowball into prolonged process delay when the personnel involved is lacking in the same. Delays with origins in human behavior, i.e. in their late document processing in a logistics system or their sloppy handling of handovers, further drag down consequences downstream, and in effect compromise the overall throughput. Under the Methods category, the use of sequential chain of approvals and the routine paper-based validation procedure comes out as a major problem. Such work schemes mean that a single department has to finish doing its job before another one can commence, causing bottlenecks that hold back vehicle readiness or loading of products. Moreover, the inability to understand SOPs and the ambiguity of procedures may cause unnecessary repetition of verification, approval multiplies or omissions, which subsequently need to be corrected.

In Machine perspective, equipment failure in a pump or inspection equipment may hold up the delivery process at large. Less visible problems- such as inappropriate delays to use printers or barcode scanners also play a role in the accumulative forms of wait times. A high-volume delivery environment where there are no redundancy or reliability systems in equipment introduces fragility limiting responsiveness. The areas that constitute material related delays are due to readiness or miscommunicated staging of materials. To act as an illustration, when documentation fails to be prepared prior to the arrival of the vehicles, the driver has to waste time waiting. Similarly, if product purity confirmation is delayed due to missing or misrouted COA documents, the entire loading process is suspended.

The Environmental category includes spatial inefficiencies like poor parking layouts or limited vehicle maneuvering space, which lead to queuing and congestion. These physical constraints often receive less attention than digital or procedural barriers, yet they significantly reduce flow efficiency in operational yards or plant exits. Finally, the Measurement dimension reveals that inaccurate or inconsistent tracking of task durations and delivery benchmarks results in poor planning. Without reliable time data, it is difficult to anticipate capacity constraints or identify early signs of delay. As a result, systemic wait time grows unchecked.

Table 4. Proposed Improvement Using 5W+1H

What	**What are the wastes that occur in the current delivery system?** Based on the analysis and data processing from the distribution of questionnaires to 9 respondents directly involved in the distribution process, seven types of waste were identified. Waiting waste was the most dominant type, indicating that waiting activities in the distribution process are the main issue that needs to be addressed.
Why	Why is it important to improve waste in the delivery system? Waste in the distribution system significantly reduces a company's operational effectiveness. Out of 1,460 minutes spent on distribution, 84% involves activities that do not directly add value to customers 56% are necessary but non-value added, and 28% are purely non-value added. If left unaddressed, this waste leads to higher distribution costs, delivery delays, lower customer satisfaction, resource underutilization, decreased employee morale, and overall inefficiency.
Where	At what stage of the shipping process does the most waste occur? Based on the results of the Process Activity Mapping (PAM The greatest wastes were found in Transportation (35.6% of time) and Operations (56.8% of time). If unmanaged, these lead to motion and waiting wastes. A small delay of 5 minutes (0.34%) may signal potential bottlenecks in internal distribution. Critical waste points occur mainly during early delivery stages (document preparation), loading, vehicle wait for departure validation, and administrative processes before customer invoicing.
When	When is the right time to carry out repairs? The most appropriate time to implement improvements is after a thorough analysis has been conducted and approval obtained from management, ideally starting at the beginning of the following quarter. Based on urgency,

	improvements targeting the wastes of waiting, inventory, and motion should be prioritized and implemented gradually. Performance evaluation and monitoring of the improvement implementation should be conducted regularly, with a comprehensive review at the end of each month to assess effectiveness and identify potential further enhancements.
Who	Who is responsible for carrying out the improvements in the delivery system? The main party responsible for implementing improvements is the Distribution Team. However, cross-departmental involvement is highly necessary. The Administration Department is responsible for document digitization and data validation. The Production and Quality Control teams support the smooth entry of goods into the distribution system. The Security team plays a role in accelerating the vehicle departure process. Additionally, support from central management is crucial for strategic decision-making and providing resources for improvements.
How	How are the proposed improvements applied to reduce waste in the delivery system? Below is an explanation of proposed improvements for each type of waste (7 wastes) in the delivery system at PT XYZ: **Waiting Waste** WasteImprove time discipline, maintain tanker trucks regularly, implement digital scheduling, ensure equipment availability, and reorganize parking layouts to reduce waiting times. **Transportation Waste** Train drivers on optimal routes, use GPS monitoring and route optimization software, maximize tanker capacity, and consider environmental factors like road conditions and weather. **Inventory Waste** Train warehouse staff on stock limits, use real-time sensors for accurate inventory monitoring. **Motion Waste** Train personnel on efficient work techniques, use automatic hoses and reels, establish SOPs for filling processes, and optimize workspace layout. **Overprocessing Waste** Educate workers to avoid unnecessary steps, regularly calibrate instruments, simplify SOPs, and continuously evaluate processes. **Defect Waste** Enhance operator training on safety and quality, regularly inspect equipment, conduct accurate pre-departure checks, use seals and sensors for quality control, and maintain a clean, safe filling environment. **Overproduction Waste** Coordinate logistics planning with demand forecasting, match deliveries precisely to customer needs, monitor consumption regularly, and ensure trucks depart only when customer tanks are ready.

Designed on the basis of 5W+ 1H framework, table 4 provides the proposed improvement strategies as the means of a structured response to the causes of the waste identified during the course of the distribution process. The first part of the strategy is to simply restate the conviction of what the real issue in the core is the dominance of the non-value adding tasks, especially the waiting time which puts a significant share of the total lead time. This then equates to the why, the excessive wastage greatly compromises effectiveness in operations by cost escalation in deliveries, delayed deliveries and damaged reliability in customer services, particularly human-operated systems enabling time-sensitive orders and frequent dispatch. The "where" targets the most important waste areas, especially at document processing points, vehicle inspection, as well as some critical points in the late-stage of administrative procedures stages, stages which essentially slow down the hand off between departments, or where manual processes ensure the process activity and these activities cannot easily be ramped up or down during periods of fluctuation in demand. The aspect of when underplays how immediate the implementation should take place with a recommendation that post approval, the roll out should commence in the next operational quarter with unending monitoring. The who identifies the distribution team but the idea is to include the cross-functional collaboration involved i.e. administration, production, quality control, security and top management to have an end to end responsibility and alignment of resources. And the final question, the "how" suggests such concrete countermeasures to each of the seven waste types as digital scheduling to minimize waiting, route optimization based on GPS to minimize transport, inventory tracking through sensors, redesigning workspaces to accommodate motion waste, streamlining SOPs to overcome over processing, QC checks to limit defects, and planning deliveries on real-time basis that avoid overproduction.

Table 5. Proposed Improvements at Process Time

Activity	Type	Time (minute) Real time	Time (minute) Proposed Improvements
Distribution receives the Sales Order (SO)	NVA	5	0
The Work Order (SPK) document is handed over to production	NVA	10	0
Vehicle inspection by security	NVA	20	0
Delivery Note (SJ) is handed over to distribution	NVA	90	10
Invoice is handed over to billing	NVA	60	0
Total		185	10

Table 5 applies a quantitative confirmation of the lean distribution strategy suggested in the current paper. Having determined six non-value-added activities that may be reduced and drawing data of their original and improved process timing, the table indicates how and where the waste removal directly relates to the total read time reduction. These document handovers to security checks amount to an accumulated 185 minutes in the existing condition. After such specific interventions, such time is cut down to 10 minutes only, which represents 94.6 percent decrease in the corresponding segments. This outcome is not a mere statistical advancement but it also signifies a move towards lean, trim down and digitally knowledgeable procedure by the organization.

All these reductions are outcomes of practical interventions based on the 5W+1H strategy, which basically entailed technological upgrading rather than simplifying as well the workflow. As an example, it becomes a possibility to completely eradicate time wasted on acceptance of Sales Orders and Work Orders (SPK) due to replacing manual handovers with the integration of automated processes where the delivery instructions are available electronically in real-time, so transportation departments can see them. In the same manner, tasks of security inspection, which previously took 20 minutes are removed with the help of the pre-dispatch checklists, sensor based validations, and route prepared vehicle queuing. Even the 90 minutes lag that had been experienced in returning the Delivery Note (SJ) to the distribution department is reduced to 10 minutes and this is possible with the conversion to centralized access of documentation and linking to ERP and the physical exchanges being avoided.

Here, the reasons of optimisation are not limited to an individual task. These six nodes constitute cyclic bottlenecks in the base workflow. All the delays did not only use time on their own but also led to downline waiting time after the next approvals, document validations, or task start. A breakdown of the new system does not only save time, but helps in restoring the continuity in the flow of processes that ensure the system resumes its normal operations. This leads to smoother task transitions, less idle manpower, and improved asset utilization.

More importantly, the time savings achieved here directly impact the organization's ability to scale operations or adjust delivery frequency without proportionally increasing resources. For instance, reclaiming 175 minutes of operational time opens capacity for additional deliveries, reduces overtime requirements, and improves schedule reliability. In customer-driven logistics environments—where order timeliness and service consistency are key differentiators—this efficiency becomes a competitive advantage. It allows the organization to respond to last-minute orders, dynamically adjust routes, and maintain tighter control over delivery windows, all while lowering operational strain.

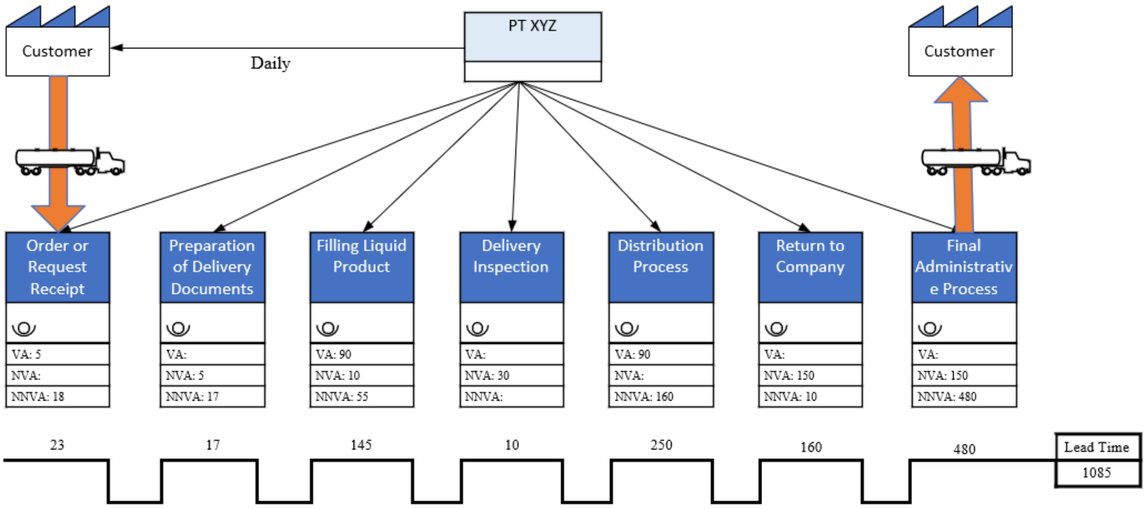

Figure 3. Future Stream Mapping Delivery of Goods

Figure 3 demonstrates Future State Stream Mapping, i.e., visualization of the reengineered delivery process that integrates all interventions with lean drivers recommended during the course of the research. This is a historic step beyond the previous process design, moving beyond hand offs and departmental siloed functions to digitally networked, synchronous working. The new mapping has consistently created a cohesiveness in the system infrastructure, where integration of the flow of operations, data sharing, as well as preparedness of tasks are integrated. Such reconfiguration of structures places PT XYZ in a position to achieve not only internal efficiency standards but also external standards of service. The essence of this design in the future is the sense of moving away from document exchanges that were manual to system-wise coordination. The delivery instruction, quality certification and administrative approvals no longer move through physical media nor depend on person to person handoff. They are instead generated, approved and accessed in a real time manner and via a common digital platform. This also prevents delays due to the unavailability of documents or getting wrongly routed and also makes it possible to prepare everything at the same time across departments. As an example, production team will be preparing the filling station but the administrative staff can pre-load the delivery records and the security unit can schedule outgoing inspection at the same time. The outcome is not only the occurrence of a faster process but also of a multi-threaded workflow with less chain-of-dependency.

The other characteristics of the future stream is the predictive structure. Upstream coordination and the ability of system visibility is what ensures that the delivery process is proactive instead of being reactive. As a case in point, digital telemetry technology can communicate to dispatch teams in advance to inform them of customer tank levels to allow it to have just-in-time filling and departure. In the same regards, automated quality control data uploads enable one to validate the Certificate of Analysis (COA) before the tanker is filled eliminating yet another possible delay. Such predictive solutions add flexibility and accuracy to the system which is becoming important in an environment that deals with time compressed orders and changing schedules.

The visual transparency of the subsequent stream can also be considered a step towards a greater process traceability and real-time performance monitoring. Durations, boundaries, and responsibilities for each step have been set, which allows the organization to identify shortcomings and initiate a corrective measure to sustain discipline in processes. Such traceability is not only desirable in terms of internal audits or compliance, but can also be used to communicate more openly with customers or external logistics providers on the expected delivery days and service levels. Also, the mapping in the future minimizes the points of contact and waste movements. Drivers do not have to wait onsite to get cleared in paper, production teams do not have to stop the work process waiting on paper work confirmations and the same process of the invoice generation does not rely on a selected workflow. The changes also minimize fatigue, remove repetition and enhance better allocation of labor-all the time maintaining a higher throughput.

Lean Distribution as a Strategic Infrastructure for Responsive Logistics Systems

These conclusions in this study indicate beyond the occasional inefficiencies; there are gaps in the systems delivery operation setup and practice. A cycle that has more non-physical adding processes not only displays the problem of administrative bloat; there is also an inherent conflict to the expectations of performance, and operations flows. This situation portends to the fact that the root of the problem is that most organizations still do not view delivery as a dynamic system, but rather a process that takes a linear progression. Redundant inspections, dependencies between documents and sequential handovers are indicative of a reactive logistics architecture design and one that is structurally unable to cope with variability in volumes, timing or expectations of service delivery. Such rigidity, in current delivery settings, translates to service failure not only in extreme occurrence but also in normal day-to-day transactions where time and coordination is of the essence. Speed and reliability in response is not an option anymore. It becomes a fundamental necessity in the process of engaging in demand-sensitive supply chains. Without a highly purposeful re-engineering of the framework of the delivery processes to focus on the theme of agility, the organization will always be tied to delays and inconsistent performance of delivery services.

Lean distribution offers a fully operative and capable system of facilitating that re-engineering. It is much more than a toolbox of waste minimizing tools. It provides a process architecture that is in line with the intrinsic performance requirements of responsive delivery systems. Lean also allows the logistics activities to operate as time-based system instead of task-based rhythms by concentrating on continuous flow, value add and eradicating interruptions. The method makes organizations question things that they perform but also why they are performing them and when. Such local optimizations, like reducing a few minutes on a single task in isolation, are no longer adequate. The need is to coordinate the various elements of delivery delivery into a low friction, high-velocity system that can generate the same results across a variety of conditions. This is the thinking that Womack & Jones (2003) referred to as a flow-centric excellence, that is always in place in any organization that wants to enhance delivery capacity without increasing the cost. The companies who do not implement this architecture in logistics operations will keep experiencing fragmented processes, variability in the completion of tasks across time, and lack of preparedness during peak workforce times.

Waiting waste poses the strongest position in this study, which explains the desirability of the need to redesign delivery processes to be ready at any moment. Waiting is no waste of time. It is an observable symptom of failure in a process-typically as a direct result of improper sequences in performing tasks, interdepartmental fumbleing or delay in getting the necessary information. Waiting even minutes in the high-volume or time-dependent rush delivery systemon, has the propensity to multiply to the much bigger disruptions through the whole chain. A machine that has to wait ten minutes to clear a document is later to miss a route space, come to the customer site at a time that the customer lacks an open window or create delays on the returns that creates issues with subsequent deliveries. Waiting also uses system slack implying that the operation loses the ability to absorb the variability or emergency orders in the form of a buffer capacity. This observation is resonated by Liker (2021) and Christopher & Holweg (2017), who proclaim that the design of logistics systems has to be not merely effective but continuous in its flow. Waiting time cannot be reduced only by making individual work steps faster; instead, it has to be synchronized among departments, real time information has to be based, demanding forward scheduling tools that sense demand and task readiness in parallel.

As much as the aspect of transportation and motion waste has been underrated in administrative logistics analysis, it is equally harmful to system responsiveness. Poor transportation arrangements including those that are as a result of idle vehicle capacity, sub-optimised routes and inefficient turn around management eat away the much needed lead time in terms of hours. This downtime has a direct effect of reducing the accuracy of services and driving the cost of a given unit delivered. This is not acceptable in delivery networks that have to work on short margins or time windows as stipulated by customers. Motion waste-- which can include excess walking, duplicative record keeping, or the need to move some equipment manually-- may not seem significant individually. Nevertheless, it also brings about accumulative fatigue, increases cycle time and restricts the foreseeability of execution. All these hidden inefficiencies are watered down on the productivity of work force and the repeatability of common operations. In fact, the effectiveness of logistics, as was seen by Sun et al. (2014) and Srai & Lorentz (2019), is based not only on inventory flow and the optimal route but also on the ergonomic design of tasks and load balance. Turning a blind eye to waste in motion and transportation is no operational glitch-rather, it is a strategic liability that erodes capacity and consistency.

The digital technologies should also be considered as part of unified facilitators, not complementary solutions. Companies tend to see digitization as the additional layer following redesign of processes, whereas this would restrict the valued effects and postpone the integration. Rather, digital solutions have to be integrated with the heart of the logistics process at the design level. This involves applying digital documentation processes, real-time dashboards to track vehicles and deliveries and systems connected with APIs where departments talk to each other live. Adoption of technology into the lean flow allows access to visibility, traceability, and automated coordination of the organizations (Núñez-Merino et al., 2020; Valamede & Akkari, 2020). Such abilities are needed to manage numerous orders, diverse customer demands, and changes in routes all of which are prevalent in contemporary fulfillment environs. According to the research findings of Bevilacqua et al. (2017) and Qrunfleh & Tarafdar (2013), the firms that use both lean and digital strategy show that the number of responsiveness and order fulfillment dispersion are higher in a significant regard. These advantage are not fringe; they are beneficial in environments where timeliness of delivery is one of the performance targets.

Another major theme that arises out of the findings of this study is coordination among functional departments. Local optimization can easily be eliminated by disconnected communication and missequencing of activities among the teams, even where individual activity is well optimized. The delivery process would become entangled in the handover lag and competing schedules when the departments do not have a common performance objective or a common working schedule. In a well functioning organization, sales, dispatch, quality control and the administrative functions should work together as segments of a goal that is collectively achieved on-time, accurate delivery, rather than a series of independent service departments committed to completing their own role. The studies conducted by Stank et al. (2001) and Htet (2024) prove that high-achieving logistics systems exhibit a constant alignment of functions through visual management, common key performance indicators, and coordination routines of the daily operations. When this coordination does not occur, even the most well-designed processes come to a standpoint at the transition points, degrading lead time reliability and overall system throughput.

This does not mean that the future state process that has been mapped out in the study is just paper improvement. It constitutes a service delivery that is structurally different. This transformation of the process, which shortens approval chains, inserts real-time visibility, and minimizes manual interventions, turns the reactive execution of the supply chain into proactive delivery. Elimination of more than 90 percent of the found NVA time in areas of critical impact is evidence that the process was not subject to external constraints. Internal structure hampered it. Logistics leaders should consider this realization as an eye opener. The capacity constraints usually are discussed as resource-based but in real fact they are embedded in processes. By reorganizing processes so that they flow, and are no longer queued, companies recover time, change manpower allocations and discover hidden delivery capacities. Gligor & Holcomb (2012) and Yan et al. (2014) underline the idea that proper logistics agility requires not an increase in the number of resources, but rather the orchestration of the current resources intelligently.

The holistic meaning of this study is that the delivery systems need to be scaled up and not at the expense of control. When the logistics environment is characterized by customer randomness, untimely demand rushes, and tight delivery schedules, elasticity of processes turns out to be one of those survival characteristics. Lean design also helps organizations achieve lead-time resilience and thus adapt to any new geographies of deliveries, time-sensitive customer groups, and integration of digital services without disrupting operations. On the other hand, systems with predetermined sequence performance, manual override, and hierarchical approvals will never keep the quota of market demands relative to its considerable frequency. That is the case because, as noted by Hosseinzadeh et al. (2024), logistics networks that fail to react to the changes in velocity and density become out-of-date in a short period. It is the mandate of the system designers and logistics strategists to try and foresee such a situation and be decisive to eliminate all internal bottlenecks that would appear in the form of outward pressure.

The situation on the case of study shows that lean distribution is not a marginal improvement scheme but a structural requirement of change in the logistics system. The results are not the byproducts of routine optimization (more speed with fewer customer-to-custome connections and process control less mysterious, greater delivery readiness) but rather the direct product of systematic process redesign. By synchronizing their flow operations in terms of delivery with the logic of flow, time discipline and digitally coordinated organization, such organizations achieve the ability to operate under pressure with predictable consistency. That is the new new. Logistics systems are no longer supposed to be focused on efficiency. They have to be constructed in terms of preparedness, flexibility, as well as service integrity. Logistics in the future will not belong to the fastest organization; instead, only the organisation that is the best equipped to react without delay, without waste or without any compromise will find a place there.

Conclusion

This paper has explained that lean distribution does not simply constitute an instrument to support the optimization of operations, but a strategic platform that could redefine the performance architecture of the deliverable systems. By extensively diagnosing waste in logistics process, specifically in the waiting, transport, and motion, the research has been able to outline, identify major inefficiencies that also hinder not only lead time but overal responsiveness and scalability of the system. There was practical improvement in terms of delivery delays and resetting of the workflow integrity following the efforts of implementing lean principles with the assistance of systematic mapping tools and cross-functional analysis.

More to the point, the results show that inefficiency does not lie in individual mistakes but in the design. Fragmented execution, limited digital integration and non-coordination of operations destroy efficiencies by providing delays, idle times, and the repetition of procedures. Through redesigning to focus on flow, time, and real time coordination, organizations have a huge amount of latent capacity to find without similar increases in resource usage. This is another reminder of the crucial observation: the performance improvement in the field of logistics is not necessarily predetermined by growth but rather is predetermined by a smooth reorganization. The future state presented on this study offers a workable guide in modernizing the logistics. It presents the potential of lean methodology being integrated into the digitally enabled operations to provide faster, more agile delivery systems capable of responding responsively to variability. The truth is that in a business environment of precision, flexibility, and uniformity, such a transformation is not a competitive advantage anymore- it is a precondition to remain relevant.

Future research can take this even further with the inclusion of real-time data analytics, machine-learning forecasts, customer-facing (transparency) of deliveries to the lean distribution architecture. The technologies are the future of smart logistics and a combination with the lean will characterize the new generation of high-performance delivery networks. As organizations evolve, so too must their delivery systems toward speed, toward control, and most importantly, toward readiness.

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