Sustainable Distribution Strategy for Improving the Delivery Efficiency of Voca Water 19L at Universitas Diponegoro Teaching Factory

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Abstract. This research primary objective is to analyze the distribution strategies used by Universitas Diponegoro Teaching Factory to improve delivery effectiveness and operational efficiency of Voca Water 19L product. It also examines how better distribution planning can minimize unnecessary trips and support green logistics practices. This research uses a descriptive qualitative approach. Data were collected using in-depth interviews with relevant operational actors as well as filed observation towards existing distribution process, including human resources, vehicle use, delivery scheduling, stock availability, and warehouse layout. The data were analyzed using data reduction, data display and conclusion drawing. This research found that existing distribution system is still considered as request-based and not yet supported by structured planning. Main problems include limited distribution personnel, dependence on a single vehicle, the absence of structured delivery schedule, delayed stock availability due to production constraints, and warehouse layout and location that does not support the whole activities. Sustainable distribution strategies are recommended which include strengthening distribution human resources, optimizing vehicle use, preparing a planned delivery schedule, improving stock control, and rearranging the warehouse layout. This study provides practical recommendations for improving distribution efficiency in a vocational-based teaching factory. The proposed strategies may help reduce delivery delays, minimize unnecessary trips, improve fuel and energy efficiency, and support sustainable business practices through simple technology-supported distribution planning.

Keywords: sustainable distribution, delivery efficiency, green logistics, teaching factory

1 Introduction

Distribution, a part of logistics management which contributes to making sure that customers receive their products on the right time, with the right quantity and of course, right quality [1]. Nowadays, distribution is not only about physical delivery process of goods, but also a strategic move for companies in managing the efficiency of energy, utilization of fleet, and operational sustainability. Green logistics is gradually becoming

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more relevant to the real world application because it is one of the primary reasons why logistics practitioner try to minimize their carbon footprint by cutting down long or unnecessary trips, optimizing loading capacity of the vehicle and also consume reasonable fuel to make it efficient [2].

As the producer of Voca Water, the demineralized drinking water, teaching Factory of Vocational School Universitas Diponegoro is faced with major distribution problem. Based on operational data in 2025, there was a significant increase in demand of Voca Water from faculties and directorates in Universitas Diponegoro. The most prominent increase that can be seen was in September 2025 in which the teaching factory should distributed 124.80 gallons in average compare to January in the same years, where they only needed to distribute 40.52 gallons in average. The increasing demand, turned into increasing delivery schedule, while the distribution capacity remains the same. This situation ignited delivery delays and complaints from customers [3,4].

In the time span from July to December 2025, voca water teaching factory received a total of 67 complaints regarding delivery delay. This issue was caused by interconnected factors especially from inside the Teaching Factory itself. Determining factors such as limited number of distribution staff, heavy reliance on only one vehicle, lack of systematic scheduling, delayed of production process which affected the availability, location and layout of the warehouse [5,6]. From Green Logistics perspective, the internal situation and poorly coordinated distribution schedule leads to inefficient transportation routes as well as high fuel usage [2,7].

This study was done with objectives: (1) To analyze in depth of the Voca Water product distribution process, (2) To identify obstacles influencing efficiency of distribution with using of Ishikawa Fishbone Diagram method, (3) To determine the best strategy distribution plan that have SWOT analysis supported Green Logistics implementation concept. These findings expected could help Learning factory Diponegoro University to improve distribution efficiency.

2 Literature Review

2.1 Distribution

In logistics management, distribution refers to the activities involved in ensuring the quick and efficient transfer of goods from the place of production to the place of consumption [1]. According to Coyle et al. (2019), the distribution strategy comprises strategic decisions that govern the movement of goods to provide the desired service level at the least resources spent [1]. The two fundamental elements that should be well-balanced in a distribution system are internal operational efficiency and customer service quality. Timeliness and availability of the product are the key factors driving customer satisfaction around bottled water distribution [8].

Sector of packaged drinking water is very sensitive to the changes in demand due to seasonality and demographics; thus a systematic capacity planning is required in the field of distribution [8]. Even in mid-sized FMCG companies, the transition from reactive to scheduling distribution system has been very effective in delivering products and the improvement of distribution planning [4].

One of the contemporary aspects of supply chain management that designs logistics activities with less cost and high-quality service delivery is distribution efficiency. The modern trends of online ordering, advanced picking methods and aggregation practices have helped to enhance efficiencies in operations of logistics process [9]. Adding all logistics activities together, we can understand the overall efficiency of distribution and delivery including ordering, warehousing, packaging, transportation, inventory management and unloading. Modern technologies have demonstrated significant progress in the distribution process efficiency [10].

Utilizing optimization methods has proven to be effective in minimizing distribution costs and maximizing resource utilization. With an average utilization ratio of 92.04% of its maximum capacity and simultaneously reducing negative environmental impacts, such as congestion and pollution, the optimization of the Vehicle Routing Problem (VRP), employing mixed capacity fleets has resulted in a cost reduction of 53% and fleet size reduction of 50% in distribution operations. The thoughtful location of distribution facilities is of great importance as has been evidenced by studies. Factoring in that facilities located near populated areas cause lower total delivery costs is crucial for decision making. Performance monitoring systems have revealed many inefficiencies in warehouse operations. For example, a two-stage matrix analysis that combines operational effectiveness, on-time delivery, and in-full delivery data enables companies to improve resource utilization efficiency and OTIF performance [13].

2.2 Sustainable Distribution Strategy

Sustainable logistics strategies represent crucial paradigms for minimizing environmental impact and achieving optimal resource usage in supply chain management. Data-driven solutions utilize real-time information, predictive analytics, and planning tools to make informed decisions about shipping routes, inventory control, packaging, and waste reduction. Machine learning models deploy techniques such as regression analysis, classification algorithms, and optimization to predict demand, choose the optimal shipping route, and reduce fuel consumption. By implementing the integrated logistics system that connects supply chain-related decisions with environmental goals, the business reduces costs and environmental footprint incurred through various actions, including improving transportation scheduling and utilizing advanced analytics to forecast demand and integrate multimodal transportation options [14]. In physical Internet supply chain model, emissions are many times lower than in traditional supply chain solutions, e.g. logistics enhanced by large cargo capacity reduces total number of trips and thereby carbon emissions while elements like information sharing help enhance sustainability through information transparency [15].

Empirical data shows that vehicle fuel consumption, customer distance, package characteristics, and transit frequency all affect the sustainability performance of a supply chain; thus, businesses should focus on connecting storage to product distribution via packaging, loading, and order-processing information to enhance reputation and thereby impact supply chain sustainability positively [17]. Three main approaches for sustainable logistics; green logistics stressing eco-friendly transportation and storage; reverse logistics stressing product reuse and recycling; and lean logistics removing waste and improving supply chains help to keep the

surroundings in balance, increase corporate competitiveness, and maximize costs while minimizing environmental impact and guaranteeing effective trash management [18].

2.3 Green Logistics

Green Logistics is a strategy of managing logistics meant to lower the environmental impact of logistics operations including the carbon footprint, fuel economy, route optimization, and more thoughtfully planned fleet usage [2]. Regarding small scale distribution like that of a Teaching Factory, Green Logistics ideas can be applied by means of needs based distribution scheduling, combining shipments into a single journey, and managing routes to avoid unnecessary travel [19]. Green Logistics helps to save operating expenses while maintaining environmental sustainability. Incorporating Green Logistics ideas into a same day delivery system helped to lower travel expenses by as much as 18% by route optimization and order consolidation [6].

Green logistics principles represent a comprehensive approach to incorporating ecological considerations into logistics and supply chain management, aiming to reduce carbon footprints and improve operational efficiency while achieving long-term environmental sustainability goals. The field explores strategies, technologies, and initiatives including sustainable transportation solutions emphasizing fuel efficiency and alternative fuels, logistics collaboration and optimization through consolidation centers and route optimization, and last-mile delivery strategies that minimize inefficiencies and maximize resource utilization [20]. Implementation in road transportation requires eco-friendly vehicles, effective transportation systems, and advanced technologies as key factors for promoting green logistics, though lack of funding and collaboration prevents many companies from adopting green logistics measures, with suggested solutions including economic driving classes, employee education, and electric or hybrid cargo-handling vehicles [21].

2.4 Ishikawa Fishbone Diagram

The Fishbone Diagram, or Ishikawa Diagram, is a cause-and-effect analysis tool used to systematically identify the root causes of a problem by categorizing them into five main dimensions: Man, Method, Machine, Material, and Environment [22]. The application of Fishbone analysis is highly significant in logistics distribution systems because of their interdependent operational characteristics a delivery delay cannot simply be attributed to a single dimension, but is often the cumulative result of failures across several dimensions at once [22]. This approach enables a comprehensive identification of distribution obstacles, ensuring that the resulting improvement strategies genuinely target the root causes rather than merely the surface symptoms.

2.5 SWOT Analysis and Strategy Matrix

SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is a strategic framework that combines an organization's internal and external factors to formulate realistic and applicable strategies [23]. The primary added value of SWOT lies in its ability to gen-erate four types of tactical strategies: the SO Strategy (using strengths to seize opportuni-ties), the WO Strategy (minimizing weaknesses through external opportunities), the ST Strategy (using strengths to counter threats), and the WT Strategy (a defensive strategy ad-dressing weaknesses and threats) [23]. In this study, SWOT analysis was conducted after the Fishbone mapping, so that the resulting strategies are

applicable and directly address the identified obstacles. A systematic SWOT approach was able to position a distribution company for aggressive growth through market penetration strategies and strengthened distribution networks [3].

3 Methods

This study uses a qualitative method with a descriptive approach. The qualitative approach was chosen because the study aims to gain an in-depth understanding of the distribution phenomenon by exploring processes, obstacles, and strategies that are contextual in nature and cannot be measured purely numerically [28xdde3]. The research locus is the Universitas Diponegoro Demineralized Drinking Water Teaching Factory, the producer of Voca Water 19L gallons and 330 ml bottles for the internal needs of the Universitas Diponegoro academic community in Semarang.

Data collection techniques comprised three components: (1) direct observation of the daily distribution process of Voca Water during the period January-December 2025; (2) in-depth interviews with three key informants the Distribution Manager, Distribution Staff, and Logistics Admin selected using a purposive sampling technique based on their direct involvement in the distribution process; and (3) documentation of 2025 operational distribution data. Table 1 below presents the detail of informants along with the data they provided.

Table 1. Average distribution data for Voca Water 19L gallons in 2025 at the Universitas Diponegoro Teaching Factory.

Informant	Position	Role in Distribution	Data Contribution
A1	Distribution Manager	Supervises delivery process	Distribution planning, constraints
A2	Distribution Staff	Executes delivery	Fleet, loading, delivery obstacles
A3	Logistics Admin	Records orders and complaints	Order data, delay records, documentation

The data were analyzed using the Miles and Huberman interactive model [25], which includes four stages: data collection, data simplification, data presentation, and drawing conclusions. The data analysis procedure is described in detail below:

1. Operational data were tabulated to identify demand trends and delay patterns.
2. Interview and observation data were coded based on distribution constraints.
3. Fishbone categories were developed using Man, Method, Machine, Material, and Environment.
4. Internal and external factors were mapped into SWOT.
5. These strategies were prioritized based on their relevance to shipping efficiency and the principles of sustainable distribution.

Data validity was ensured through source triangulation and methodological triangulation, by combining the results of observations, in-depth interviews, and operational documentation. The analytical tools applied were the Ishikawa Fishbone

Diagram to identify challenges and the SWOT Matrix to determine distribution strategies.

4 Results and Discussion

4.1 Distribution Process for Voca Water Products

Within the framework of logistics management, distribution presents a chain of actions required to ensure that goods reach the final consumer in the fastest and the most efficient way possible [1]. Logistics refers to all the processes from planning and implementing to controlling the flow of goods and information from point of departure to point of consumption and is not limited to the mere movement of products only [1]. Since demineralized water is a fast-moving item, it needs a distribution system that can respond quickly to market demand and is able to deliver sufficient volumes of product to ensure availability of goods in the market constantly [4].

Voca Water's distribution process consists in six consecutive stages: (1) accepting orders using WhatsApp Official; (2) getting the delivery note ready; (3) loading goods onto the pick-up fleet car; (4) delivering to consumer sites across the campus; (5) handing over goods and signing distribution papers; and (6) summarizing deliveries and inputting information into the logistics administration system. Every phase greatly relies on the level of human resources readiness, fleet availability, and warehouse product stock readiness. Any disturbance in any of these three components causes a domino effect that impacts the whole distribution process chain [26].

Operational data for 2025 show a highly significant increase in delivery demand throughout the year. Table 1 presents the complete data on the average distribution of 19L gallons over 12 months. This increase was primarily driven by the addition of new customers from campus work units, the holding of academic events and graduation ceremonies, and growing awareness among the academic community of the importance of quality drinking water [3,4].

Table 2. Average distribution data for Voca Water 19L gallons in 2025 at the Universitas Diponegoro Teaching Factory.

No.	Mount	Initial Stock (Gallons)	No. of Deliveries	Effective Days	Average/ Day	Remarks
1.	January 2025	1,265	1,216	30	40.52	Low demand
2.	February 2025	2,049	1,252	19	65.94	Short working days
3.	March 2025	1,797	1,136	31	36.66	Lowest, semester break
4.	April 2025	2,661	1,810	21	86.18	Start of semester, surge
5.	May 2025	2,651	2,076	22	94.41	Approaching peak
6.	June 2025	2,523	1,807	21	86.05	Stable, high
7.	July 2025	2,224	2,100	24	87.43	Demand surging

8.	August 2025	2,197	2,743	25	109.70	Critical phase, graduation & course registration
9.	September 2025	2,497	3,370	27	124.80	PEAK demand
10	October 2025	2,601	2,705	26	104.04	Still high
11.	November 2025	2,589	2,698	26	103.78	Stable, high
12.	December 2025	2,022	2,199	25	87.95	Year-end, beginning to decline
	Total	–	24,112	–	–	–

Source: Distribution Operational Data, Universitas Diponegoro Demineralized Drinking Water Teaching Factory, 2025.

Table 2 clearly shows the shift in demand. The graph shows that the average number of gallons delivered daily follows a steadily increasing trend, peaking at 124.80 gallons per day in September 2025 and a low of 36.66 gallons per day in March 2025. The 88.14 gallon per day difference between the peak and lowest indicates that the Teaching Factory's distribution system will require flexibility beyond what it currently has.

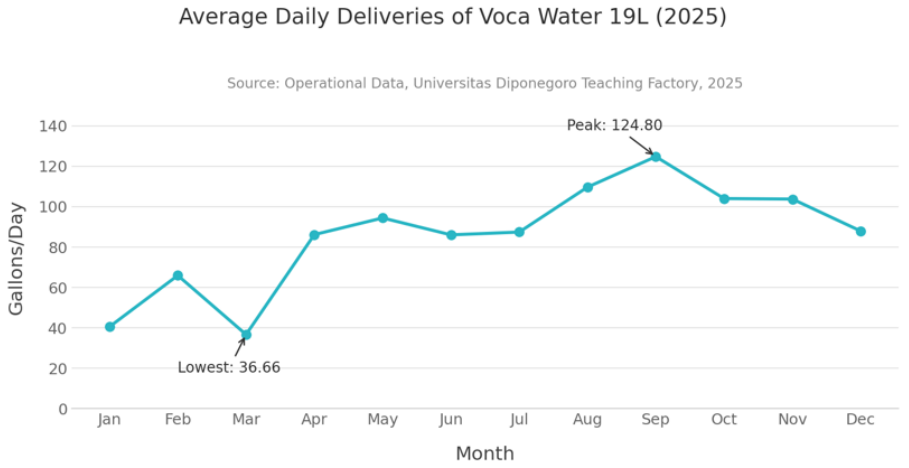


Figure 1. Trend in the average daily delivery of Voca Water 19L gallons throughout 2025. (Source: Operational Data, Universitas Diponegoro Teaching Factory, 2025)

4.2 Factors Hindering Distribution: Ishikawa Fishbone Diagram

The real impact of the imbalance between capacity and demand is reflected in the rising number of delivery delay complaints. As shown in Table 2 and Figure 2, the number of delays increased from 6 cases in July to 14 cases in December 2025, with a total of 67 complaints during July–December 2025. Of these 67 complaints, 44 were submitted in writing (via the official WhatsApp channel) and 23 were delivered directly [4,6]. Previous research has found that the main consequences of delays in packaged drinking water distribution include the risk of lost sales at distribution points, declining customer

trust, and customer migration to alternative products these three consequences are cumulative and progressively weaken the organization's competitive position [19].

Table 3. On-time and delayed delivery data for Voca Water 19L gallons, July-December 2025

No	Month	No. of Orders /Unit	No. of Deliveries /Unit	Late	On Time	Written Complaints	Direct Complaints
1	July	224	224	6	218	4	2
2	August	204	204	9	195	6	3
3	September	185	185	15	170	9	6
4	October	183	183	12	171	7	5
5	November	168	168	11	157	8	3
6	December	142	142	14	128	10	4
	Total	1,106	1,106	67	1,039	44	23

This delay trend is visually illustrated in Figure 2. September recorded the highest number of delays (15 cases) aligning with the peak demand surge in the same month, and confirming that the existing distribution capacity was not designed to respond to demand exceeding 100 gallons/day.

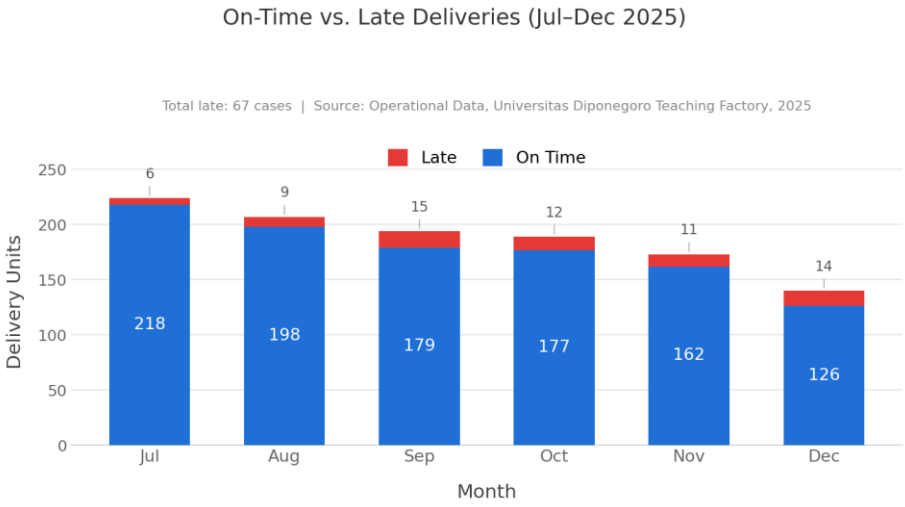


Figure 2. Comparison of on time vs. delayed deliveries of Voca Water 19L gallons during the
July-December 2025 period.
(Source: Operational Data, Universitas Diponegoro Teaching Factory, 2025)

The results of the Ishikawa Fishbone Diagram analysis identified distribution obstacles across five dimensions, as summarized in Table 4. These five dimensions are interrelated and create a distribution system that is not only inefficient but also contrary to the principles of Green Logistics [7]. The application of Fishbone analysis is highly

significant in logistics distribution systems because of their interdependent operational characteristics a delivery delay cannot simply be attributed to a single dimension, but is often the cumulative result of failures across several dimensions at once [22].

Table 4. Identification of distribution obstacles based on the Ishikawa Fishbone Diagram

Fishbone Dimension	Obstacles Identified in the Field
Man	Only 2 permanent distribution employees; dependence on internship students who also perform production functions; physical and psychological pressure during peak demand; no formal backup personnel when core staff are unavailable.
Method	Reactive distribution system based on daily orders without structured scheduling; SOPs not consistently implemented; no standard route prioritization; weak coordination between divisions.
Machine	Only one pick-up fleet unit with no formal backup vehicle; no periodic maintenance schedule; a tire failure has occurred during operations; loading aids (hand pallets) are still limited.
Material	Delays in procuring production support materials (gallon caps, bottles, seals, washing soap); no minimum stock policy; production disruptions due to PLN power outages causing stock to be unready for delivery.
Environment	Cramped warehouse with stock scattered across two separate locations; warehouse conditions do not support smooth loading; 19L gallons and 330 ml bottles occupy the same space, slowing delivery preparation.

Source: Results of Ishikawa Fishbone Diagram Analysis, Research 2025/2026.

4.3 SWOT-Based Sustainable Distribution Strategy

Based on the obstacles identified through the Fishbone Diagram, a SWOT analysis was conducted to map the internal and external factors of the Teaching Factory's distribution system. Table 5 presents the complete SWOT Matrix along with the four resulting strategy groups [23,27]. SWOT analysis can be defined as a strategic framework that combines internal factors (Strengths and Weaknesses) and external factors (Opportunities and Threats) to formulate four types of tactical strategies: SO, WO, ST, and WT Strategies [23]. A systematic SWOT approach was able to position a distribution company for aggressive growth through market penetration strategies and strengthened distribution networks [3].

Table 5. SWOT matrix of the Voca Water distribution system at the Universitas Diponegoro Teaching Factory

	STRENGTHS (S)	WEAKNESSES (W)
	S1: Strong support from the campus institution **S2:** Availability of internship students as supporting human resources **S3:** Pick-up fleet still operationally fit	**W1:** Only 2 permanent distribution staff **W2:** A single fleet vehicle with no backup **W3:** No structured distribution scheduling

	S4: Responsive order-communication system via WhatsApp **S5:** Management commitment to service improvement	**W4:** Cramped warehouse with stock split across two locations **W5:** SOPs not consistently applied **W6:** No minimum stock policy
OPPORTUNITIES (O)	**SO STRATEGY**	**WO STRATEGY**
O1: Campus fleet vehicles can be borrowed during peak periods **O2:** Growing trust among internal customers **O3:** Potential to expand customers to new units O4: Campus policy support for domestic products O5: Availability of internship students from various cohorts	**SO1:** Optimize the distribution network to all campus units by leveraging existing fleet and human resources (S1,S2,S4+O2,O3,O4) **SO2:** Expand distribution coverage to new work units using the existing WhatsApp ordering system (S4,S5+O2,O3)	**WO1:** Borrow campus fleet vehicles during peak demand to cover fleet limitations (W2+O1) **WO2:** Formalize the distribution internship scheme to add structured backup human resources (W1+O5) **WO3:** Implement a Distribution Scheduling Form to address the current reactive distribution approach (W3+O2,O4)
THREATS (T)	**ST STRATEGY**	**WT STRATEGY**
T1: Unexpected demand surges during campus events **T2:** Production disruption due to power outages **T3:** Unexpected fleet breakdowns **T4:** Rising customer complaints **T5:** Competition from external bottled-water products	**ST1:** Schedule distribution based on the campus academic calendar to anticipate surges during major events (S1,S5+T1,T4) **ST2:** Leverage the strength of WhatsApp communication for rapid response during fleet disruptions (S4+T3)	**WT1:** Apply a minimum finished-goods stock policy to anticipate production disruptions (W6+T2) **WT2:** Reorganize the warehouse to speed up loading and reduce delay risk (W4+T4) **WT3:** Develop a written distribution SOP as a standard operating guideline (W5+T4,T5)

Source: Results of SWOT Analysis, Research 2025/2026.

Of all the strategies generated by the SWOT Matrix, three priority strategies are considered the most relevant for developing a sustainable distribution strategy and improving delivery efficiency at the Universitas Diponegoro Teaching Factory. These strategies focus on strengthening distribution planning, improving resource readiness, and ensuring the continuity of delivery operations.:

Strategy 1. Strengthening the Needs-Based Distribution Scheduling System (WO3/ST1)

The essential solution for improving the existing request-based delivery system is implementing systematic distribution planning using the Delivery Distribution Scheduling Form. The present delivery system remains largely dependent on the daily incoming requests that sometimes make it difficult for the distribution team to streamline their routes and prioritize deliveries.

A scheduling system that is based on needs permits you to organize your customer orders according to zones for delivery, urgency of orders, number of deliveries and available stock. This makes it possible for the distribution team not only to cover more delivery points, but also to avoid redundant deliveries to nearby places, thus making distribution operations much more predictable each day. In addition, scheduling by academic calendar enables the Teaching Factory to foresee demand spikes during graduation, academic events, enrollment of new students and similar high-demand periods.

Thus, with the adoption of this plan, it would lead to the establishment of sustainable distribution mechanisms by ensuring the accurate delivery of goods, maximizing the efficiency of resource utilization, ensuring reliability of services, and optimizing routes. Furthermore, it provides a practical framework for better communication between the logistics manager, production personnel, warehouse personnel, and distribution personnel.

Strategy 2. Strengthening Distribution Human Resources and Shared Fleet Support (WO1/WO2)

Second in importance comes the need to strengthen the distribution of human resources and to create a more reliable fleet support system. Currently, the distribution system is based on just two permanent distribution staff and one pick-up. Whenever demand is high or several staff members are absent from work, or the vehicle fails to work properly, the operations face considerable risks.

The establishment of an organized distribution internship program can help an organization be prepared with extra members of staff for moments of peak load. Interns ought to perform only distribution-related tasks such as order preparation, documentation, loading assistance, client approval, and delivery tracing. This program should be kept isolated from production activities to ensure that staff members are available whenever the organization needs them.

Additionally, it is essential that the Teaching Factory coordinates the establishment of a centralized system of fleet support with the university within the campus. Utilizing the university's vehicles when demand is high makes it possible to diminish dependency on the fleet unit and ensure uninterrupted services, but this system should be built around the clearly developed rules that govern the availability of vehicles, delivery priorities, assignment of drivers, and carrying out of lease maintenance checks. This has the effect of ensuring uninterrupted delivery services in situations of disturbances or changes in demand.

Strategy 3. Warehouse Reorganization and Minimum Stock Control (WT1/WT2)

The reconfiguration of the warehouse layout and the implementation of a minimum stock level policy are next on the list of priorities. Currently, the warehouse is in less than ideal condition because some products are stored in separate zones despite being part of the same restricted space. This is detrimental to the speed of preparation, increases in the volume of the loads, and lowers the efficiency of delivery.

Given that this product has a greater distribution volume and calls for more physical handling, warehouse rearrangement should give top priority to the location of 19L gallons nearer the loading point. To slow movement barriers and quicken order preparation, the storage space for 19L gallons should be kept apart from 330 ml

packaged items. Additionally helping distribution workers quickly find ready to deliver stock is a more organized warehouse design.

Moreover, for finished products and auxiliary manufacturing materials including gallon caps, seals, bottles, and washing supplies, a minimum stock level ought to be set. Average daily demand and production lead time help one to determine the lowest stock level. Important to guarantee that material shortages, production delays, or unforeseen power blackouts don't interfere with delivery operations. Improved stock readiness, lower loading delays, minimum repeated handling tasks, and more constant satisfaction of consumer demand helped this plan to enable sustainable distribution.

Integrated Sustainable Distribution Strategy

The three top priorities support one another. The scheduling method helps to plan deliveries and combine routes. Improved operational resilience comes from enhanced human resources and shared fleet support. Warehouse remodeling and basic stock management make sure items are ready prior to the start of delivery operations.

These techniques taken together provide a more dependable, effective, and flexible distribution system rather than one only geared at short-term delivery issue fixing. Sustainable distribution for the Universitas Diponegoro Teaching Factory is the capacity to keep service continuity, maximize scarce resources, lower delivery delays, enhance communication among operational units, and react quickly to changes in demand.

5 Conclusion

This study finds that the Voca Water supply system at the Universitas Diponegoro Teaching Factory is still reactive and has not been able to properly meet demand increases. Demand for operational data in 2025 shows a more than three-fold increase from 40.52 gallons/day in January to 124.80 gallons/day in September not matched by enough distribution capacity, therefore causing 67 delay complaints over the second part of 2025.

The five interconnected aspects found via the Fishbone Diagram are: (1) inadequate distribution of human resources; (2) reliance on a single fleet vehicle devoid of backup; (3) lack of organized distribution planning; (4) stock availability restrictions caused by manufacturing interruptions; and (5) less than ideal warehouse conditions. This scenario points to a lack of operational sustainability in the existing distribution network as it still generates several deliveries, wasteful use of resources, and limited responsiveness to demand variations.

Based on the SWOT Matrix, the three top priorities are: (1) strengthening the needs-based distribution scheduling system via the use of a Delivery Distribution Scheduling Form; (2) formalizing backup distribution personnel and a campus fleet-borrowing mechanism; and (3) reordering the warehouse layout and creating a minimum stock policy. By enabling better delivery planning, maximizing limited resources, increasing stock readiness, and so helping to ensure service continuity, these three approaches collectively enhance distribution efficiency. The use of the Delivery

Distribution Scheduling Form, the practical result of this study is a concrete step toward a more effective, resource-conscious, and sustainable distribution system.

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