Design Of An Operations Strategy-Based Framework To Align Demand And Capacity In A Crsytal Ice Manufacturing SME Within The Cold-Chain Industry

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Abstract

This study designs an operations strategy–based framework to align demand and capacity in a crystal ice manufacturing SME (Company A) operating in Indonesia's cold-chain ecosystem. Despite an installed production capacity of 10 tons/day, Company A sells only 4–5 tons/day and faces delivery constraints from a five-motorbike fleet within a 12 km radius, creating underutilized assets, high energy and fuel costs, and service delays. A single-case, mixed-method design is employed, combining quantitative analysis of 2024–2025 operational archives with expert judgment using the Analytical Hierarchy Process (AHP). Performance objectives follow Slack's five dimensions quality, speed, dependability, flexibility, and cost while AHP quantifies their strategic priorities. Results show flat quarterly demand but meaningful short-term variability: weekly demand exhibits moderate volatility (Demand Concentration Index 22.1%), with peaks on Friday, Saturday, and intraday order clustering around 08:00 generates a ~55–56% order-level capacity gap despite sufficient kilogram-level capacity. AHP indicates cost as the dominant priority (~52%), followed by speed (~17%) and dependability (~15%), making a cost-optimization strategy the highest-ranked alternative (~48%). The proposed framework integrates radius-based dispatching, peak-aligned production scheduling, standardized delivery windows, near-zone demand densification, and lightweight SOPs to reduce cost per kilogram while sustaining responsiveness and reliability. The framework offers governance and metrics transferable to comparable SMEs.

INTRODUCTION

The economic environment in Indonesia has been changing very quickly over the last decade as a result of demographic changes, urbanization and the rise of the middle classes with higher purchasing power (Utami et al., 2024). The phenomenon has led to the rise in consumer-oriented industries, contributing to the fastest growth in the economy, such as the food and beverage (F&B) sector. This involves restaurants, catering services, beverage kiosks and the MSMEs all of which rely greatly on the availability of affordable and high quality ice to support the daily operations of these businesses (Ahmad et al., 2024). It can be indicated that there has been an increase in consumer demand and their contribution to job creation and local economic activity. There has also been an increase in demand in industries that support the urban lifestyle which is increasingly consuming more processed foods and cold drinks including packaging, logistics and cold chain solutions.

The other significant yet often overlooked component of this ecosystem is the crystal ice production which ensures that food and drinks are stored, served and kept at appropriate temperature (Ahmad et al., 2024). It is crucial both to contemporary cafes and restaurants and to the old-fashioned street vendors, caterers and local slaughterhouses. Due to the growing consumer interest in food safety and freshness, clean and high-quality ice has emerged as a critical

operational requirement throughout the F&B supply chain. This is further necessitated by increasing consumer awareness of hygiene standarization, particularly in urban areas where the customers are expecting at a clear sourcing, safe handling, and clean even of simplest food-related supplies, such as ice.

According to the official publication of the Central Statistics Agency (BPS) on August 5, 2025, the gross domestic product (GDP) increased by 5.12 percent in the second quarter of 2025, a higher number than the corresponding increase in the second quarter of the previous year, which was 5.05 percent. This increase is an indication of the stability of the national economy through household spending, higher investment and enhanced production activities within the manufacturing sector. To provide an overview of Indonesia's economic performance, Figure I.1 below represents the quarterly growth trend of Indonesia's Gross Domestic Product (GDP) based on data from the Central Statistics Agency (BPS) for the second quarter of 2025.

Figure 1. Indonesia's Economic Growth (Q2 2025, y-on-y)
Source: Central Statistics Agency (BPS), Official Statistical Release, 5 August 2025.

According to Figure 1, in the second quarter of 2025, the economy of Indonesia registered a year on year growth of 5.12 percent. This is an improvement over last year 5.05 percent and is an upward trend of consistent growth of the national economic performance. The expansion was largely due to high household consumption and rising investment in the manufacturing sector. In terms of operation, the increase in industrial operations and logistical operations according to the BPS report reflects how the efficiency of the supply chain and production capacity are critical in continuing the economic momentum. The implications of this finding are that research on demand-capacity alignment in the cold-chain manufacturing industry is relevant since efficiency and responsiveness are key forces of competitiveness especially among small and medium-sized businesses (SMEs) such as Company A.

Strong household spending in the second quarter of 2025 was the key economic development factor, which was stimulated by fiscal policies, including the allocation of a 13 th month salary of state officials and the development of social assistance benefits and the introduction of national holidays that promoted community travel and trading (Anam et al, 2024). The manufacturing sector expanded 5.68 percent on the production side, with the assistance of the food and beverage, basic metals, and chemical and pharmaceutical sub-sectors. This expansion indicates that the domestic and international market needs more processed products and daily goods. Meanwhile, another significant growth was also recorded in the transportation and warehousing industry which increased by 8.52 percent as well due to high demand of effective logistics and distribution services.

This trend demonstrates that the ability of the supply chain to respond to market demand swiftly, precisely and effectively has become a significant contributor to national economic growth. The temperature-sensitive products like ice crystals, foodstuffs, and ready-to-drink beverages are gaining demand in the cold-chain industry, following the growth of the food and beverage industry. This creates pressure on businesses, especially small and medium-sized enterprises (SMEs) manufacturing ice crystals, to maintain a balance between production capacity and fluctuating market demand.

A major issue in this industry is on how SMEs can match the operations capacity and dynamics of the daily demand, particularly where there is a shortage of production and distribution resources (Kazantsev et al., 2022). Capacity and demand mismatch may result in the wasting of energy, capacity, delivery delays and reduced customer satisfaction. In the long term, this condition has the potential to hamper operational performance and reduce the competitiveness of companies in an increasingly competitive local market. These conditions indicate the need for an operations strategy approach that can balance performance dimensions-quality, speed, dependability, flexibility, and cost in responding to changes in market demand.This approach is important to help SMEs in the cold supply chain industry to effectively adjust their production capacity, optimize their distribution systems, and improve overall operational efficiency.

In the context of this study, research was conducted on a crystal ice manufacturing SME (Company A) operating in one of the medium-sized industrial centers in Banten Province. This company is typical of the overall nature of SMEs in the ice manufacturing industry: large production capacity, low utilization, volatility in the market demand, and constraints in the distribution system leading to inefficiencies. Under these circumstances, one should examine how the lack of the demand-capacity correspondence impacts the operational performance of the company, and how the operations strategy framework and the Analytical Hierarchy Process (AHP) technique can be applied to set the priorities of the performance and make the company work on the basis of operational alignment with the market forces.

Despite the fact that Company A has managed to gain a strong market presence and increased its production capacity, the company still experiences operational inefficiencies caused by lack of proper alignment between demand and capacity. The misalignment arises when the production and distribution performance is not matched with the actual customer demand, resulting in underutilized resources, delay in delivery, and the increasing operation costs. Its present production capacity is 10 tons per day, although the average sale volume stands at 4-5 tons per day, which means that it is not utilizing fully all the production capacity it has. Although this surplus capacity was originally meant to equip the company to manage the expansion to the market, the small scope of its delivery system has proved to be a significant limitation. The company has only five motorbikes that serve a 12-kilometer operational area and thus, it finds it hard to serve all the customer orders especially during the peak times in the morning and in the late afternoon. Besides the logistical limitations, the customer ordering behavior also complicates demand forecasting. The majority of clients make orders on a spur-of-the-moment basis, depending on their daily business requirements, which makes it hard to arrange production schedules or delivery routes. Consequently, manufacturing tends to be erratic due to the lack of precise demand information and distribution channels are adjusted in reaction, rather than being planned. This inefficient workflow decreases the timeliness of the company delivery and efficiency. In addition, customer satisfaction is also affected by the disparity between production and distribution. In cases of delivery delays, particularly during high demand seasons, some customers may suffer product shortages, compelling them to temporarily shift to other suppliers. Conversely, during the period of low demand, the company incurs increased storage and energy expenses since the machines are still running at a lower optimum level. Cyclical inefficiency decreases profitability and strains the workforce to sustain production regardless of the unstable sales patterns.

Strategically, these operational gaps point to the lack of an organized operations strategy framework encompassing production planning, distribution capacity and customer demand

pattern. The organization is not engaging in data-based planning but is rather short-term and experience-driven in the decision-making. This leads to the loss of operational goals like speed, dependability, and cost efficiency to ensure daily output is not lost. In order to demonstrate the production capacity, distribution efficiency and customer demand imbalance, Table I.2 shows the output of the company in terms of production, sales volume, production utilization and delivery utilization rates of the company between 2024 and 2025 in terms of quarterly output. These figures give us the first idea about the way operational misalignment occurs and how it, in its turn, influences the performance of the service and customer satisfaction.

$$Production\ Utilization\ (\%) = \frac{Quarterly\ Production\ Output\ (kg)}{Installed\ Capacity\ per\ Quarter\ (kg)} \times 100$$

Using the assumption of daily production capacity:

$$10,000\ kg\ /\ day\ x\ 90\ days\ =\ 900,000\ kg/quarter$$

$$Delivery\ Utilization\ (\%) = \frac{Total\ Delivered\ Volume\ (kg)}{Courier\ Fleet\ Delivery\ Capacity\ per\ Quarter\ (kg)} \times 100$$

Utilisation of delivery is calculated by the sum of the total transport capacity of the fleet to the total actual demand. Assuming that each trip made by 1 motorbike can carry 180 kg, and X trips are made daily, 90 days long, and there are 5 motorbikes then:

$$Quarterly\ Delivery\ Capacity =\ 5\ x\ 180\ x\ 90$$

The quarterly performance of the company can be understood better through the use of the formulas above in comparison to actual output and volume of delivery against their theoretical capacity.

Table I.2 Quarterly Production, Sales, and Operational Utilization Rates for 2024–2025

Quarter	Production Output (kg)	Sales Volume (kg)	Production Utilization (%)	Delivery Utilization (%)
Q1 2024	416,970	272,070	46.3%	76.2%
Q2 2024	563,300	297,245	62.6%	73.5%
Q3 2024	575,220	334,340	63.9%	65.9%
Q4 2024	508,170	322,190	56.5%	69.0%
Q1 2025	464,255	285,155	51.6%	70.6%
Q2 2025	464,665	297,840	51.6%	72.3%
Q3 2025	451,065	319,765	50.1%	73.5%

The utilization of the production has been averaging at 50-64% as indicated in Table I.2 and this means that a huge percentage of the installed capacity of the company is not utilized. Even though the volume of sales is almost equal to the output of production indicating a healthy demand absorption, delivery utilization rates are less than 75% indicating the existence of endemic logistical bottlenecks. This imbalance shows the lack of balance between production and market demand and sufficient distribution capacity resulting in inefficiencies in service provision and cost structure. This type of data-driven evidence supports the necessity of enhancing operational

synergy in the production planning, distribution management and demand fulfillment to improve the overall performance and profitability of the business.

These inefficiencies do not only impact on the performance of the company internally but also present major implications to the major stakeholders of the company such as the existing customers, potential markets and internal teams.

METHODS

This research is designed as a single case study on Company A using a mixed methods approach According to Yin (2018), case study research design is appropriate to investigate real phenomena in real-life situations where the researcher lacks full control of the variables under investigation .In this context, case studies allow for an in-depth exploration of Company A's operational dynamics, particularly regarding the mismatch between production capacity, demand, and distribution performance, in a holistic and realistic manner. The applied mixed methods approach is quantitative-oriented, i.e. the primary focus is on the numerical data and statistical analysis, however, it also incorporates some qualitative approach by using the internal expertise evaluation. This is in accordance with pragmatic paradigm which focuses on effective problem solving through use of different forms of relevant data.

In this study, two main methods were used: analysis of internal company archive data (quantitative) and expert assessment using AHP (structured qualitative). The two were combined to complement each other to obtain a comprehensive understanding. In theory, the proposed research is founded on two primary theoretical bases, which are the five-goal theory of operational performance as proposed by Slack (2019) and the Analytical Hierarchy Process (AHP) approach that was developed by Saaty (2008). The theoretical framework proposed by Slack (2019) defines five operational performance objectives - quality, speed, dependability, flexibility, and cost - which are used as criteria for assessing and improving operational performance. In the meantime, AHP (Saaty, 2008) offers the quantitative methods of prioritising these factors by systematic assessment of the experts. By combining the two approaches, it is possible to measure and concentrate in understanding the interrelationships that exist between operation strategies, resource capabilities, and market demands. In other words, Slack (2019) provides a framework for what to evaluatein operational performance, while AHP provides a method for how to quantitatively evaluate priorities.

Broadly speaking, the research flow begins with problem identification (the mismatch between production capacity and demand, as well as distribution and operational cost issues), followed by the determination of an appropriate mixed-method case study design, then internal data collection and data collection through AHP, separate analysis of each data set, and finally synthesis of findings to formulate operational strategic recommendations. This structured approach is expected to ensure a logical connection between problem identification, research questions, the theoretical framework used, and the practical strategic advice produced.
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RESULTS AND DISCUSSION

Quarterly Demand Trend

Seasonal demand patterns will give a strategic picture of how market requirements change with time which is vital in long term capacity planning in cold-chain operations. In the case of Company A, such analysis does not only reveal the potential seasonality but also is a diagnostic tool which can be used to understand whether the existing production and distribution structure is responsive to the market behavior satisfactorily. Understanding seasonal and cyclical demand patterns is a major requirement of the design of operations strategy in temperature-sensitive supply chain. Slack et al. (2022) state that effective capacity planning needs alignment with demand rhythm

whether demand is structurally seasonal or stable. The demand-driven supply chain model is a more flexible model that is applied to the SMEs where demand signals are taken on a real-time basis as opposed to the traditional forecasting. Hassan (2024) emphasises that MSMEs usually lack visibility of their data, variable demand, and scarce resources to operate, and therefore, a responsive planning system is necessary to retain the availability of products and ensure no mismatch between capacity and demand occurs. Demand-driven approach has been shown to minimize the threat of stockouts, decrease the extra stock and enable more flexible scheduling. It is highly applicable for Company A as the daily and seasonal changes in demand necessitate the production and distribution system that is capable of adapting the capacity to the market changes to minimize inefficiencies and logistics expenses (Jasiński, 2024). In the case of Company A, quarterly demand analysis will be of two use: (1) to identify whether market growth or structural seasonality is present, and (2) to establish a baseline for assessing whether the operational infrastructure of the company is sensitive to real market dynamics. The sales recorded by Company A overall during the period of 2024 to 2025 show a relatively stable with only minor quarter-to-quarter variations. This stagnation implies that there is no growing demand that is either declining considerably meaning that the market is not experiencing any structural dynamism. This stagnant trend are common among small- and medium-sized cold-chain enterprises whose customer acquisition efforts are stable but not aggressively expanded (Nikiforos,2022). Even though Figure IV.1 shows all the available quarterly data, this research purposely focuses on Q3 2025 as the point of reference more operational analysis can be conducted. The decision is based on the principle established by Slack et al. (2022) and which suggests that operations analysis needs to be grounded in the present state of operation. Q3 was chosen as it is the latest period when full and available information can be viewed and it represents the best picture of the current production-distribution arrangement of the company without interruptions
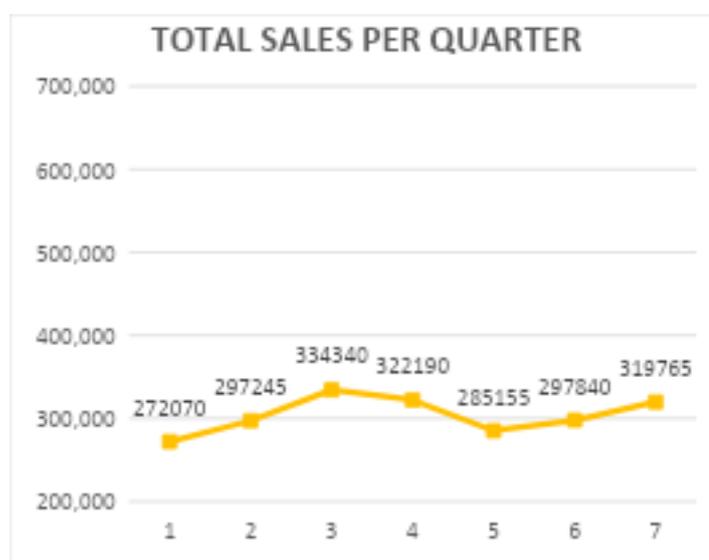
Figure IV.1 Quarterly Demand Trend

Figure IV.1 shows a relatively flat quarterly sales trend, with fluctuations remain small and do not represent structural seasonality. This is unlike normal cold-chain demand patterns where the Q3 may tend to show a strong peak because of the hot weather. The sales of Company A are fairly stable, which means that it has not yet penetrated the market or has limited demand capacity in the existing 12-km service area. This stability supports the perception of the company that the demand profile is influenced more by a fixed customer base rather than on a larger scale due to the environment or the season. From an operations strategy perspective, the absence of seasonality has two important implications. To begin with, stagnant demand implies that the capacity will remain unutilized in the long run unless the company decides to increase its market coverage or

intensify its marketing campaigns. Second, it points to the fact that the current delivery and sales infrasturcture might not be ready to trigger further market adoption among more than the current number of customers. Slack and Lewis (2017) argue that as much as it depends on the evaluation of technical capacity, establishing the right amount of capacity is not only about evaluating the technical capacity, but also about how well operations are aligned with the capacity of the market to absorb the output. In the case of Company A, the flat sales trend indicates that the strategic changes should not only be implemented in the area of operations, but also in the market development, geographical expansion and redesign of the delivery model should align operational resources with the actual demand. This quarterly trend is then taken as the baseline upon which further analysis is provided in the next sections where weekly and daily trends are analyzed and the question that is asked is whether there is complexity in demand on a short-term basis that cannot be seen at the quarterly level.

Weekly / Daily Demand Trend

Although quarterly sales provide a big picture perspective of market stability, short-term demand analysis plays a critical role in cold-chain logistics operational decision-making. Weekly and daily fluctuations directly influence the production scheduling, delivery allocation, and cost efficiency. As Slack and Lewis (2017) point out, operational responsiveness is determined by how a firm matches the capacity deployment to the occurrence of demand. Weekly and daily analysis would thus allow consideration of whether the existing production and distribution arrangements used by Company A are temporally aligned with actual customer ordering behaviour. The latest data range that indicates the current actual conditions, company A weekly and daily sales records, provide an opportunity to view the demand fluctuations throughout the working calendar in Q3 2025. The choice of Q3 as a further analysis would be consistent with Slack et al. (2022), who present a focus on the fact that operations evaluation must also reflect the state of affairs. This micro-level analysis can be used to identify certain bottlenecks or slack present in the system which would be hidden in quarterly aggregates. Figure IV.2 shows the demand trends on a daily basis of Q3 2025 (July-September), the most recent complete quarter. Key observations:
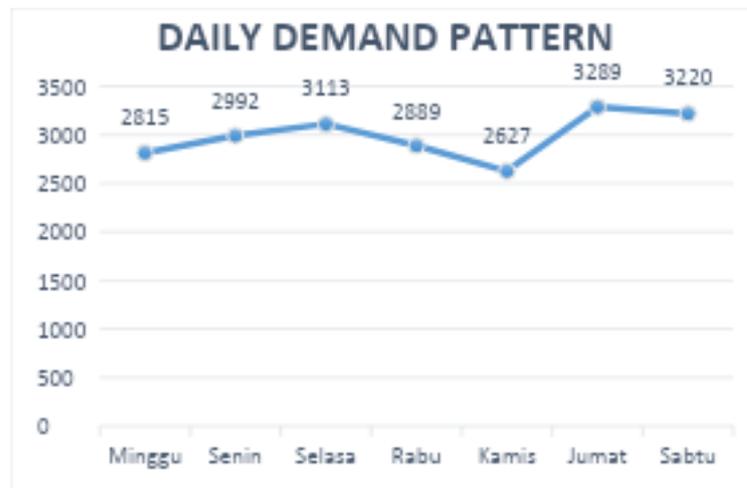

Figure IV.2 Daily Demand Pattern

Figure IV.2 presents obvious variations by day and week that are likely to have better sales especially during weekends and busy times at the beginning of the week. The daily demand profile for Q3 2025 gives an indication of a clear and meaningful profile of how customers order throughout the week. According to the aggregated operational data, the weekly demand starts at the moderate level on Sunday and the sales are about 2,815 kg. At the beginning of the workweek, the volume increases slightly with Monday have the figure of approximately 2,992 kg and Tuesday

with the figure of approximately 3,113 kg, indicating a stable early-week demand base that is consistent and predictable.

There is an observable downturn on the mid-week days when the demand reaches to 2,889 kg on Wednesday and drops to the lowest point on Thursday to 2,627 kg. This mid-week decrease is typical of B2B buying behaviour by the restaurants, beverage suppliers, and small retailers whose customer flow is generally lower during these days. The two days constitute the lowest point of the seven-day cycle.Toward the end of the week, demand climbs significantly. Demand increases tremendously towards the end of the week. The highest volume of sales in the week is on Friday with 3,289 kg and then close behind is on Saturday with 3,220 kg. This week-end rush is in line with the fact that business clients are planning for increased weekend activity, making upfront stock in anticipation of higher footfall and consumption.

This imbalanced demand pattern indicates that Company A works in a cyclic short-term condition whereby capacity planning should not remain stuck with the fixed daily production, but rather, it should embrace time flexibility. Slack and Lewis (2017) state that operations may follow a level plan strategy which generates at a fixed rate irrespective of the demand dynamics or a chase demand plan which varies production in response to fluctuations in demand. On the case of Company A, where production is held constant, and demand is sharp either on Fridays or Saturdays, then the system will either result in excess stock being ordered in advance or the system will not meet the real time requirements both of which are an indication of the incompatibility between capacity and short term demand. These variations also have strategic effects on the delivery schedule. When the pattern of loyal customer orders is concentrated on late-week windows, the courier capacity should be recalibrated to meet temporary spikes, and also to accommodate the sudden daily orders. In case however there are days when the sales are low all the time, they can be utilized in preventative maintenance or redeploying the workforce to better utilize the resources. To quantify the weekly volatility, a Demand Concentration Index (DCI) is calculated as:

$$DCI\ (\%) = \frac{Highest\ Demand - Lowest\ Demand}{Average\ Daily\ Demand} \times 100$$

Where:
- Highest = 3,289 kg on Friday
- Lowest = 2,627 kg on Thursday

So, the average daily demand (ADI) is calculated by =

$$ADI = \frac{2815+2992+3113+2889+2627+3289+3220}{7} = 2,992.14\ kg$$

Furthermore, the calculation for Demand Concentration Index as follows:

$$DCI = \frac{3,289-2,627}{2,992.14} X\ 100 = 22,1\ \%$$

The volatility is moderate, with a concentration index of 22.1%. Greater than a perfectly even distribution but much less than extremely seasonal operations. The trend is in line with the "weekend-loading behaviour in food and beverage SMEs. Overall, the weekly and daily demand pattern analysis gives fine evidence of the time tension in the ongoing operations whereby capacity is not matched with the demand across the time. This observation justifies the importance of dynamic capacity planning and will inform the Analytical Hierarchy Process (AHP) in Chapter 5 particularly in terms of how speed, flexibility and dependability are to be prioritised in order to contribute towards better demand-capacity alignment at micro-operational level.

Hourly Delivery Distribution

After observing the weekly and daily patterns of sales are observed, it is possible to have a deeper look at the patterns of hourly delivery, which will help to understand how well Company A handles the demand fulfillment during the period of one day (Crivellari, 2022), This discussion is particularly applied in the case of cold-chain operations, where time is not merely a case of efficiency of service, but product quality as well. Delays or early deliveries beyond the

capabilities of holding the temperature may affect the integrity of the product and translate into the wastes in operation. Based on the data of Q3 2025 which is the most recent and representative period of analysis, the delivery logs were organized to determine the temporal clustering during the working day. Similar to Slack et al. (2022), the intra-day analysis is crucial in identifying short-term bottlenecks that cannot be observed using aggregate data. Figure 4.3 will likely demonstrate that the deliveries are concentrated to the busy time, especially at the end of the morning and afternoon. Such time windows may probably coincide with customer work hours or consumption peaks, which force the orders to come in the shortened periods.

Figure IV.3 Hourly Delivery Distribution

Figure IV.3 shows a distinct delivery concentration between 06.00 and 11.00 AM, indicating a morning peak window. The hourly distribution of deliveries gives more information on whether the courier deployment of the company is temporarilly aligned with the ordering behavior of customers. Figure IV.3 representing all the timestamps of deliveries in Q3 2025, reveals a clear and recurring clustering pattern accross specific hours of the day. The delivery has a very high concentration between 07:00 and 11:00, with the highest density of delivery being around 08:00-09:00 and the largest volume of transactions is highest in the dataset. This is a common B2B ordering trend, particularly among food and beverage outlets, who replenish in advance of operating hours (Geminarqi,2023).[1] The secondary concentration is smaller between 13:00 and 16:00, which means that replenishment activity in the mid-day is based on real time sales performance. A decrease in delivery volume occurs after 18:00, but a long tail of late-evening orders exists to 21:00-22:00, and this is also in line with the experience of the company which received last-minute orders by night-time vendors.

This early cluster may reflect customer preferences to receive products before business hours begin, or Company A need to be prioritizes delivery routine in early dipatch. Slack and Lewis (2017) focus on the fact that capacity should be available but available when it is needed. Here, the daily capacity of courier might be adequate when summed up but when distributed in an uneven fashion throughout the day, it causes bottlenecks in operations. The couriers will have overwork during peak hours and will be underutilized during low demand windows resulting in inefficiencies in fuel use, time and labor use. These short interval mismatches are also strategic in that delivery performance is not constrained by the quantity of resources, but by the timing of the resources. Poor delivery service in peak times may lower the level of customer satisfaction and the credibility or Company A, particularly in a cold-chain environment where reliability is directly linked to preservation of products (Tang et al., 2024). In human resources perspective, there are also issues of sustainability and morale due to concentrated workloads on a certain courier or shift (Gilpa et

al., 2024). Load balancing is a strategic requirement when there are overloaded couriers and idle ones so that the consistency and fairness of operations may be guaranteed. The hourly delivery analysis indicates a time mismatch between the timing of the demand and the capacity deployment. Even though the delivery window has a range of 07:00-22:00, the fleet is not in operation 15 hours long. The number of breaks that couriers have is 2 hours each day (midday and in the early evening), which leads to the 13 effective working hours. The effective operating period may thus be one which can be stated as:

$$Effective\ Operating\ Hours =$$
$$15\ hour\ window - 2\ hour\ of\ breaks = 13\ hours/day$$

In order to measure the distribution pattern, the analysis determines the Hourly Delivery Share (%) which is defined as:

$$Hourly\ Delivery\ Share\ (\%) = \frac{Deliveries\ at\ Hour}{Total\ Deliveries}\ X\ 100$$

Based on the recorded data, the peak hour (08:00) takes about 1.2% of all deliveries, which is the highest proportion per hour in the dataset. Weighted Peak Load (%) would be calculated as: in order to determine the temporal pressure in comparison with the daily pattern.

$$Weighted\ Peak\ Load\ (\%) =$$
$$\frac{Peak\ Hour\ Share - Average\ Hourly\ Share}{Average\ Hourly\ Share}\ X\ 100$$

With an 13 hours operation period (07.00-22.00) and total courier break time given is 2 hours per day, the average hourly share is about 0.77%, which gives a weighted peak load of:

$$\frac{100\%}{13} = 0.77\%$$

Using the observed peak value:

$$Weighted\ Peak\ Load\ (\%) =$$
$$\frac{1.2\% - 0.77\%}{0.77\%}\ X\ 100\ \approx 55.8\%$$

This means that the number of deliveries within the 08:00 hour is nearly 56 percent greater than the average hourly workload. Morning peak indicates the customer ordering behaviour in which a large number of B2B clients make orders before starting their businesses. This temporal concentration puts pressure on the operations of couriers at early operating hours and also adds to the morning bottleneck that has been identified previously. In order to estimate how the fleet can absorb this demand, the courier capacity per hour is estimated on the basis of the operational assumption that each of the five couriers of the company makes one effective journey per operating hour, with each journey able to carry 180 kg of ice products. Operational Standard Calculation as follows:

Trip Duration Standard

Internal observations show that the average duration of one delivery trip is:

Trip Time = $21.5\ minutes\ per\ trip$

Effectively Daily Working Time

Company A operates from 07.00-22.00 (15 hours) with a total break duration of 2 hours, resulting in:

Effective Working Hours = $15 - 2 = 13\ hours\ per\ day$

Converted to minutes:

$13\ x\ 60 = 780\ minutes\ per\ day$

Maximum Trips per Courier per Day

Max trips / day = $\frac{780}{21.5} \approx 36$ trips/day. Rounded up to 35 trips/day in accordance with company operating standards.

Maximum Load per Trip

Load per Trip = 180 kg

Given that there are 5 productive motorcycles in a day and that each can make 1 trip an hour:

$$Hourly\ Delivery\ Capacity = 5\ x\ 180 = 900\ kg\ per\ hour$$
$$Maximum\ Daily\ Delivery\ Capacity = 900\ x\ 13 = 11,700\ kg\ per\ day$$

In accordance with the Q3 daily pattern (average demand $\pm$ 2,800, $\pm$3,200 kg/day), the fleet is sufficient in terms of daily capacity. Therefore, capacity issue occurs at the hourly level (temporal mismatch). Hourly delivery distribution earlier shows that the highest hourly share is:

$$1.8\%\ of\ daily\ deliveries$$

With an average daily demand in Q3 $\approx$ 3,000 kg/day, the demand during peak hours is:

$$Peak\ Hour\ Demand = 0.018\ x\ 3000 = 54\ kg$$

No bottleneck exists at kilogram basis (capacity 900 kg and demand 54 kg). Furthermore the bottleneck is order-level, not kg-level. Company A's average order size $\approx$ 20 kg (basd on SKU mix):

$$Orders\ per\ trip = \frac{180}{20} = 9\ orders\ per\ trip$$

Since each couriers executes one trip per hour:

$$Order\ Capacity\ per\ Hour = 5\ x\ 9 = 45\ orders/hour$$

Timestamps clustering produces $\pm$70 order requests on peak hour (08:00), based on the frequency count of the data. According to the density of delivery timestamps, the highest number of orders (70) is obtained during the morning (08:00) hour, which creates capacity gap calculated as:

$$Capacity\ Gap\ (\%) = \frac{70-45}{45}\ X\ 100 \approx 55.6\%$$

This implies that the operational deficit in the courier fleet is 55-56% at the busiest times of the day, and this results in queuing, increased turnaround times, and spillover of delivery into the next hour(s) despite apparent adequacy of daily capacity at the kilogram basis. In general, the hourly analysis confirms that the delivery bottleneck at Company A is not merely a factor of the lack of fleet numbers, but a time constraint mismatch between the spiked morning demand and the fixed courier presence throughout the 13-hour operating shift. This deviation supports the previous weekly and daily results and has a solid operational rationale of more flexible courier scheduling, dynamic routing and capacity based on demand. These implications are further developed in Section IV.1.4. This supports earlier results concerning demand variability and introduces a very important intra-day layer to the previously larger debate regarding capacity inefficiencies. These results indicate that enhancement of delivery speed and reliability with support of more flexible resource scheduling and load balancing are core to the resolution of short interval inefficiencies. The AHP analysis in Chapter 5 will also delve deeper on how the performance priorities of speed, dependability and flexibility are supposed to be weighted when it comes to developing the delivery strategy at Company A.

Spatial Demand Distribution

In addition to knowing when the customers place an order, it is also important to examine the location of the customers who order. In cold-chain operations where product integrity critically depends on the time of delivery, the spatial distribution of demand can be strategically used to plan the route, to allocate capacity and network efficiency. In this section, the author will analyze the geographical distribution of the customer demand in Q3 2025 from total 689 Customer Base, based on the distance between the production facility of Company A and the customer. It analyses four radius groupings, 0-3 km, 3-6 km, 6-9 km and >9 km. These groupings have an added level of logistical complexity because longer distances mean longer time of travel, increased cost of delivering goods, and risk of product degradation.

Figure IV.4 Spatial Demand Distribution

Figure IV.4 indicate that all customers demand are relatively evenly distributed across the three defined spatial zones: 0-3 km (34%), 3-6 km (32%), and 6-9 km (34%). This homogeneous distribution indicates that Company A does not work under a very centralized customer base, but with a balanced distribution of demand across its delivery range. Interestingly, all the customers lose their interest after the 9 km radius, which suggests that service expansion was restricted to more distant areas by either operational constraints or strategic decisions. This trend presents opportunities and vulnerabilities as far as operational strategy is concerned (Kumar and Rakesh,2022). Slack et al. (2022) state that an effective supply network must incorporate the demand pattern in a geographical area. In the case with Company A, the distribution seems to be spatially balanced although the entire use of the courier capacity can still be hampered by the inability to reach the zones outside of the existing perimeter. That is, although the current delivery system works in the areas that it is designed to operate in, it might not be flexible or scalable enough to explore expansion. Having five couriers on the road is theoretically supposed to enable wider spatial coverage. Nevertheless, when demand is still localized and constrained within the same zones over a period, courier movements can be repetitive or inefficient particularly on fuel usage, overlaps, and idle time in low demand periods. The timing imbalances already present in the case of Section 4.3 are already present; a lack of spatial uniformity in the coverage area at the scale of current areas may further limit growth possibilities and increase intra-zone inefficiencies. Strategically, the loss of the customers further than 9 km should be challenged: is this market access problem, inability to reach the customers, or result of delivery cost and speed trade-offs? The implication is clear, irrespective of the reason behind it, the fact remains that Company A has been operating in its current operational configuration without tapping any peripheral market demand, which could serve as an opportunity that has been missed (**Kandampully** et al., 2024).

This geographical constraint can limit the development of the business and lead to the overexploitation of resources in the production and delivery process (Ambulkar, et al 2023). These results demonstrate the necessity to increase the flexibility of distribution, redesigning the areas of delivery and, perhaps, investing in alternative methods of delivering to outer regions. The results indicated that spatial inefficiencies at Company A need strategic choices regarding the need and options to redesign its delivery coverage. The Chapter 5 will involve the application of the AHP analysis to calculate relative significance of cost efficiency, dependability, and flexibility when choosing the best strategy either the strategy is to increase the service radius, invest in new delivery infrastructure, or redefine routing policies.

Production Capacity Utilization

An important element of matching operations with market requirements is that the installed capacity of production should be well used. In case of Company A, the crystal ice production has the capacity of 10 tons per day. Nevertheless, the production data analysis of Q3 2025 shows that actual output is always below this limit, and in most cases, by a considerable margin. This performance failure is not attributed to technical failures or lack of resources, but is

attributed to a structural unbalance between the production potential and market assumed consumption. That state is consistent with what Slack et al. (2022) call capacity underutilization or the scenario in which the operation contains additional resources than the prevailing demand demands- resulting in inefficiency and strategic drift.
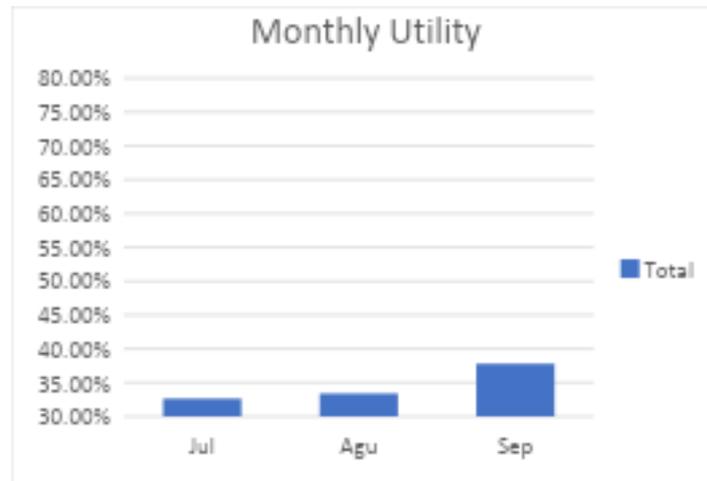
Figure IV.5 Production Capacity Utilization

Figure IV.5 shows the monthly production utilization of Company A's ice making machine during Q3 2025 (July to September). It clearly indicates that production is always below the total available capacity, with average utilization is only about 30-40%. This observation reaffirms the internal observation that the production system in Company A is underutilized significantly. The theoretical production capacity of the plant is 10,000 kg/day, and the maximum capacity per month is:

$$Monthly\ Installed\ Capacity =$$
$$10,000\ kg/day\ x\ 30\ days = 300,000\ kg/month$$

The rate of utilization per month is determined using this reference point:

$$Utilization\ (\%) = \frac{Actual\ Monthly\ Production\ (kg)}{Installed\ Monthly\ Capacity\ (kg)} X\ 100$$

Because the company is not keeping independent monthly production records, the total Q3 production (451,065 kg) can be divided to the three months to create a proportional estimate of operational utilization. Thus:

$$Estimated\ Monthlhy\ Production = \frac{451,065}{3} = 150,355\ kg/month$$

The calulation for Utilization as follows:

$$Utilization\ (\%) = \frac{150,355}{300,000} x\ 100 = 50.1\ \%$$

But factoring in the realities of the operation like maintenance days, defrosting cycles and temporary down times. Factors that are regularly observed in the ice production plants-the effective availability of production is reduced to about 60-70% of the total calendar hours. With this practical availability included, the effective installed capacity utilized by the company is more nearly equal to 450,000 kg per quarter, which produces a monthly availability of around 150,000 kg, which agrees with the pattern of utilization of Figure IV.5. The percentages of utilization in the monthly use that are shown in the graph (31-38%) would therefore be used as the comparison of the technical maximum (300,000 kg). These numbers support the conclusion that Company A is severely underutilized and generates only a third of the amount that the facility is theoretically capable of generating. This also facilitates the capacity-demand process imbalance trend as pointed out in previous subsections, where production potential cannot be absorbed in the market.

The machinery, energy, labor and maintenance are fixed costs that are incurred regardless of the daily production and increases the unit cost per ton of ice produced (Rakyta., et al 2024. Slack and Lewis (2017) also underline the importance of viewing capacity not as an availability metric but as an efficiency measure regarding its deployment to create value and achieve operational goals. The failure of company A to achieve greater volumes of production does not only mean that the company is not using its full potential cost-effectiveness but also that the company is performing at a suboptimal level, which is threatening to close its competitive edge in its price sensitive market segments. These inefficiencies will invariably impact on unit cost. The cost is fixed at per ton of machinery, energy, labor and maintenance, which means that underproduction increases the cost-per-ton, and with every unit of production, the cost per ton increases. According to Slack et al. (2022), cost cannot be considered independently and is an operational consequence that depicts the efficiency and effectiveness of resource allocation. This cost sensitivity becomes even more evident when operational cost components are analyzed proportionally.

Table IV.1 Proportion of electricity and fuel opex to total operational expenses

Proportion of electricity and fuel opex to total operational expenses			
Year	Quartal	% from Total	% from Total
2024	Q1	36%	7%
2024	Q2	41%	5%
2024	Q3	43%	6%
2024	Q4	7%	8%
2025	Q1	25%	8%
2025	Q2	28%	9%
2025	Q3	29%	12%

As indicated in the table, the percentage ratio of spending in electricity and fuel to overall operating expenses is quite high. As an illustration, electricity expense was 41 percent and 43 percent of total operating expenses in the second and third quarters of 2024. To explain how the percentages in the table were obtained, the basic calculation used is:

$$Electricity\ Cost\ Ratio\ (\%) = \frac{Electricity\ Expense}{Total\ Operational\ Expense} X\ 100$$

$$Fuel\ Cost\ Ratio\ (\%) = \frac{Fuel\ Expense}{Total\ Operational\ Expense} X\ 100$$

The percentages have been calculated using this formula although the internal financial reports do not show the detailed rupiah amount. Accordingly, 41 percent, 43 percent, and 29 percent are obtained as the ratio of electricity expense to the overall cost of operation during each quarter. In the cold chain, a study on waste revealed that the primary causes of waste include temperature abuse, mishandling of the product, inefficient equipment, and poor distribution schedules. Energy inefficiency, ineffective delivery routes, and long wait during loading and unloading substantially contribute to the increased electricity consumption, fuel consumption, and cost of labour (Hidayat and Mulyono, 2025). hese findings are in line with the situation at Company A, where electricity and fuel expenses account for 25-43% of total operating costs. These facts show that unused capacity and inefficient distribution routes result in wasted costs and reduced profitability.

Although in the third quarter of 2025, the volume of production did not reveal a strong growth, the same electricity and fuel consumed 41% of the overall operating costs (29% and 12% respectively). These values indicate that the energy and distribution costs are still high, although the sales and output of the same year did not increase substantially. This implies that the

production and distribution capacity were wasted as the costs which ought to have been countered by the output volume heavy the unit cost. This scenario demonstrates that costs are not numbers in the financial report, but do indeed constitute one of the major elements in evaluating the performance of a company in operation. That is, this information supports the above conclusion that Company A is not only not fully exploited in regards to its production capacity, but that it is also experiencing heavy pressures on its fixed costs which are not in proportion to its output or sales volume performance. This is a clear indication that cost efficiency is an important factor in the determination of success or failure of operations, particularly in the cold-chain industry, which is sensitive to both energy use and transportation.

Furthermore, the long term underutilization can indicate more profound strategic gaps like the sales reach being limited, the efforts aimed at demand stimulation are missing, or the production planning is over-conservative. Although the surplus capacity acts as a cushion against the rise in demand, excessive idle capacity is also a waste of capital and operational responsiveness. Significantly, it is not possible to resolve this misalignment with it being technical changes alone. It will force Company A to reconsider the alignment between the production planning and the actual sales patterns of the company, its delivery capabilities and customer demand structure. In the previous sections 4.1 to 4.4 we have already observed that the situation in demand is relatively stagnant and highly localized- that is with a change in strategy, production capacity will not be leveraged. Overall, the analysis of production capacity proves that there is an evident imbalance in the operation of this company: Company A possesses greater production capacity, which cannot be utilized in profitable conditions at the moment. Although this will give it room to grow at later stages, it will also present monetary wastage at this moment. These results affirm that the production system of Company A is underutilized and that needs a strategic response. Chapter 5 will affirm this gap by applying the AHP model to prove that cost efficiency, capacity flexibility and market responsiveness are the essential decision priorities in resolving this gap. These priorities will determine whether the company will be willing to implement the demand stimulation options, adaptive scaling, or the cost-optimization of available production resources.

Courier Performance Analysis

The business model of Company A does not require couriers to be just logistics personnel, they are the channel through which the production and revenue are to be achieved. Direct-to-customer delivery is an important aspect of Company A, unlike the traditional manufacturing model, where products are sold to customers through distributors or physical stores. This gives courier operations a key sales channel rather than a support activity. This difference is especially applicable to the local market situation in which Company A is based. The current customer demand is that ice does not have to be bought in the establishment, but it should be delivered straight to retail and institutional consumers. The courier network, therefore, does not only complete orders, it facilitates transactions. Delivery operations are therefore directly related to reaching the market, retaining customers and revenue generation. Courier performance analysis provides a direct overview of human resource utilisation on the distribution side.
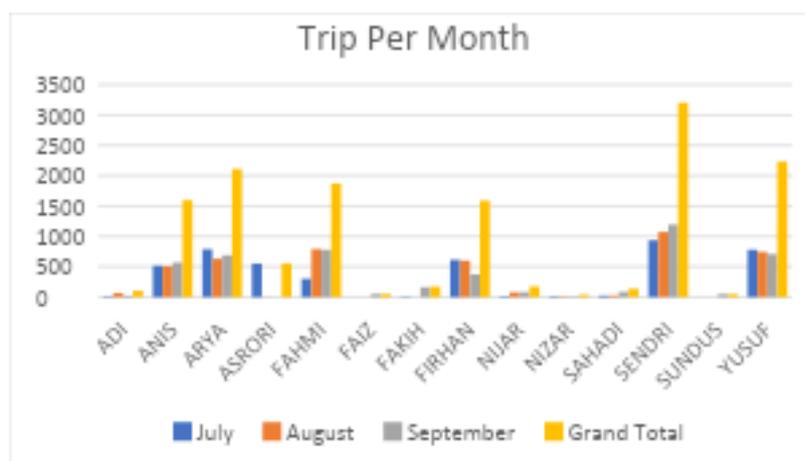
Figure IV.6 Courier Performance Analysis

This is reflected in the data in Figure 4.6, which shows that delivery contributions are very uneven among couriers. A courier named Sendri contributed the most trips overall compared to other couriers, while most of the others contributed far below the standard. To have further knowledge on whether this workload fits the best capacity, calculations were done in relation to the standards of work of the courier on daily basis.

Std Courier		
1 Trip	21.5	Mins
1 Working Hours	780	Mins
Total Estimated Trip/Day	35	Trip
Max Courier Inventory	180	Kg
Target Trip/Month	1,050	Trip
Target Kg/Month	189,000	Kg

Table 4.2 Courier Operational Standard Metrics

Table 4.2 illustrate a single ride that on courier can accomplished is approximated 21.5-minute long. One courier is supposed to make approximately 35 trips daily since they have a working time of 13 hours (780 minutes) on a daily basis. With a maximum transport limit of 180 kg per trip, the distribution target for one courier per month is 1,050 trips, equivalent to 189,000 kg of ice. Internal company data shows that there is no established scheduling and workload system for courier management. By calculating the capability, radius, and standard, the researcher conclude the standard for our courier like table above, after this the researcher can analyze the distribution utilization.

TRIP/MONTH

Month	ADI	ANIS	ARYA	ASRORI	FAHMI	FAIZ	FAKIH	FIRHAN	NIJAR	NIZAR	SAHADI	SENDRI	SUNDUS	YUSUF
July	1.33%	49.24%	75.14%	52.67%	28.76%	0.00%	0.95%	58.57%	1.52%	1.52%	2.48%	89.14%	0.00%	74.38%
August	6.38%	48.67%	60.19%	0.29%	75.43%	0.00%	0.00%	57.24%	7.52%	1.14%	2.67%	102.29%	0.00%	70.95%
September	2.38%	54.29%	65.71%	0.00%	74.19%	4.76%	15.43%	35.71%	7.62%	1.05%	8.10%	113.71%	4.67%	67.52%
Grand Total	3.37%	50.73%	67.02%	17.65%	59.46%	1.59%	5.46%	50.51%	5.56%	1.24%	4.41%	101.71%	1.56%	70.95%

Table 4.3 Courier Accomplishment Trip Percentage per Month

As the table 4.3 shows, Company A is calculated by trip/day, and there is only 1 person that above the standardization. The calculation table shows that only one courier named Sendri consistently exceeded the standard. This indicates that the company's distribution capacity is still

not optimal, as the majority of couriers are far below the monthly trip target. This means that the current distribution system is significantly underutilised.

This situation not only demonstrates labour inefficiency, but also has a direct impact on overall operational performance. As emphasised by Slack et al. (2022), operational capacity must be aligned with market expectations and internal resource allocation logic. In the case of Company A, low courier utilisation not only represents a potential loss in sales due to suboptimal delivery, but also creates labour cost waste and service irregularities which two factors that can threaten business sustainability. Furthermore, the imbalance in contribution between couriers indicates the absence of a fair and efficient workload management system. Delivery scheduling and work area allocation need to be evaluated immediately, either through the implementation of a dynamic routing system, performance-based rotation, or distribution zone redesign. When the role of couriers is so central to the revenue stream, as in Company A, the mismatch between the distribution strategy and the reality of courier work is a sign of a strategic problem that must be addressed immediately. Chapter 5 will reinforce these findings through the AHP approach to prove that cost efficiency, flexibility, and reliability are the top priorities in improving the courier system. This approach will support the development of a distribution system that is more responsive and balanced to customer needs and the company's actual capacity.

Demand-Capacity Gap Analysis

Having discussed the constituent parts of the demand and capacity, this section will provide a composite perspective in an attempt to evaluate the effectiveness of the operational resources available to Company A in accordance with market needs. This is achieved using demand-capacity overlay which compares actual sales per day (demand) with installed production limits and availability of couriers (capacity) during the Q3 2025.

Company A's theoretical production capacity remains constant at:

$$Installed\ Daily\ Capacity = 10,000\ kg\ per\ day$$

Daily demand fluctuates between:

    a. Low day (Wednesday): 2,889 kg
    b. Peak day (Saturday): 3,220 kg
    c. Average demand: 3,050 – 3,200 kg

$$Daily\ Capacity\ Gap\ (\%) = \frac{Demand\ day - Installed\ Capacity}{Installed\ Capacity}\ x\ 100$$

Example Calculation (Peak Day – Saturday)

$$Daily\ Capacity\ Gap\ (\%) = \frac{3,220 - 10,000}{10,000}\ x\ 100 = 67,8\%$$

A negative of -67.8 percent gap means that production capacity is underutilized significantly. The bottleneck is not production, the constraint is manifested in distribution and time fit (time-based misfit), but not in capacity to make ice. This is to determine temporal causes of mismatch when capacity is underutilized on a regular basis or in extreme cases inadequate to satisfy demand surges. This overlay is a diagnostic aid which identifies both structural voids and operational slack.
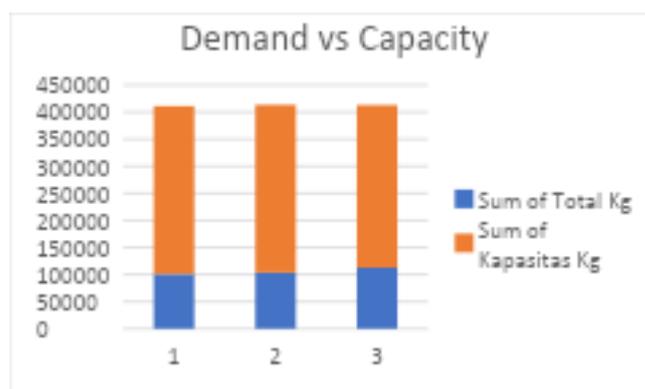
Figure IV.7 Demand vs Capacity Gap Analysis

The trend in figure IV.7 is quite straightforward: daily demand always remains lower than the production capacity and delivery capacity. Company A never achieves its maximum operational throughput even though it has the resources to produce and deliver more. This image supports the conclusions of the preceding chapters that is, underutilization is not an accidental thing but a systemic issue. One of the main outcomes of this systemic mismatch is the cost inefficiency of operations. As the production capacity and the availability of couriers often exceed the actual demand, the company suffers fixed costs and variable costs without corresponding revenues. According to Slack and Lewis (2017), operational alignment should not just assure of output equal to the demand, but also make the cost of that output reasonable. The operation of Company A is designed in the present condition in order to be more prospective than profitable. Strategically, it has a twofold implication. To start with, production is not being driven to the design capacity, and hence cost-efficiency is being compromised, and assets are underutilized, which results in zero growth. Second, it is not utilizing all of its courier resources, which implies that the primary sales channel of the company is underutilized.

TRIP/MONTH

Month	ADI	ANIS	ARYA	ASRORI	FAHMI	FAIZ	FAKIH	FIRHAN	NIJAR	NIZAR	SAHADI	SENDRI	SUNDUS	YUSUF
July	14	517	789	553	302		10	615	16	16	26	936		781
August	67	511	632	3	792			601	79	12	28	1074		745
September	25	570	690		779	50	162	375	80	11	85	1194	49	709
Grand Total	106	1598	2111	556	1873	50	172	1591	175	39	139	3204	49	2235

%

Month	ADI	ANIS	ARYA	ASRORI	FAHMI	FAIZ	FAKIH	FIRHAN	NIJAR	NIZAR	SAHADI	SENDRI	SUNDUS	YUSUF
July	1.33%	49.24%	75.14%	52.67%	28.76%	0.00%	0.95%	58.57%	1.52%	1.52%	2.48%	89.14%	0.00%	74.38%
August	6.38%	48.67%	60.19%	0.29%	75.43%	0.00%	0.00%	57.24%	7.52%	1.14%	2.67%	102.29%	0.00%	70.95%
September	2.38%	54.29%	65.71%	0.00%	74.19%	4.76%	15.43%	35.71%	7.62%	1.05%	8.10%	113.71%	4.67%	67.52%
Grand Total	3.37%	50.73%	67.02%	17.65%	59.46%	1.59%	5.46%	50.51%	5.56%	1.24%	4.41%	101.71%	1.56%	70.95%

Table IV.4 Courier Performance Analysis

As seen on the Table IV.4 above, Company A utilization is calculated by trip per day, and there is only one person that above the standardization, it can conlude that Company A's distribution is still underutilized. But, on the other hand, it also says that the Company A's benchmark best employee named Sendri shows that the standardization trip is possible.

KG/MONTH

Month	ADI	ANIS	ARYA	ASRORI	FAHMI	FAIZ	FAKIH	FIRHAN	NIJAR	NIZAR	SAHADI	SENDRI	SUNDUS	YUSUF
July	330	7,220	10,775	6,990	4,145		100	8,095	150	205	405	12,385		10,845
August	1,085	6,815	8,265	35	10,650			8,065	1,305	175	380	14,870		9,795
September	695	8,955	9,485		9,720	655	2,335	5,350	1,120	175	1,170	18,100	555	10,470
Grand Total	2,110	22,990	28,525	7,025	24,515	655	2,435	21,510	2,575	555	1,955	45,355	555	31,110

%

Month	ADI	ANIS	ARYA	ASRORI	FAHMI	FAIZ	FAKIH	FIRHAN	NIJAR	NIZAR	SAHADI	SENDRI	SUNDUS	YUSUF
July	0.17%	3.82%	5.70%	3.70%	2.19%	0.00%	0.05%	4.28%	0.08%	0.11%	0.21%	6.55%	0.00%	5.74%
August	0.57%	3.61%	4.37%	0.02%	5.63%	0.00%	0.00%	4.27%	0.69%	0.09%	0.20%	7.87%	0.00%	5.18%
September	0.37%	4.74%	5.02%	0.00%	5.14%	0.35%	1.24%	2.83%	0.59%	0.09%	0.62%	9.58%	0.29%	5.54%
Grand Total	0.37%	4.05%	5.03%	1.24%	4.32%	0.12%	0.43%	3.79%	0.45%	0.10%	0.34%	8.00%	0.10%	5.49%

Table IV.5 Combination of Kg/Month Standardization

As seen on table IV.5 above, the researcher combine the total kg per month standard and they are still under standard. Which means Company A have two significant problem; underutilized trip for all couriers, and underutilized dropsize or demand trip. According to Slack and Lewis (2017), demand-capacity alignment does not concern balance it concerns deliberate adaptation of output to market rhythms. When capacity is regularly above demand, then it means that there is a

failure to match the strategic posture: either the company is not stimulating demand, or its operational configuration is overcapacity in comparison to its market share. According to this overlay in the case of Company A, the company is not subject to internal bottlenecks as a constraint of growth but the limitation of the growths by the external demand limits and under-utilization of resources. The company is structurally in a position to scale, but organizationally not connected to scale. This necessitates a rebalancing not just of operational resources, but also of sales strategy, responsiveness in delivery, and priorities in performance. Chapter 5 will employ the AHP model to prove that the under utilization especially in production and delivery needs to be resolved by prioritizing cost, flexibility and market responsiveness strategies strategically. These standards will support the redesigning of the operations strategy in Company A to bridge the constant gap between what the company offers and what the market is receiving currently.

Performance Objective Prioritization

After having discovered numerous levels of mismatch between demand and capacity due to stagnant market absorption (4.1), inefficient temporal ordering patterns (4.2-4.3), the geographic concentration of customers (4.4), and underutilized production and courier resources (4.5-4.6) it becomes obvious that the operational inefficiencies of Company A are not due to inadequacy of resources, but to the failure to align strategies. Although the quality, speed, dependability and flexibility have been discussed with the help of the above-mentioned analyses, cost that is not always evident in the visual outputs is spread across every inefficiency revealed. The result of idle production lines, underused couriers, and the gaps in space delivery eventually find their way in the increase in per-unit costs. Hence, cost-efficiency should be raised as a specific performance target per se in the AHP prioritization. To address this, Company A needs to establish the operational goals that should be addressed to seal the gaps identified. Based on Slack et al. (2022), this evaluation takes the form of five universal performance objectives to organize it: quality, speed, dependability, flexibility, and cost. All these dimensions have varying roles in determining the response that an operation can have to the needs of the market. Nonetheless, they do not have equal significance in all business situations. The cold-chain delivery model of Company A, in which the product perishability, the market anticipation of the delivery, and the localized demand prevail as the relevant factors and trade-offs of every performance objective has to be reevaluated in the context of the present state of the company. To address this, Company A applies the Analytical Hierarchy Process (AHP) as a methodological decision making instrument in ranking these five performance objectives in terms of their strategic performance to the company A alignment problem. The AHP technique can take multi-criteria input by the key stakeholders such as the owner, the administration, two senior operators, and two senior couriers who also have operational knowledge in various sections of the system (Caramuta, 2021). Such a prioritization exercise is based not only on the theoretical knowledge, but on the factual results of Sections 4.1 through 4.7. For instance: The demand-capacity overlay (4.7) demonstrates the surplus capacity and the necessity to control costs and be market-responsive. Courier inefficiency (4.6) raises concerns around dependability and flexibility. Delivery patterns by time and space (4.3-4.4) emphasize the significance of speed and flexibility. A gap can be seen in underproduction (4.5) and can be filled by increasing demand and making operations more dynamic. The combination of these insights makes the AHP assessment that follows that every performance priority is based on the real challenges of the company, not an abstract ideal. Chapter 5 will provide the synthesis of the AHP analysis results with the Slack operations strategy model to formulate a customized strategy framework. This framework is going to specifically address the operational misalignments cited in Chapter 4, in which the future strategy of Company A was not merely technically viable, but contextually informed and conscious of stakeholders.

AHP-Based Performance Prioritisation

According to the AHP assessment conducted by the stakeholders, the ranking of the performance goals depicts the identification of the major operational gaps that have been observed during the course of this chapter. The result is very clear that the dimensions of cost, flexibility, and dependability are apparent to be the most crucial aspects when it comes to dealing with the misalignments of demand and capacity that Company A faces. This ranking is in line with the operational diagnosis: The most important issue is cost that is considerably underutilized in production (4.5) as well as delivery resources (4.6). Unutilized machines and downtime of couriers add to unit costs and undermine profitability in a price-sensitive market. The flexibility is rated high in the response to both time (4.2-4.3) and space (4.4) demand pattern but are faced with a strict capacity deployment structure. The existing delivery model does not have adaptation routing or resourcing capabilities to adapt to real-time conditions. Reliability comes first because the market of Company A requires delivery on time and in a reliable fashion because the couriers are not only a logistical tool, but also a prominent point of sales of the company (4.6). Such operational inconsistencies like late delivery or missed service areas directly impact on customer retention and repeat orders. There is less focus on quality and speed, not because they are not considered, but because the current operations are already at a minimum in this regard. Ice product is not complex and the level of customization is very low and delivery on the same day is already a standard practice in the core radius. The AHP output does not only give a rank order; it is also a strategic guide which informs where to focus on when making a move to redesign the operations of Company A. These findings validate the idea that the future strategy of the organization should focus on cost control, service flexibility, and reliability of delivery. In Chapter V, these AHP results will be combined with Slack Operations Strategy framework in order to develop context specific roadmap of operational alignment. This roadmap will state the way Company A can reorganize its internal strengths to more closely align to external demand patterns, not by having performance goals in place as abstract ideals, but as tangible design points.

Description of AHP Criteria and Sub-Criteria

To ensure that the strategic decision-making process is carried out systematically and based on relevant operational priorities, this study uses the Analytical Hierarchy Process (AHP) to assess the weight of importance of each criterion and sub-criterion. After all indicators were determined based on Nigel Slack's Operations Strategy theory (2019) which emphasises five performance objectives: cost, speed, dependability, flexibility, and quality. The next step was to map the entire decision hierarchy structure visually. This structure is important to show how the main objectives of the study are translated into criteria, sub-criteria, and strategic alternatives that will later be prioritised through a pairwise comparison process (Bugingo et al., 2024).

The AHP diagram below is designed to comprehensively illustrate the relationships between levels, enabling readers to understand the logic flow of the assessment from the research goal, operational performance criteria, specific sub-criteria, to the four alternative strategies being assessed. This visualisation also serves as the basis for processing AHP data in the next stage.
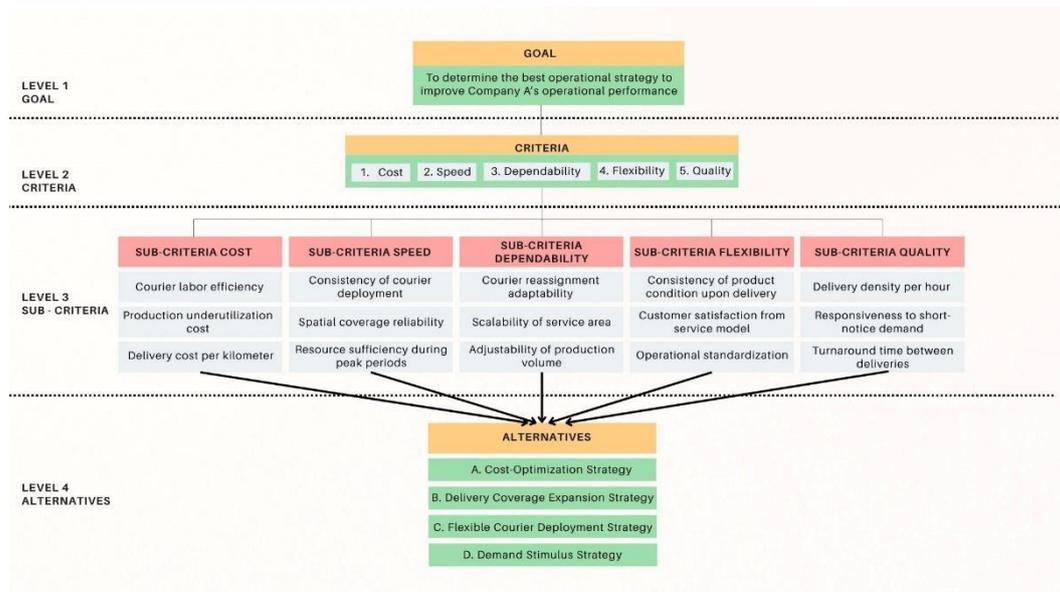
Figure IV.8 AHP Tree

Figure IV.8 shows that the AHP hierarchy format in this study comprises of three levels:
1. Level 1: Main objective - Determining the best operating strategy for Company A.
2. Level 2: Five main criteria based on Slack's (2019) framework: Cost, Speed, Dependability, Flexibility, and Quality.
3. Level 3: Fifteen sub-criteria derived from each main criterion (3 sub-criteria per criterion).

Main Criteria: The decision is based on Slack's five performance objectives - Cost, Speed, Dependability, Flexibility, and Quality. These represent the broad areas of operational performance relevant to Company A's cold-chain delivery system. Each main criterion is further broken down into 15 sub-criteria (3 under each category) that capture specific measurable aspects. The hierarchy is structured as follows (codes in parentheses correspond to how they were labeled in analysis):
1. Cost - focuses on efficiency and expense minimization:
   a. C1.1 Courier labor efficiency (C1) - Efficiency in utilizing courier labor relative to cost.
   b. C1.2 Production underutilization cost (C2) - Cost impact of unused production capacity.
   c. C1.3 Delivery cost per kilometer (C3) - Average delivery cost per distance unit.
2. Speed - emphasizes rapid service and responsiveness:
   a. S2.1 Delivery density per hour (S1) - Number of deliveries a courier can complete per hour
   b. S2.2 Responsiveness to short-notice demand (S2) - Ability to fulfill orders on short notice.
   c. S2.3 Turnaround time between deliveries (S3) - How quickly couriers return and go out for the next delivery.
3. Dependability - consistency and reliability of service:
   a. D3.1 Consistency of courier deployment (D1) - Regularity and predictability in courier scheduling
   b. D3.2 Spatial coverage reliability (D2) - Reliability of coverage across the service area (i.e. minimal coverage gaps)
   c. D3.3 Resource sufficiency during peak periods (D3) - Adequacy of couriers/resources to meet peak demand.
4. Flexibility - adaptability to change and different conditions:
   a. F4.1 Courier reassignment adaptability (F1) - Ease of rerouting or reassigning couriers as needs change.

b. F4.2 Scalability of service area (F2) - Ability to expand or adjust the delivery area quickly.

c. F4.3 Adjustability of production volume (F3) - Ability to ramp production up or down to match demand.

5. Quality - service and product quality outcomes:

a. Q5.1 Consistency of product condition upon delivery (Q1) - Delivered items arrive in good condition consistently.

b. Q5.2 Customer satisfaction from service model (Q2) - Customers' happiness with the overall delivery service experience.

c. Q5.3 Operational standardization (Q3) - Standardization of processes to ensure uniform quality and fewer errors.

Alternative Strategies: There were four available options of strategies (A, B, C, D) which were compared with the above criteria:

A. Cost-Optimization Strategy - Minimization of operational costs and enhancing efficiency (e.g. idle capacity reduction, labor costs reduction).

B. Delivery Coverage Expansion Strategy - Focuses on widening the delivery radius and improving coverage reliability (even if it incurs higher cost).

C. Flexible Courier Deployment Strategy - Focuses on dynamic courier and resource distribution to be responsive to the changes of demand.

D. Demand Stimulus Strategy - This approach concentrates more on enhancing demand (e.g. marketing, promotions) in order to more effectively use the existing capacity, although existing operations may not be as efficient (Petropoulos et al., 2025).

These options will deal with the essence of problems in Company A differently. The AHP will rank these strategies quantitatively according to their ability to fulfill the weighted criteria.

1. Weight of Main Criteria of AHP Results

Using AHP pairwise comparisons, the researcher was able to come out with weights of each criterion and sub-criterion. Several experts (6 respondents) were asked to give judgments which were combined (geometric mean) in order to have a consistent group preference. A check of consistency was conducted on every comparison matrix to ensure logical consistency (consistency ratios were within acceptable limits). The resulting weights are summarised below:

Table IV.6 Main Criteria Weight

	Cost	Speed	Dependability	Flexibility	Quality	Weight (W)
Cost	57%	72%	59%	43%	30%	52%
Speed	10%	12%	20%	23%	21%	17%
Dependability	11%	7%	12%	23%	20%	15%
Flexibility	13%	5%	5%	10%	25%	12%
Quality	9%	3%	3%	2%	5%	4%

Table IV.6 Main Criteria Weights shows the five main criteria were not considered equally important - Cost was by far the most critical factor, receiving ~52% of the total weight (priority) on average. Speed (~17%), Dependability (~15%), and Flexibility (~12%) followed, while Quality (~4%) was given the least importance. In other words, cost-related performance was judged more than half of the decision, aligning with the company's need to control high operating expenses. Speed and dependability were the next most significant areas, whereas quality (e.g. product

condition) was considered satisfactory or less problematic, thus a lower priority. This is consistent with the findings in Chapter IV, where cost inefficiency such as idle machinery, high fuel expenditure, and underutilised labour are the main contributors to operational inefficiency.

2. Sub-criteria Weightings and Operational Priority Findings

Next each of the five main criteria was evaluated. The results show that the top three sub-criteria all come from the Cost category, namely:

1. C1.1: Courier Efficiency = ~19.4%
2. C1.2: Production Underutilization Costs = ~16.6%
3. C1.3: Delivery Cost per Kilometre = ~16.0%

Combined, these three account for more than 52% of the total decision weight. Meanwhile, the three sub-criteria with the lowest weight come from the Quality category:

1. Q5.2: Customer satisfaction with service model= ~1.3%
2. Q5.3: Operational standardisation= ~1.3%
3. Q5.1: Consistency of product condition upon arrival= ~1.5%

Table IV.7 Global Weight of AHP Sub-Criteria

Sub-Criteria	Global Weight	Rank	Alternatives			
			A	B	C	D
C1	0,19398562	1	62%	15%	16%	7%
C2	0,16634546	2	68%	11%	12%	12%
C3	0,160072851	3	71%	11%	11%	12%
S1	0,062376129	4	32%	33%	22%	14%
S2	0,057754759	5	25%	32%	25%	18%
S3	0,053475623	6	28%	27%	30%	17%
D1	0,05274111	7	38%	21%	21%	21%
D2	0,048833586	8	32%	70%	27%	11%
D3	0,045215433	9	25%	50%	21%	19%
F1	0,042386093	10	27%	29%	35%	8%
F2	0,039245759	11	25%	27%	32%	14%
F3	0,036337983	12	28%	23%	31%	19%
Q1	0,01537126	13	25%	27%	25%	23%
Q2	0,012680375	15	25%	33%	45%	16%
Q3	0,013177959	14	25%	27%	23%	25%

Table IV.7 indicates that Company A's biggest problem lies in cost efficiency, rather than service quality, which is already considered to be quite stable.

4. Evaluation of Alternative Strategies and Final Rankings

Each alternative strategy (A, B, C, and D) was evaluated against each sub-criterion. The four alternatives strategies evaluated in the AHP are:

a. Cost-Optimization Strategy
b. Distribution Area Expansion Strategy
c. Courier Felxibility Strategy
d. Demand Increase Strategy

The AHP calculation result show that:

a. Strategy A obtained the highest final score (approximately 48%) because it excelled in almost all cost sub-criteria and some of the reliability and flexibility sub-criteria.
b. Strategy B excelled in a small portion of the speed and distribution area sub-criteria, but not significantly overall.

c. Strategies C and D showed low performance because they only won in sub-criteria with small weights.

The chart below shows the percentage weight contribution of each sub-criterion to each of the strategies. This visualization assists in determining what strategy shows an overall superiority in terms of its performance on the most significant sub-criteria:
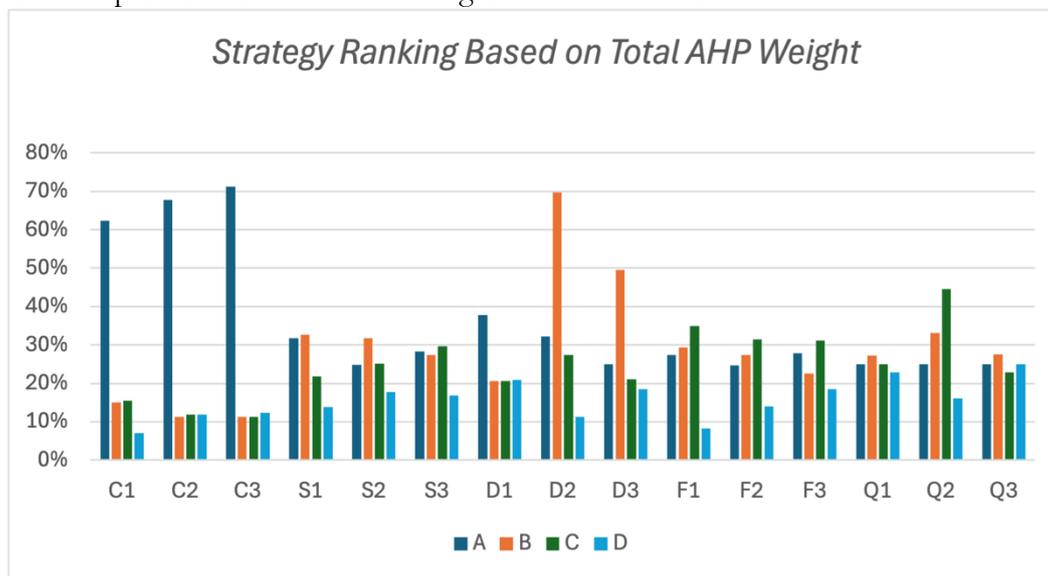

Figure IV.9 Strategy Ranking Based on Total AHP Weight (Author, 2025)

Figure IV.9 indicates that the main recommendation given is the implementation of Strategy A (Cost Optimisation), as this strategy is most suited to the conditions and challenges faced by the company, as analysed in the following section.

Cost-Beneficial Interpreation of Operational Findings

As indicated in the analysis contained in Section IV.1, the key operational weaknesses encountered by Company A have a high cost implication in terms of production, distribution, and its general workflow. The low level of utilisation (34-36) of production means that the company is incurring the fixed cost of energy and labour costs which is not being fully translated to output that generates revenue. Meanwhile, the bottle-necks at distribution or, notably, in the morning and afternoon peaks, have certain hidden costs, which include extra fuel utilisation, longer courier working hours and the repetitive backward and forward routing. Further, the abrupt demand characteristic of the business will result in unexpected dispatching choices which raise the unit cost per kilogram dispatched especially when the courier has to cover dispersed destinations with small order quantities. The overproduction is also tied to melt-loss, which contributes to waste in the operation, i.e., a part of the energy as well as production input is not compensated by sales. Taken altogether, all these aspects show that the failure to match the production capacity with the timing of demand, as well as distribution capabilities, directly translate into unnecessary costs of operation (Alahmari, 2023). This is why cost became the most important concern in the AHP outcomes: the enhancement of operational efficiency can be rational again only in case they will be able to save the unnecessary costs without deteriorating the speed and reliability the cold-chain customers expect. The interpretation of cost-benefit presented above is hence the basis of the business solutions in the following section, which guarantees that every improvement is aimed at reducing the cost of operation, without a drop in the quality of services.

Business Solutions

Based on the operational gaps outlined in Section IV.1, a number of business solutions are designed to align the mismatch between production capacity, demand patterns, and distribution performance. These solutions are directly based on the results of the analysis and aligned with the performance goals, which were given priorities via the Analytical Hierarchy Process (AHP), which identified cost as the primary objective, followed by speed and reliability. To align with these priorities, the solutions are proposed with cost-optimisation orientation as an order-winning goal that will focusing on reducing the cost per kilogram through improve fleet utilisation, reduce energy waste, and more efficient scheduling. The speed and reliability serve as the qualifying objectives that cost-saving measures do not affect the service consistency and the responsiveness. An approach in line with the principle of Slack that the operational decisions should be based on the needs of the market and the capabilities of the resources. The sub-sections below are an overview of the operational enhancements that have been offered in order to minimise inefficiencies, stabilise performance, and strengthening Company A's ability to respond the fluctuating market demand.

Distribution Capacity Improvement Through Radius-Based Workload Maximisation

The distribution analysis in Section IV.1 indicates that the courier workload bottlenecks are primarily caused by sudden and unpredictable customer ordering behaviour rather than fixed routing patterns. Courier routes cannot be predesigned as static loops since the deliveries are carried out in real time. Instead, the optimisation opportunity can be seen in maximising the effectiveness of delivery within each of the radius categories, which already demonstrates a relatively balanced customer distribution (approximately 30% within each radius segments).In order to reduce the logistics cost per kilogram and reinforce the speed and reliability, Company A should utilise the existing radius segmentation (0-3 km, 3-6 km, 6-9 km and > 9 km) as a decision-making model rather than as fixed routes.It implies that the dispatch team priorities the deliveries with the highest priority to near-distance radiuses (0-3 km and 3-6 km) where fuel usage is lowest and the potential for higher kg-per-trip is the greatest. Strengthening demand density within these closest zones will enable couriers to maximise load efficiency, mean less kilometres per kilogram delivery, and stabilise service speed for customers located farther away.By adopting a radius-based workload maximisation approach, the fleet can achieve the following cost-oriented improvements:

1. Increased kg delivered per kilometre travelled, reducing the cost of fuel per unit.
2. More effective grouping of sudden orders in the same radius.
3. Reduced travel variance that also improves speed and dependability.
4. No need to invest further in fleet, since the optimisation is structural but not capacity-based.

This radius-centered approcah aligns with the priorities of Company A regarding the AHP consideration because the cost efficiency is the core operational driver, and the increase in the speed and reliability is the natural outcome of the further workload consolidation within closer service areas.

Synchronisation of Production Schedules With Sudden-Demand Patterns

The production analysis in Section IV.1 reveals that Company A is working with a very low utilisation averaging 34-36 percent not because of low demand but due to the inability of the distribution fleet to absorb output during peak periods. Production cannot rely on a fixed to any time schedule since customer demand is very unpredictable and tends to spike at specific hours of the day. Instead, production should be synchronised with real-time demand patterns and expected peak windows so Company A can minimise unnecessary energy consumption while maintaining supply readiness (Vetrivel et al., 2025). Cost-oriented production synchronisation strategy involves the adjustment of machine running hours and batch sizes in such a way that the machine running is concentrated around demand peaks hours, especially in the morning delivery period (07:00-09:00) and afternoon period (16:00-19:00). When the demand is low, it is possible to lower or stop

the production to prevent melt-loss and waste of electricity. This will guarantee the company has a sufficient buffer stock to take up the sudden orders particularly when the B2B customers have early opening hours without having to face the unnecessary cost of overproduction.

Synchronising production to demand patterns will help Company A to achieve the following improvements:

1. Lower cost of energy per kilogram, as machines will only operate when needed.
2. Increased synchronization to courier availability, which facilitates delivery operations at morning and afternoon peaks.
3. Improved cost-efficiency which aligns with AHP results that cost is the major operation priority.

This synchronisation approach is a way of making production more like a flexible but cost-efficient support mechanism for distribution. enhancing speed or reliability or influencing operational budget or machine life.

Establishment of Standardised Delivery Windows to Stabilise Sudden-Demand Workflows

As indicated by the hourly demand analysis in Section IV.1, most orders are occur in concentrated particularly during the morning and the afternoon peaks resulting in courier overload, as well as, unreliable delivery time. Since Company A is based on a sudden-demand model, delivery windows will not be able to remove variability, but wll significantly decrease the amount of hidden costs in ad-hoc dispatching, repeated back-and-forth routes, and waiting idle time. In order to optimise cost and be responsive at the same time, Company A should implement three flexible but standardised delivery windows:

1. Morning Window: 07:00-09:00
2. Midday Window: 10:00-14:00
3. Afternoon Window: 16:00-19:00

These windows are a schedule guide and not a strict rule-orders can also be handled outside the windows where there is a need to do so, but most dispatching business is planned around these windows. By grouping orders according to radius and time window, the company is able to minimize the amount of fuel consumption, enhance the courier readiness, and achieve more predictable delivery cycle. This enhances speed and reliability and also the cost-per-trip remains controlled.

Strengthening Sales Outreach to Increase Demand Density in Close-Radius Zones

The customer distribution data indicates that demand in all the radiuses (0-3km, 3-6km, 6-9km and > 9km) is relatively balanced at approximately 30%. Nevertheless, the 0-6 km area is the most optimally cost-efficient area since the deliveries in this range use considerably less fuel, allow multi-drop efficiency, and accommodates a higherkilograms per trip. In response to this, Company A needs to focus on specific sales outreach in the nearest zones to maximize density in demand. This involves approaching food stalls, cafes, mini-restaurants and beverage outlets that are very numerous within these short distances. As density in 0-6 km increases, couriers can cluster sudden orders efficiently, which results in:

1. Reduce logistics cost per kilogram
2. Higher drop-size per trip
3. Improved response time
4. Reduced fuel waste

This outreach solution helps directly with the AHP cost priority, and inherently enhances the speed and reliability because of the closer geographic clustering.

Standardisation of SOPs to Reduce Operational Variability and Hidden Costs

The day to day operations of company A are based on manual coordination, fulfilment of sudden demands and making of decisions in real time. This brings variability in loading ice by

couriers, prioritisation of orders, and dispatch decision making during the peak hours. This variability results in hidden costs such as the wasteful use of fuel, long wait times, inconsistent route decisions as well as delivery mistakes (Ajeigbe and Peace., 2023). A series of simple, practical Standard Operating Procedures (SOPs) has to be put in place to minimise these inefficiencies and also contribute to the cost-first performance orientation that was identified in the AHP results. SOP standardisation is intended to provide a standard base upon which day to day operations will be based but leave room to allow flexibility due to the possibility of sudden orders. SOPs make the couriers, production operators and the administrative team have a clear picture thus they have easy time coordinating their operations and reducing unnecessary waste of operations. Key SOP components include:

1. Loading and Capacity SOP
a. The maximum weight of 180 kg per courier to avoid unsafe and inefficient loading.
b. Standardised loading squence to minimise waiting time and decrease turnaround time between trips.
c. Rapid pre departure inspection to minimize risk of product defects (ice melted or damaged).
2. Order Handling & Grouping SOP
a. Whenever possible, orders must be clustered by radius (0-3 km, 3-6 km, 6-9 km, >9 km) to minimise the fuel cost per kilogram.
b. In simultaneous sudden orders, dispatch gives priority to closest-radius orders, which is a cost-effective logic.
c. Setting up of soft cut-off time per delivery window to allow minimal batching without reducing responsiveness.

3. Routing Decision SOP
a. Use a nearest-first (or radius-first) courier-assignment policy; the couriers that are already in a particular zone are supposed to give priority to the orders within that zone.
b. Couriers must make clustered deliveries rather than fragmented routing in the case of multi-drop opportunities within the same radius.

Company A will be able to significantly decrease the logistics cost per kilogram without sacrificing speed or reliability in cold-chain distribution by decreasing variability in loading, routing, and order handling practices. These SOP enhancements make dependency robust without compromising operational agility to respond to the spontaneous orders.

CONCLUSION

This study was conducted to analyse the causes of inconsistencies between production capacity, demand patterns, and distribution performance at Company A, which operates in the crystal ice industry in the context of cold chain. Based on quantitative findings from operational data and prioritisation results through the Analytic Hierarchy Process (AHP), this study concludes that the company's main problem is not a lack of capacity, but rather a mismatch between available capacity and distribution capabilities in meeting sudden demand. Production is only utilised at around 34-36% because output cannot be fully distributed by the limited distribution fleet. On the other hand, fluctuating demand patterns with peaks in the morning and evening cause a backlog of work for couriers and cost inefficiencies, as evidenced by high fuel consumption, waiting times, and suboptimal travel distances.

The AHP results confirm that cost is the highest performance priority that the company must achieve, followed by speed and reliability. This finding is in line with the fact that cost waste arises from irregular workflows, unsynchronised production, and unstructured distribution routes. Thus, the main focus of the operational strategy must be directed at efforts to reduce costs per kilogram, while maintaining the speed and reliability of the service. This conclusion forms the basis for the recommendations and strategic implications discussed in the next section. According to

the outcomes of operational analysis and evaluation, the following major recommendations which can be implemented by Company A are as follows:

1. Radius-Based Distribution Optimisation. Plan courier loads with radius (0-3 km, 3-6 km, 6-9 km, >9 km) to optimise fuel use and the amount of kilograms that can be transported on each trip. Align Demand Patterns and Production Schedules.
2. Synchronize machine working time, to coincide with peak demand, particularly in front of the morning and afternoon delivery run. This has the ability to save on electricity expenses, minimize the loss of melts, and keep the stock buffers at the optimal levels.
3. Install Adaptable Delivery Time. Create delivery windows (morning, afternoon, evening) as a guide to decrease ad-hoc deliveries and maintain the capability of the company to react to spontaneous demand.
4. Density Demand in the Radius around. Initiate systematic sales outreach programs to gain customers that are within 0-6 km radius to ensure better cost efficiency and fleet utilisation.
5. Operational SOPs Standardisation. Create straightforward yet standardized SOPs to load, group orders, route determination and complaint management to minimize variation and the unseen expenses in day-to-day operations.

These solutions will be aimed at achieving the cost-reduction per unit and per trip, as per the AHP priorities, and optimising the responsiveness and reliability of emergency ice delivery services. The findings of this study have significant strategic implications for the design of Company A's operating strategy. Based on Nigel Slack's operating framework, operating strategy is built through three main layers: strategic orientation (performance objectives), structural decisions (capacity & supply network), and infrastructure decisions (planning & control, improvement, measurement).

1. Strategic Orientation: Cost as Order-Winning Objective. The outcomes of the AHP indicate that the most important performance dimension is the cost. This implies that every operational decision, production and distribution included as well as staff planning should be planned based on the principle of cost effectiveness without any sacrifice of speed and reliability that are the minimum conditions required of cold-chain services.
2. Structural Decisions: Capacity and Distribution Network Design. A capacity of 10 tonnes per day is not a problem, but it must be positioned as a strategic capacity cushion. The main focus is to ensure that the distribution network structure, through radius-based zoning and efficient routes, can absorb production output at minimal cost.
3. Infrastructure Decisions: Process Control Improvement. The operations built on a stable, predictable, and inexpensive foundation are based on demand-pattern-based scheduling, consistent SOPs, and measurement of performance on five Slack objectives (through AHP weighting). Therefore, the strategic implication of this study is that Company A should develop an operational strategy framework that is cost-efficient and in accordance with sudden demand trends and retain the quality of services provided to customers.

Based on the research results, several managerial implications that need to be considered by the owners and management of Company A include:

a. The management should rethink its approach that the capacity need not be used fully, it is more important to optimise the use of the capacity used.
b. The daily route decisions should be modified to be less intuitive regarding the courier and structured to be more of a radius.
c. Regular distribution performance monitoring should be undertaken on the basis of such indicators as kg per trip, fuel per kg and on-time delivery.
d. The sales operations should be focused on the local radius in order to maximise the fleet utilisation.
e. Short training and regular monitoring is needed to adjust to the new SOP.

This research has a number of limitations such as:

a. The sudden demand pattern makes it impossible to conduct accurate long-term predictive analysis.
b. The study focuses on only one company, so generalisations to other industries should be made with caution.
c. Some operational data is still recorded manually, making it susceptible to recording variations.
d. The study has not explored mathematical optimisation models or system simulations due to limited digital data.

For future research, several opportunities that can be developed are:

a. Formulating an Excel forecasting model using past data to forecast daily and weekly demand. Simulation of route optimisation (e.g. VRP method).
b. Evaluation of the viability of micro distribution hubs with a quantitative methodology.
c. Exploring the opportunities of cold-chain SME digitalisation to enhance real-time visibility.
d. Integrating the AHP technique with other techniques (e.g., TOPSIS or ANP) to have a more detailed assessment of operational priorities.

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