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**Research Article**

# Analysis Of Product Supply And Demand Planning For Sustainable Supply Chain : A Study At Petmax Oil Company

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**ABSTRACT**

**Purpose** – This study aims to measure the level of performance at my department which is responsible for sourcing and procuring products, primary distribution, and establishment of the Product Supply and Demand Planning work process for sustainable supply chain. The goal is to achieve supply sustainability, sustain good performance, have standardized work procedures, and increase efficiency in downstream operations.

**Design/Methodology/Approach** – The paper presents an overview of the supply chain which includes upstream and downstream. Next, this paper also presents performance measurement and the establishment of the work process using an appropriate method such as benchmarking,standardization of the work process, Key Performance Indicators, and business process management tools to evaluate the level of performance.

**Originality/value** – The model and source of information gathered for this study are from PETMAX Dagangan Berhad, hence other information to support this study is obtained from journals, research, and articles.

**Keywords** – Benchmarking, Product Supply and Demand Planning, Sustainable Supply Chain, Performancemeasurement, Key Performance Indicators(KPIs).

## 1.0 INTRODUCTION

PETMAX offers high-quality solutions to customers in Malaysia and worldwide throughits marketing and trading arms. PETMAX Oil Company (POC)is the principal marketing arm of Nasional Oil Company. Incorporated in Malaysia underthe Companies Act 1965 on 5 August 1982 and listed on the Main Board of Bursa Malaysiaon 8 March 1994, PDB has since established itself as Malaysia's leading retailer and marketer of downstream oil and gas products.

PETMAX supply chain involves two major sectors, Upstream and Downstream. Upstreamactivities consist of exploration, drilling, extracting, and production. Meanwhile, the activities involved Downstream are refining, marketing, and distribution of the products tobe delivered to end customers **(Elhuni et al, 2017).** PDB is one of the Downstream businessesin PETRONAS.

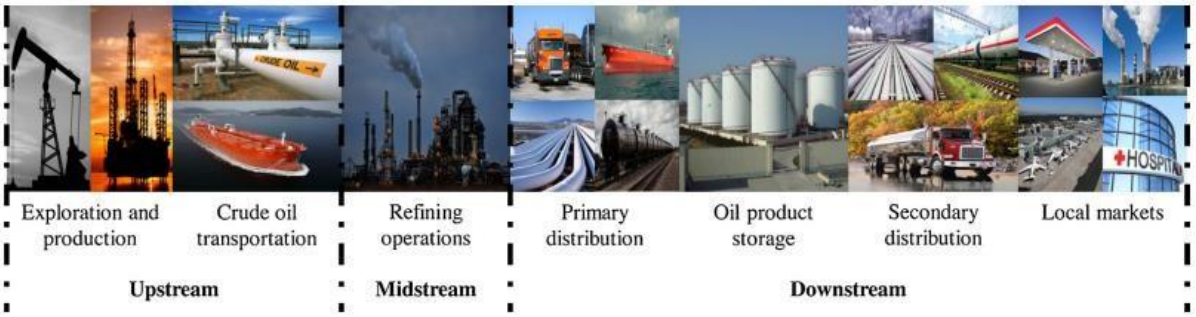


***Figure 1: The Oil and Gas supply chain***

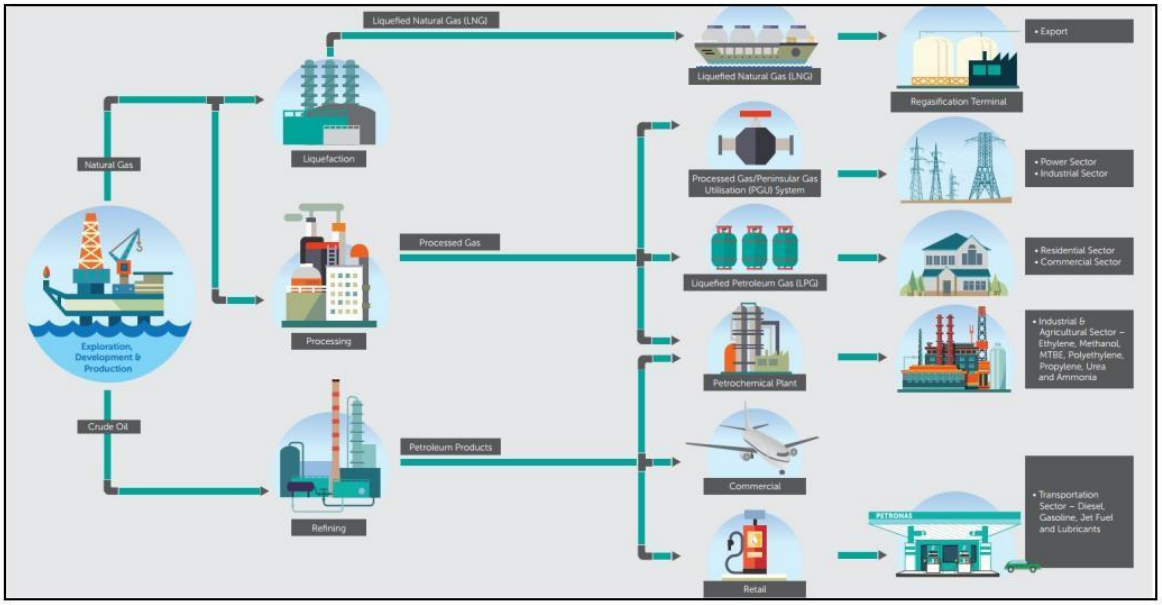


***Figure 2: PETMAX supply chain***

In the researcher department, Product Supply and Distribution (PSD) fell under Primary distributionand is divided to 3 business units which are Product Sourcing and Planning (PSP), Primary Distribution and Operations (PDO), and Vessel Operational Assurance (VOA). PSP is responsible for sourcing and procuring products (Clean products, Special products, andAdditives). Whereas in PDO, is responsible for scheduling the transportation mode (Vessel, Multiple Product Pipeline (MPP), Barge) to supply the products. On the other hand, VOA isresponsible for providing as well as enabling transportation to deliver product through Vessel.

The product Supply and Distribution department requires high efficiency throughout its work processes to sustain good performance, and to achieve desired result (Ibrahim, 2019,2020). Thus, it is vital for PSD department to measure it by using Key Performance Indicators (KPI) as indicator to measureprogress towards an intended result. In order to do achieve a good KPI in PSD, researcher need to achieve a KPI target for Monthly Demand Forecast (MDF), Occurrences of Low Stock (OoLS), and Liquified Petroleum Gas (LPG) Vessel Performance.

Moreover, an effective gas supply management is primarily based on accurate natural gas consumption forecasting tools and techniques, which can assist countries and organizationsin establishing reasonable gas supply plans, managing supply contracts, improving operational efficiency, and providing basic data for production and infrastructure construction planning, all while saving energy and lowering costs (Liu et al., 2021). This also applies to Petroleum-based fuel as well, providing an accurate supply and demand planning and forecasting data is crucial to help facilitate inventory stock at terminal and avoid supply disruption (Sundram et al, 2019). Therefore, natural gas consumption and petroleum-based fuel supply and demand planning forecasting is essential for the sustainable development of anycountry.

## 2.0 LITERATURE REVIEW

Supply chain management is essential for increasing an organization's efficiency and profitability. The procurement of raw materials, production, storage, transportation, and delivery to the client are all integrated in this (Amer et al, 2019). Information and money go back and forth through the chain, driven by the end user. Benchmarking is essential to any supply chain management system's ability to achieve these goals (Rahmat et al., 2023). The term can be defined as “the continuous process of measuring products, services and practices

against the toughest competitors or those companies recognized as industry leaders" (Ralston et al., 2001). Therefore, supply chain benchmarking can be defined as the measurement of one company's products, services, and operations that exist along the chain, and it can be compared to the relevant metrics of successful organizations. Hence, benchmarking in supply chain covers various aspects such as processes, products, performances, and strategies (Peng Wong et al., 2008 & Zailani et al 2023). Supplementing this, implementation of performance benchmarking strategy will allow organizations to examine performance in more detail. Each KPI values will take into account, and the KPI is then ordered in descending order of performance and divided into "Superior" and "Parity" categories. This will result in the testing of each component's ability to perform better in comparison to benchmark values and the recommendation of futuristic adjustments (Mubarak, et. al., 2023 & Tripathi et al., 2018).

Planning is a crucial element of all supply chain processes, including sourcing, processing, and delivery. It is critical to monitor operations such as demand forecasting, planning cycles,as well as inventory and distribution demand planning from a performance aspect. Supply chain planning is based on forecast data, which serves as the foundation for operations, product sourcing, stock inventory management, and other supply chain activities (Akanmu et. al., 2023 & Lima et al., 2016). Demand forecasting must reflect real customers' demands as much as possible and provide consolidated market data such as production and sourcing with high accuracy tothe upstream supply chain (Chae, 2009). This measure is essential for reducing inventory levels and, as a result, enhancing organizations' cost savings (Ramanathan, 2014).

Furthermore, Demand estimates act as a primary input for effective planning and decision-making in any organization. Demand forecasting needs historical demand data and forecasting methods to forecast future demand (Punia et al., 2022). A firm's marketing,production, distribution, and finance departments use short-to-long-term forecasts to supportdifferent decisions (MirHassani, 2008). Being such a pivotal input to business decision-making, the quality of forecasts is very important.

According to a study by Fin et al., (2017), a standardized work process leads to an effective way for quality improvement, especially in its implementation of manual tasks. This results in the optimization of operators' tasks and movement processes. Standardized work can be applied throughout the manufacturing and services operations; therefore many industries canbe benefited from it. By standardizing the operation concept, work elements, and work application methods, it aims to achieve better results in increasing productivity and reducing rework index. This study developed a standardization in Operation Routine Sheets by creating fixed task sequences and allotted time as well as, Standardised Operations Sheet in describing the safety and quality items, work in process, and operators' optimal movementsto enhance the operator comprehension to the tasks' order and movements. Performing this concept has shown that the process time was decreased by 15%, a reduction of 34.5% in theoperator mobility, and downtime was reduced by 9.6%. Moreover, the amount of waste produced during the operation was also decreased in addition to the work process being optimised. As production and manufacturing involves running multiple activities,counterbalancing a repetitive task reduces errors and waste probability. Hence, the study assists in establishing standardization to the management in order to readily detect potential issues and improvements and validate activities' sequences (Fin et al., 2017).

Key Performance Indicators (KPIs) are the critical (key) indicators of progress toward an intended result (Stefanovic, 2014). KPIs provides a focus for strategic and operational improvement, create an analytical basis for decision making and help focus attention on whatmatters most (Punia & Shankar, 2022). Despite its importance, implementing performancemeasurement has always been a challenging task. Because of factors such as a lack of top management support and an organizational culture hostile to performance measurement, developing KPI is always a sophisticated process that can be extremely difficult for smaller organizations (Shepherd & Gunter, 2006).

## 3.0 METHODOLOGY

### 3.1 Benchmarking for continuous improvement

In this research paper, the aim of benchmarking in PSD department is to provide a standard way to measure performance and to use KPI indicators to monitor overall performance as wellas improving a given business operation or a process by exploiting best practices (Frank et al.,2016). Performance benchmarking is a powerful tool to evaluate a single aspect of theorganization. Moreover, it allows to identify current gaps in performance and to find opportunities for improvements. Thus, PSD department can compare their output to their historical results by establishing relevant performance metrics such as KPIs for one section oftheir operations.

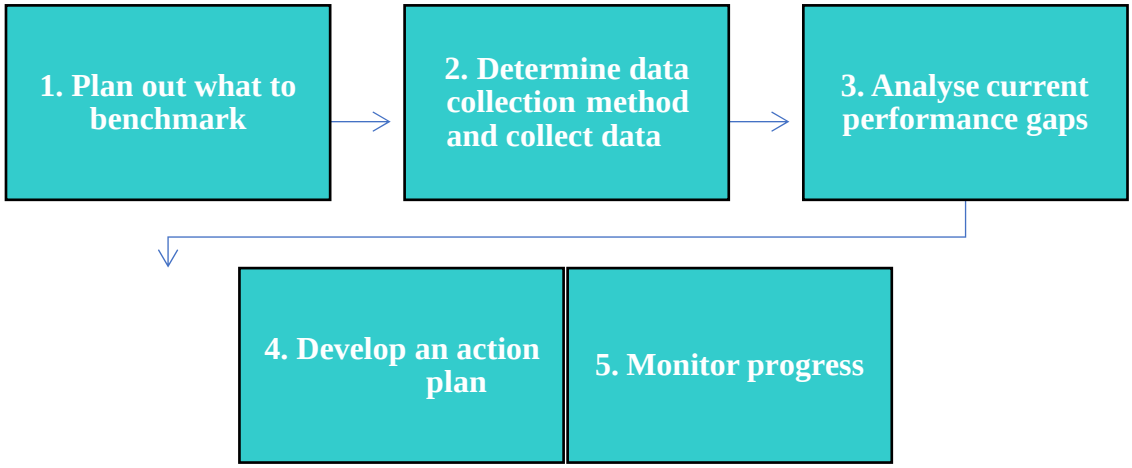


***Figure 3: Benchmarking process to evaluate performance***

### 3.2 The establishment of Product Supply and Demand Planning work process

In order to gain better insight of the Establishment of Product Supply and Demand Planning work process, this research was conducted by observing my department during my industrial training at PETMAX Dagangan Berhad. In addition, the data and information obtained for this study was recorded by noted-taking, audiovisual recordings with the employees, discussion, and meeting.

Next, there are six Key Process proposed by Product Sourcing and Planning (PSP) team for Monthly Demand Forecast (MDF) to have a standardized work procedures and to achieve MDFKPIs target.

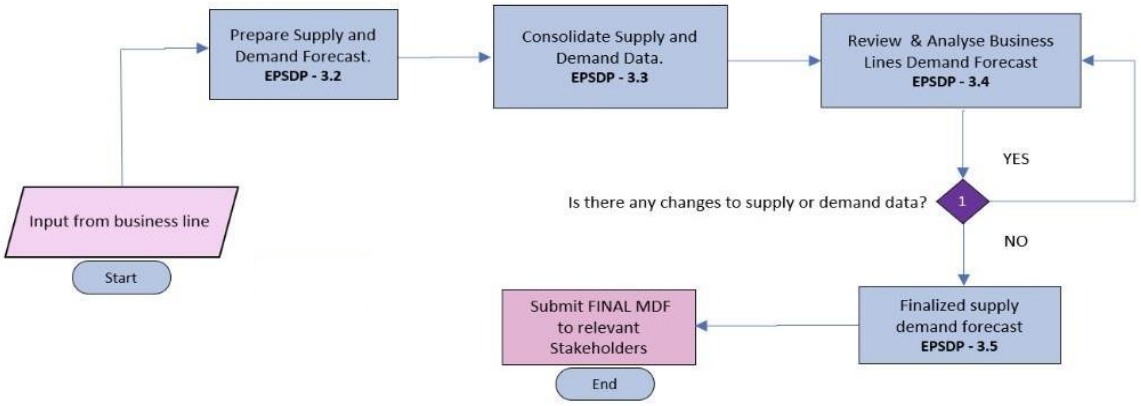


***Figure 4: Establish Product Supply and Demand Planning (EPSDP) work process***

Below are the descriptions of each work process of MDF:

1. When receiving input from business line such as Commercial and Retail department, PSP team need to assess business requirement to prepare supply and demand forecast.
2. Gather Business lines supply and demand forecast with historical data.
3. To review and evaluate the Business lines supply and demand forecast with historical data. Thus, if there are changes to supply and demand data, it need to be review and evaluate again for the changes. Otherwise, proceed to the next process.
4. After that, finalize and conclude the supply and demand forecast and to submit the MDF to relevant Stakeholders.

### 3.3 Monthly Demand Forecast (MDF) KPIs target and KPI indicator

| KPI & Target | KPI indicator |
|---|---|
| **i.** Overall Variance (%) between MDF and Actual Lifting | **i.** (±) 10% of overall variance. |
| **ii.** The percentage of every terminal is (±) 10% variance. | **ii.** 50% of terminal meets the (±) 10% variance. |
| **iii.** Consecutive occurrence of terminal above tolerance variances. | **iii.** No terminal exceed variance (±) 10% for more than 3 consecutive months. |

***Table 1: Monthly Demand Forecast (MDF) KPIs target and KPI indicator***

MDF formula and how to calculate the (%) of the variances:

a) Overall Variance (%) between MDF and Actual Lifting:

$$\frac{\sum Monthly\ Overall\ Actual\ Sales\ (kl) - \sum Monthly\ Overall\ Sales\ Forecast\ (kl)}{\sum Monthly\ Overall\ Sales\ Forecast\ (kl)}$$

b) The (%) of every terminal is (±) 10% variance:

$$\frac{\sum Count\ of\ within\ variance}{\sum Count\ of\ within\ variance + \sum Count\ of\ Underlifting + \sum Count\ of\ Overlifting}$$

To monitor the performance of MDF every month, the document needed is Monthly Demand Forecast Reporting excel sheet from Product Sourcing & Planning (PSP) based on Products (clean product) and Terminals in Malaysia.

Referring to formula from above, we need to have all of the historical data and current data toperform this calculation to determine PSD department performance. For example, the sum of Monthly Overall Actual Sales is retrieved from Retail and Commercial business lines, the sumof Monthly Overall Sales Forecast is retrieved from Overall Actual Sales two (2) months beforethe current month (M-2). All the data received to calculate overall variance between MDF andactual lifting are in kilolitres (kl) unit.

Next, to calculate the variance for every terminal is (±) 10%, the data needed are sum of Countof within variance (meaning the amount of terminal that are within (±) 10% variance), and sum of Count of Underlifting (terminal that are below than -10% variance) as well as sum of Count of Overlifting (terminal that are below than +10% variance). Hence, all of the consolidated data from January to December need to be accurate to calculate the performanceof the department for that year.

## 4.0 DISCUSSION AND FINDINGS

Forecasting is used to develop anticipated demand and actual demand is created from sales and production orders **(Al-Othman et al., 2008).** This is believed to support healthy stock level at all terminals and avoid supply disruption. Additionally, Monthly Demand Forecast (MDF) is created to drive the best behavior to achieve sustainable and continuous product supply at all Terminals and closer to the market in terms of cost, quality, as well as delivery performance.

Managing with the use of KPIs includes target setting (the desired level of performance) andtracking progress against that target. Managing with KPIs often means working to improve leading indicators that will later drive lagging benefits. Leading indicators are precursors of future success; lagging indicators show how successful the organization was at achieving results in the past. A good KPIs consist of:

a) Provide objective evidence of progress towards achieving a desired result.
b) Measure what is intended to be measured to help perform better decision making.
c) Can track efficiency, effectiveness, quality, timeliness, governance, compliance, behaviors, economics, project performance, personnel performance, or resourceutilization.

Based on the calculation of MDF formula, the results of historical performance by years are shown as follows:

a) Overall Variance (%) between MDF and Actual Lifting:

| YEAR | OVERALL PERFORMANCE |
|---|---|
| 2019 | -1.74% |
| 2020 | -2.63% |
| 2021 | 3.61% |

***Table 2: Overall Variance (%) between MDF and Actual Lifting***

b) The (%) of every terminal is (±) 10% variance:

| YEAR | OVERALL PERFORMANCE |
|---|---|
| 2019 | 44% |
| 2020 (Jan – March & Oct – Dec) | 26.6% |
| 2021 (Exclude MCO period) | 27.4% |

***Table 3: The (%) of every terminal is (±) 10% variance***

Reviews of the calculations conducted to obtain KPI's for evaluating overall performance, as seen in Table 2 and Table 3. The results from Table 2 shows that overall performance for year2019 is -1.74%, followed by year 2020 -2.63% and for year 2021 is 3.61%. This means that PSD department has achieved its target KPI which is (±) 10% on Overall Variance (%) between MDF and Actual Lifting. Furthermore, the results in Table 3 (The percentage of everyterminal is (±) 10% variance) shows that overall performance for year 2019 is 44%,

whereas for 2020 is 26.6% followed year 2021 which is 27.4%. The results stated on Table 3 may not achieve PSD target KPIs due to the Covid-19 pandemic arise in Malaysia which affect the operations overall performance at every terminal.

However, having a target KPIs alone without a standardized work process could potentially affect the desired level of performance in PSD department. This is because by if the work procedures are not standardized, it will lead to incomprehensive work procedures which operational processes in PSD department are not clearly defined. It also potentially lead to aninneffective planning, scheduling, and resource allocation. Moreover, lengthy work process and repetitive tasks could affect the PSD performance due to unclear work process, hence more time spend on non-value-added activities.

PSD has enhanced the current key performance indicators (KPls) to objectively measure andreport its performance. Strong focus on measuring and monitoring MDF performance will enable PSD to highlight successes and identify areas for continuous improvement. Having a standardized work procedures is the key in achieving the PSD department goals and target.

## 5.0 RECOMMENDATION

### 1. Internal Benchmarking

PETMAX can use benchmarking to measure numerous areas of their operations againstinternal and external standards. Hence, internal benchmarking is all about improving businesses by comparing it to historical data. This means that PSD department can do comparison between related department or business lines such as Retail and Commercialby using internal benchmarking to uncover the best, most efficient practices for continuous improvement to be a resilient organization.

### 2. Document the standardized work procedures into system

A standardized work procedures will make the operations to be more safe and secure, increase efficiency, hence, document the work procedures will become more beneficial for future reference. Additionally, having a system where all the documented work procedures are being placed would be excellent initiative. This will promote visibility as well as being transparent within internal employees as it will become easier for them to access for guidance to enhance the performance and healthier knowledge-sharing culture.

### 3. Develop training program

Capability training has a direct impact on the productivity and efficiency of an organization. Employees develop a better understanding of their duties as well as the skillsand knowledge required to execute their job tasks. It is important that employees understand the new standard procedures and adhere to them, that will eventually eliminateredundancy and focus more on value-added activities. Hence, this will boost their confidence level which will benefit their performance thus, achieve organization's goals.

## 6.0 CONCLUSION

The study on analysis of Product and Demand Planning discussed in this paper which involvesbenchmarking process, the establishment of new standardized work process, and the key process to measures performance using Key Performance Indicators (KPIs). The framework allows a standardization and measuring of the applied indicators and the calculation of overall performance for PSD department. Moreover, the benchmarking methodology can be adaptedto allow PSD to examine the operational performance in more depth, having an effective planning, scheduling, and resource allocation.

Therefore, Key Performance Indicators (KPIs) is another important element in this study on forecasting. Forecasting technique helps PSD to develop Monthly Demand Forecast that drivethe best behavior to achieve sustainable and continuous product supply at all Terminals in Malaysia. Thus, the establishment of standardized work process give a positive impact towards PSD department as it helps on a comprehensiveness of operation processes, better in decision making, improve efficiency of work, performance improvement and elimination of non-value-added activities. Lastly, a powerful quote by Joseph M. Juran, "Without a standardthere is no logical basis for making a decision or taking action."

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