

Supply Chain Demand Planning

Overview on planning process

Minh Vo

Bachelor's thesis

December 2021

Technology, communication and transport

Degree Programme in Logistics Engineering

| | | |
|--|--|-------------------------------------|
| Author(s) Vo, Minh | Type of publication Bachelor's thesis | Date December 2021 |
| | | Language of publication: English |
| | Number of pages | Permission for web publication: x |
| Title of publication Supply Chain Demand Planning Overview on planning process | | |
| Degree programme Logistics Engineering | | |
| Supervisor(s) Pahlsten, Ville | | |
| Assigned by JAMK University of Applied Sciences | | |
| <p>Abstract</p> <p>Planning, particularly supply chain demand planning, has always been a difficult task. One of the main difficulties when doing demand planning is that there are almost an infinite number of variables that can greatly affect the result of the business, hence the planning.</p> <p>The objectives of the study were to study a country, based in South East Asia, to learn how a planning process was set up and implemented. From the study, at least an overview process can be visualized so that other companies, or at least individuals, could take it as a reference for future operation work.</p> <p>Both qualitative and quantitative methods were used for the study. Formulas and simulations were used to compute different scenarios in the planning. In addition to that, interviews, with related context to the study, were conducted. These interviews were transcribed accordingly.</p> <p>The overview planning process was generated with an open approach. This means that the process is not particularly used only for a special business field but also, can be applied for various organizations. However, several factors need to be considered carefully before the implementation.</p> | | |
| Keywords/tags: demand planning, supply chain, automotive | | |
| Miscellaneous | | |

Contents

| | |
|---|----|
| Terminology | 4 |
| 1 Preface | 5 |
| 1.1 Preface | 5 |
| 1.2 Objectives..... | 5 |
| 1.3 Company introduction | 6 |
| 1.3.1 About company X | 6 |
| 1.3.2 About Automotive Aftermarket's business | 7 |
| 1.4 Research boundaries..... | 8 |
| 1.5 Research methods..... | 9 |
| 2 Theoretical Basis | 10 |
| 2.1 Inventory | 10 |
| 2.2 Customer Service Level | 13 |
| 2.3 Demand Planning and Forecasting..... | 14 |
| 3 Methodology..... | 28 |
| 4 Automotive Aftermarket's supply chain | 31 |
| 5 Case Study..... | 39 |
| 5.1 Question 1: What was the situation of AA before the restructure of demand planning and forecasting?..... | 39 |
| 5.2 Question 2: How was the project implemented? | 46 |
| 6 Conclusions | 57 |
| References | 58 |

Figures

| | |
|---|----|
| Figure 1. PBS strategy | 7 |
| Figure 2. Product portfolio of an automaker | 17 |
| Figure 3. Product portfolio of a guitar company..... | 18 |
| Figure 4. BCG matrix | 19 |
| Figure 5. Stages of a sales pipeline | 22 |
| Figure 6. Requirements for supply chain | 32 |
| Figure 7. Hub-and-Spoke model | 33 |
| Figure 8. AA's supply chain map | 34 |
| Figure 9. OFTS and OFTM structure | 36 |
| Figure 10. CSL explanation | 38 |
| Figure 11. Country's Y CSL1 in 2018 | 41 |
| Figure 12. FAI in junction with turnover ratio | 45 |
| Figure 13. Overview of planning process | 49 |
| Figure 14. First level drill down | 50 |
| Figure 15. PN level planning..... | 54 |
| Figure 16. Initial planning of a PN | 55 |
| Figure 17. Low sales in January with no demand revision | 56 |
| Figure 18. Low sales in January compensated by increase in February sales | 56 |
| Figure 19. Low sales in January with demand revision | 56 |

Tables

| | |
|---|----|
| Table 1. Methods of data collection | 9 |
| Table 2. Examples of logistics set up | 27 |
| Table 3. Summarize of interviewees | 30 |
| Table 4. FAI's components | 43 |
| Table 5. FAI calculation for an SKU | 44 |

| | |
|---|----|
| Table 6. ABC analysis for turnover | 51 |
| Table 7. ABC analysis for demand consistency | 52 |
| Table 8. Stocking policy based on value-volume matrix | 52 |

Terminology

| | |
|-----------|--|
| AA | Automotive Aftermarket |
| ADC | Area Distribution Center |
| ASP | Average Selling Price |
| CBF | Core Business Field |
| COGS | Cost of Goods Sold |
| Company X | A multinational company |
| Country Y | A country in South East Asia, where on of the branches of company X located |
| CSL | Customer Service Level |
| FAI | Forecast Accuracy Index |
| H&M | A clothing company |
| IAM | Independent Aftermarket |
| LDC | Local Distribution Center |
| OE | Original Equipment |
| OEM | Original Equipment Manufacturer |
| OES | Original Equipment Services |
| PBS | Parts, Bytes and Services |
| PG | Product Group |
| PH | Product Hierarchy |
| PN | Part Number |
| SKU | Stock Keeping Unit |
| TBP | Target Business Plan |
| TCT | Total Coverage Time |
| TGS | Total Gross Sales |
| UOM | Unit of Measurement |
| Zara | A clothing company |

1 Preface

1.1 Preface

To open a business has always been a difficult target that only ones with high ambitions and entrepreneur mindset can think about and implement. However, to ensure the business to survive and operate profitably is an even more difficult task, which has been proved that fails are far more easily be met than successes. Too many factors need to be taken into consideration to put the business on a smooth-running gear. These factors can range from external ones (for example, customers and economics status) to even internal ones (for example, human resources and available budget).

However, among those factors, one has become prominent and been taken into consideration more and more highly in recent times. This factor that being described is the supply chain function of the organization, in which the business runner(s) has to plan the most efficient and effective ways to deliver the company's products or services. Just like the business as a whole, within the supply chain itself, there are also multiple of elements that would require the responsible people to compromise and balance to achieve the most optimal result. One of the most interesting and highly impact puzzle for the supply chain team to solve is how to maintain a healthy inventory while securing the highest satisfaction level from the customers.

1.2 Objectives

The problem mentioned above can occur at every enterprise, especially for those who own a large-scale with high complexity operations. Thus, by examining a company, whose business spreads across multiple countries and continents, the thesis may shed some light on such vague and complicated puzzle for the readers. In particular, this study will focus on a project run by the aftersales sector of the mentioned company. The target of the project is to set up a supply chain demand planning process that is realistic and follow-up closely with the development of the business plan.

The research questions of the thesis are as below:

- What was situation of the aftersales sector before the project implemented?
- How was the project implemented?

By answering the first question, the reader will also know why the company would need to establish and invest for the mentioned project. The second and final question would help the readers understand deeply how the project was run by the involved stakeholders and what were points considered when implementing the project.

1.3 Company introduction

1.3.1 About company X

Due to confidential agreement (which will be discussed more in Methodology part), the case study company will now be called as company X instead. Company X is a multi-industry company with headquarter located in Europe. However, with a focus on multinational operation in addition to the hometown scene in Europe, the company have also allocated a vast amount of capacity in other continents as well. Based on the annual report published in 2019, more than 60 % of employees are located outside of Europe.

As mentioned, company X have been investing and operating in multiple businesses and industries. These business sectors can vary from daily consumer goods to industrial technology and energy and building technology. However, in this study, we will solely focus on company X's mobility sector, or more particularly, Automotive After-market business (or also known as AA). As stated in its name, the mission of AA is to provide the customers necessary after sales products and services that are related to motorized vehicles. These vehicles can be (but not limited to) passenger vehicles (such as civilian sedans) and commercial vehicles (such as off-road vehicles and heavy-duty vehicles). To put in comparison, under mobility sector, company X are also running Original Equipment business (or also known as OE) in parallel, where the company have to directly provide parts and services for OEs' manufacturing purpose (for example, production lines).

1.3.2 About Automotive Aftermarket's business

As mentioned above, AA was established to provide automotive products and services that are required for after sales purpose. The Parts, Bytes and Services (or also known as PBS) may represent AA strategy in the most comprehensive way, which can be shown in Figure 1 below.

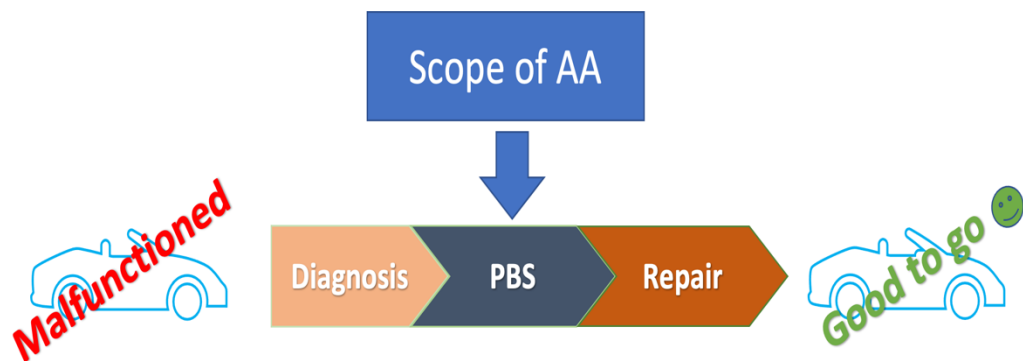


Figure 1. PBS strategy

As described in Figure 1, AA, through PBS strategy, will provide necessary tools for maintenance of automotive related products. There are three main types of supports that are under AA's scope, which are parts, bytes and services (hence the name of the strategy). Parts are mechanical products that are direct replacements for defected items. Some examples can be tires, engine parts or car's electric system. On the other hand, bytes are tools and software which can support the repair of malfunctioned units. In addition to that, under service category, AA also provide necessary support for maintenance in needed cases.

In most cases, AA do not operate as a retailer. This means that they do not have their own set up of retail chain (like H&M or Zara) that interact and connect directly to end customers. In fact, AA's customer can vary from case to case depends on the distribution channel. Under its business, AA have two different distribution channels, which are called Independent Aftermarket (or also known as IAM) and Original Equipment Services (or also known as OES). IAM customers are mostly first trade level wholesalers (or in some cases, retailers if the customers are big enough) and in recent years, with the ever-increasing in popularity of Internet, e-commerce partners

have also been increasing as potential IAM customers as well. In contrast, OES customers are OEM's service centers, repair shops and workshops.

Even though serving different customers, each distribution channel has its own purpose and responsibility. IAM functions as a "cash cow" for AA since IAM channel accounts for most of AA's revenue. Due to such impact and importance in terms of business result, most of the capacity of AA is allocated to serve IAM customers. This is also where AA strive for market share and penetrate competitive business. In stark contrast, not only OES business generates a lot less revenue (compared to AA), it also requires a lot of capacity per value due to high requirement and urgency coming from the market. The reason is because, as described above, OES target customers are mainly OEM's service centers and independent repair centers. Thus, most of the orders are raised when the customers receive malfunctioned vehicles at their workshop and would need the replacement parts as soon as possible. However, regardless of those difficulties, OES channel plays a pivot role in AA's strategy as a whole. First and foremost, OES exists due to obligations made with OEMs. As a consequence of OE business, company X are contracted to providing not only components for OEMs' production lines, but also replacement parts for their respective service centers. In addition to that, company X can also greatly increase their branding and market share through OES channel as well. Unlike other products where end customers can easily experience the products (such as clothes and mobile phones), many automotive products, especially those highly technical ones, would require support from experts from end customers. Therefore, when partnering with repair centers (in general), technicians from these sites can recommend end customers about AA's products during their vehicle service sessions. Gradually, AA can build their reputation as a trust-worthy-brand and highly certified by specialists.

1.4 Research boundaries

In this study, to keep the focus of the topic, we will only discuss about IAM channel of automotive aftermarket. In addition to that, instead of focusing on across all automotive aftermarket branches of company X, the study will only deep dive in one of the company's branches located in country Y, located in South East Asia.

1.5 Research methods

When conducting a study, determining the right research method is an important step. For most cases, it is a decision between choosing qualitative method or quantitative method. According to Streefkerk (2019), a quantitative research is expressed through graphs and numbers while a qualitative research is expressed in words. Not only the two methods are different in how they convey the message to the readers, but they do also have different approaches in collecting necessary data. In an article by McCombes (2020), the author has showed multiple methods of data collection for each research methodology, which can be presented in Table 1 below.

Table 1. Methods of data collection

| Quantitative Method | | Qualitative Method | |
|---------------------------|--|---------------------------|---|
| Method of data collection | Remark | Method of data collection | Remark |
| Survey | Where, when and how the survey was conducted | Interview | Where, when and how the interview was conducted |
| Experiment | Which methods and processes were used for the experiment | Participant observation | Where, when and how the observation was done |
| Existing data | Why and how the data was chosen and collected | Existing data | Why and how the data was chosen and collected |

As the target of this thesis is to check whether company X have improved their supply chain operation after implementing the new demand planning and forecasting process or not, using qualitative method would be a wise choice in this case. By comparing relevant statistical figures, we can conclude what was the outcome of the project and how effective the implementation was. In addition to that, as company X are willing to provide necessary data for the purpose of data analysis (with changes in scale and figures, which will be discussed in detail later on), we would have an ample amount of information to adopt quantitative method. However, as we are examining

a real business case, the final result should not only be determined through statistics and figures. Thus, qualitative method, interviews to be precise, were also used to support our study as well.

2 Theoretical Basis

By doing studies and examine on literature reviews which are relevant to our topic, we can come up with ideas and throughout understanding for the thesis. On this chapter, we will define and discuss three key concepts, which are inventory, customer service level and demand planning and forecasting.

2.1 Inventory

According to Kenton (2021), inventory (or also known as stock) is a term to indicate the finished goods that are ready to sell to customers or materials that are used to manufacture desired products. In terms of company's asset, inventory is considered one of the most important resources as it serves as the main source for company's income and revenue (Kenton, 2021). There are three main types of inventory, which are raw material inventory, work-in-progress inventory and finished goods inventory (Types of Inventory). Raw material is material that is bought from a defined supplier and would typically need to go through a manufacturing process before can be used for company's purpose (Banton, 2020). Different industries would require different raw materials for their purpose, which can vary from meat (for food industry), minerals (for heavy industry) to wood (for paper industry). On the other hand, finished goods are products that have gone through necessary production method or can also be bought directly from an external supplier (Bragg, 2019). In contrast to raw material, these products are ready to be sold to the customer at any time the later place an order. Some examples of finished goods are gasoline, clothes and computers. Company can also have work-in-progress inventory, which are partially finished goods that are pending for further treatment before putting to use (Hayes, 2020). In one way, these are raw materials that have been processed halfway, for example, iron ores that have been melted and are waiting to be casted into a mechanical component.

In Kokemuller's point of view, there are three main benefits for a company to maintain a healthy inventory at their own premises.

First and foremost is to increase significantly customer satisfaction. In the end, regardless of business type and industry, a company's ultimate target is to provide their product and service on time and on par with customer's requirements. Only through satisfying target customers that a company can generate revenue and compete for market share with others. For companies who offer a low number of products and product range or (luckily) in control of a consistent customer demand, the risk of not fulfilling customer's orders is relatively low. However, in stark contrast, for those who need to manage a huge variety of products (retailing business for example) with an unpredictable demand, the uncertainty is remarkably notable (MacCarthy & Brabazon, 2008, p. 2). This factor is crucial important, especially when considering the ever-demanding market and customer. One of the most used and most effective way to reduce the risk significantly is to carry enough stocks in the required distribution centers. By keeping the stocks on shelves and ready to be delivered at any time, loss of sales due to late delivery can be negated and avoided, especially during peak demand, high season or urgent requirement from the customer.

Secondly, with the help of inventory, companies can leverage the huge advantage of economies of scale in order to gain a competent cost saving. According to Amadeo (2020), economies of scale are cost reduction that can be achieved when enterprises expand and boost their production. In Kenton's point of view (2021), one of the reasons why economies of scale can work is because of lower variable cost in general through a stronger negotiating power with suppliers. In addition to that, internal function costs and fixed costs are also being spread among more units (Kenton, 2021). In case of inventory, by allowing more products and raw materials to be purchased and stored in the warehouse, companies can achieve a lower cost-per-unit when buying bulk orders from suppliers. Warehouse capacity (such as warehouse space) and administrative cost are also being used and utilized more efficiently. If managing well, such measurements can in the end, reduce production cost and improve company's profit.

Finally, a healthy inventory will also support company's daily operation and special projects. For instance, visual merchandising can greatly benefit from the mentioned

resource. According to Dennysal (2019), visual merchandising (in retail business) is an exercise where companies need to decide how to arrange the floor plans and three-dimension displays to encourage and motivate the customer to make a purchase. In addition to utilizing colors, lightning and proportions to design an attractive display, visual merchandising also relies on psychology and neuroscience to drive customer's behavior and feeling toward the target objective. Thus, it is believed that visual merchandising is a blend of art and science together (Dennysal, 2019). With the help of inventory availability, the store design team would have more options and more flexibility in planning the desired layout. It will also be less challenge for the team to fulfill the shelves with all the company's product ranges, which in the end, creating an impression among customers that the company is offering a wide range of product and diverse portfolio.

However, as every silver lining has a cloud, there also disadvantages that would require company's wise decision. According to Leonard (2019), there are several cons for a company when holding inventory. Firstly, the company would need to consider the costs that are generated from the inventory. The most obvious costs are direct costs, which, for example, are storage and human resource cost. The more inventory the company has, the more space and personnel it requires. Thus, the more budget is demanded. However, there are also cases where companies choose to lease the whole warehouse instead. In this case, these costs are now considered as fixed costs (rather than variable costs) and are calculated based on the contract with the service provider. In this case, as mentioned above, the company would need to utilize the economies of scale as much as possible to spread the cost among the products so that cost-per-unit can be greatly reduced. It is also worth noting that personnel cost does not only consider people who work in the warehouse, but also the ones who manage the inventory. Company with large scale and complex inventory will need to put expertise and experienced personnel(s) to control and be in charge of the inventory. The mentioned person should know what products need to be stored in the warehouse and at what amount of stocks are suitable for the business so that excessive stocks can be prevented, especially for low running products. This practice is to ensure that only an appropriate amount of capacity is tied up to the inventory without harming the cash flow of the entity. For example, holding too much unrequired

inventory can delay and prolong the return on investment. This will prevent the company to allocate the capacity to other projects or business, which can accrue (usually unseeable) indirect costs. In some cases, these stocks may become obsolete (apparels that are out of season), which may even require additional budget to resolve. If possible, companies still can try to distribute these stocks to the market, for example, through sell-off activities with big promotion and highly reduced price, which will decrease the profit-per-product. However, in case the attempt is unsuccessful, or products are unsellable (foods that are expired), companies may need to find ways to recycle the products or worst case, scrap the inventory. When holding inventory, it is also a wise choice for the company to consider insurance for the inventory to recover in case there are unexpected events happened, such as robbery, accidents (fire) and force majeure (natural disaster and pandemic).

2.2 Customer Service Level

One of the most important factors in ensuring a firm's long-term and sustainable is customer satisfaction. Customer satisfaction is used to evaluate whether the products or services provided by a company meet customer expectation and anticipation or not (Kierczak, n.d.). To measure the mentioned element, Customer Service Level (CSL) is put into used as an effective KPI.

According to Copley (2017), one of the most important reasons why a high achievement in CSL is so important to a company's successful is because it is an evident signal of consumer repurchase intention and longstanding customer loyalty. It is not hard to understand that when a company provide a solid purchase experience for its customers, there will be a higher chance that customers will come back for more for the company and thus, building a strong and loyal customer base. Based on an infographic compiled by Saleh, it may cost as much five times to attract a new customer than to keep an existing one. This compilation also states that the probability of selling to an existing customer is 60 to 70 percent, which is three to fourteen times higher than selling to a new client.

Based on a study by Nielsen (2012), 92 percent of consumers confirm that all forms of advertising cannot compared to suggestions and recommendations that received

from family and friends. With such powerful word-of-mouth effect, companies with good reputation in satisfy customer's requirements can acquire several leverage advantages, not only in bringing in additional valuable sales revenue (tangible asset) but also in establishing a key differentiator to standout in nowadays' highly competitive business scene (intangible asset).

Thus, coming up with a way to measure CSL is a must for a company to guide its business on the right direction. Depends on different services and products that are offered to customers, enterprises may have different methods to determine and evaluate their customer's satisfaction degree. These methods may vary from collecting customer's feedback (which is highly suitable if customers are end users due to large data pool) to a more mathematical and formula-based calculations (the percentage of IT tickets can be closed in one month, for example). However, for our study case where the business sector is an aftermarket service with a supply chain point of view, we will focus purely on customer order fulfillment (or fulfillment rate) as a method to measure CSL. This approach was also chosen as the way for company X to calculate and weigh its CSL. In its most simplistic form, fulfillment rate is the percentage of successfully delivered order lines in a period of time. The formula to demonstrate order fulfillment is as below:

$$\text{Fulfillment rate} = \frac{\text{Successfully delivered order lines}}{\text{Total order lines delivered}}$$

In this formula, an order line considered successful when the order is delivered with the required Qty, at the right time and at the right place. It is also worth noted that the number of successfully delivered order lines and total order lines should be counted in the same period of time. This period, depends on the objective of the analysis, may vary from one week to one month or even one fiscal year.

2.3 Demand Planning and Forecasting

To ensure a long term and sustainable success, no one can deny that building a detail business plan is one of the most essential steps. Regardless of the type of business

we are looking at, all of the business plans should be based on forecasting. From the sales and market point of view, this forecast can be forecast of total gross sales for the fiscal year, forecast of newly participating customers or forecast of profit generated from upcoming promotion campaign. However, from the supply chain point of view, one of the most important forecasts to guarantee a glitch-free operation is demand forecast, which is highly tied with demand planning process.

The objective of demand planning is to foresee and predict the future demand for the goods or services provided by the company. Through anticipating such demand beforehand, enterprise can carefully prepare and satisfy the demand in the most efficient way without bringing in unnecessary costs that can damage their cash flow and profitability. In short, demand planning is to ensure company fulfill the supply chain's utmost important requirement: to bring in the products or services according to customers' need while maintaining the occurred cost as low as possible (John Galt, n.d.).

With the mentioned objectives in mind, there are specific roles that the demand planner (who is responsible for demand planning) need to cope with. In an article by Bryce, the author has explained several roles and functions of a demand planner in a B2B service.

One of the most prominent roles discussed in the article is that a demand planner should collect and process market intelligence. Market intelligence is the information gathered by the marketing team about a specific market or industry that the company want to (or plan to) involve and expand their market share. This information may involve in studies about market situation, potential and existing customers, challenges, competitors and growth opportunities. With the help of a good market intelligence, company can make wise business decisions and develop a competitive market strategy (Riserbato, 2020). Even though market intelligence could involve a vast variety of types of information, from the writer's point of view, the most relevant ones for a demand planner's work are macro trends, product portfolio and channel marketing.

According to Burch (2018), a macro trend is a directional shift and development that will influence a large population (usually on a global scale) and often last for 10 years or more. There are multiple ways for a company to perceive and identify the macro

trend. According to Ross (2019), one of the methods is keeping track of government policies. As stated by Williams (2019), through regulations and permits, government can greatly impact the economic scene. Laws such as minimum wage and required permissions for a specific process may cause additional cost and unnecessary burden of bureaucracy, which create a great barrier for companies to cope with, especially for new players and entrepreneurs. In addition to that, setting high taxation and high artificial interest rates can discourage enterprises in investing and creating more businesses that in return, creating more jobs for the communities (Williams, 2019). With too much interference of government and establishing of bad policies on the business, huge disturbance in the economic, in some cases crisis, is unavoidable. In contrast, with good policies and high discipline management, government can work as a market catalyst to stimulate and encourage the economy grow in a positive direction. As macro trend is a mega movement which heavily affects all aspects of daily life and business, it could both act as an opportunity or a risk to a company's fate. If the company can take advantage of these changes and leverage them to make them outstanding compare to the competitors, such company can gain huge benefits and sustainable their growth remarkably. On the other hand, those companies who cannot recognize or adapt the macro trend can significantly slow down behind and ultimately, without necessary reform, meet their demise. Thus, being prepared for macro trends can ensure a good development for the companies. One of the examples how a demand planner can work with marketing team to utilize macro trend is in automotive industry. Through aiming at a more sustainable and more environmentally friendly planet, governments have been implementing stricter requirement in environmental regulations in recent time, especially in carbon neutrality. With such megatrend, a demand planner can coordinate with marketing team to draft a phase-out plan for diesel-engine-related products and prepare for an increase in consumption for greener and less emission products, such as battery cells for electric vehicles.

Besides macro trends, marketing team is also a good source to provide market intelligence related to product portfolio. While macro trend is a high-level information (which will provide a long-term guidance and strategy for a company for years to come), product portfolio and channel marketing are more operational-level information that is fundamental for both marketing and demand planning team to

achieve the highest customer service level without compromising enterprise's cash flow due to excessive accrued cost. According to Bragg (2020), a product portfolio is an assemblage of all product and service that a company provide or offer to the customer. As a tool for the company to view and analyze the whole product range, a product portfolio should consist of all products' categories, different product lines and ultimately, each of the individual product (Bhasin, 2020). Examples of product portfolio can be seen below in Figure 2 and Figure 3, which demonstrate a lineup of an automaker and a guitar company.

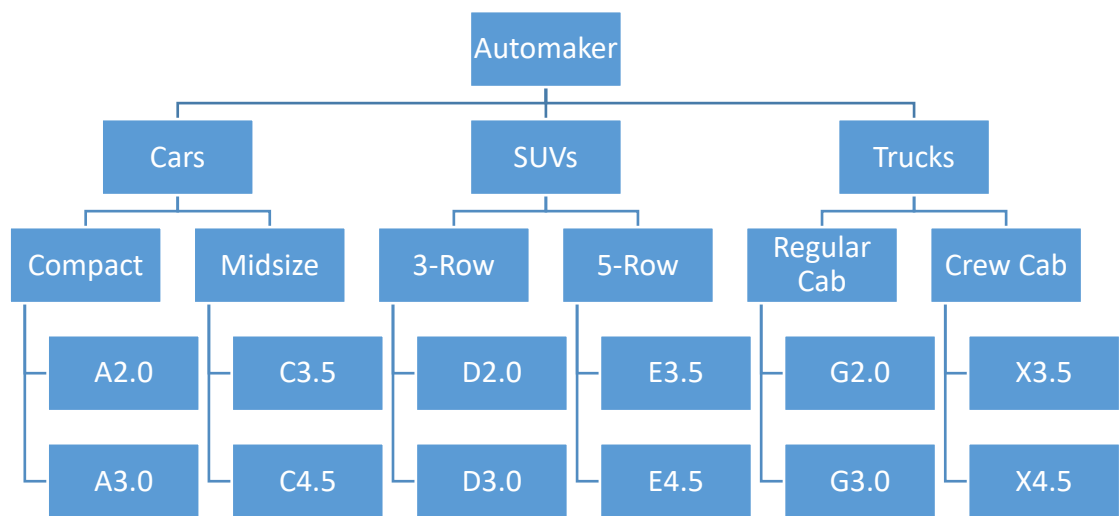


Figure 2. Product portfolio of an automaker

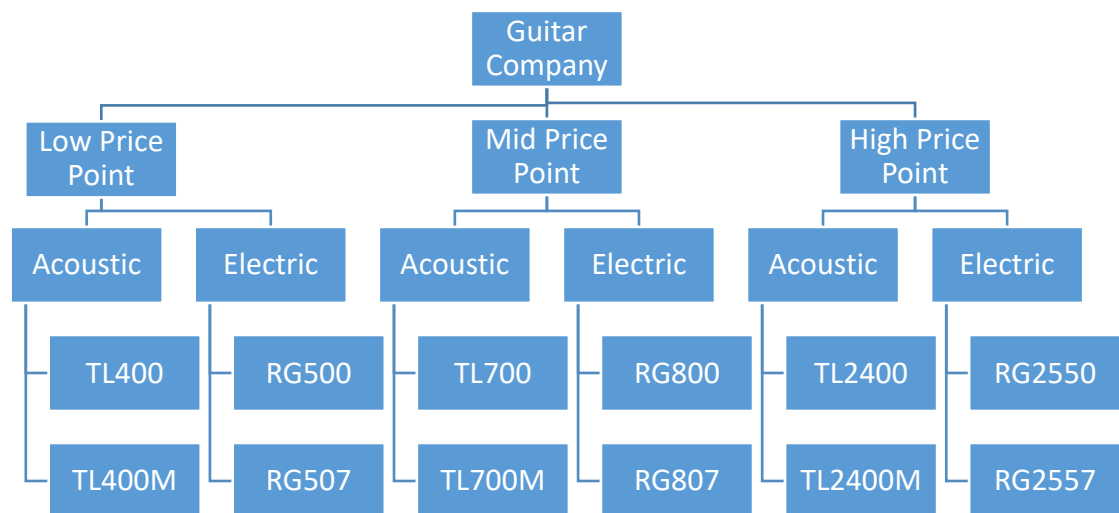


Figure 3. Product portfolio of a guitar company

From the two figures above, we can see that each product portfolio can clearly show the full product line-up of each company. In addition to that, we can also recognize that companies can find different ways to break down their products in different levels and categories. In the case of the automaker, at the first level are the types of cars (cars, SUVs and trucks) offering to the customer. After which, each type's class is identified (compact and midsize for cars, for example) before each particular model comes in the picture. On the other hand, for the guitar company, the products are firstly categorized based on their price range, which range from low price point all the way to high price point. Only then, types of the guitar (acoustic or electric) are displayed in the portfolio before each particular model is presented. Thus, depends on the business segment and how the market behave, different companies can have different ways to build their product portfolio to make it most suitable for their management and analysis.

There are multiple benefits for an enterprise to prepare and build a clear product portfolio. By combining a structural product portfolio and BCG matrix, sales and marketing team can easily identify and have appropriate strategies for each product. According to Hanlon (2020), a BCG matrix is a multi-application analysis (which means it can be applied not only to product analysis but can also be used for customer analysis, for example) developed by Boston Consulting Group during the 1970's. Based on

the basis of relative growth rate and market share, a BCG matrix will divide the target sample into four quadrants, which can be demonstrated through Figure 4 (Hanlon, 2020).



Figure 4. BCG matrix

Figure 4 shows us the name of each quadrant, which are stars, question marks, dogs and cash cows. Through categorizing the products by using BCG matrix, marketing team can assign relevant strategies for each quadrant. For example, Dog products are the ones with low growth and low market share at the same time. Usually, they will not generate much revenue. Thus, for this type of product, company will try to simplify and avoid allocating as much capacity as possible. On the other hand, Cash Cow products have high market share and low growth rate, which are typically market leaders that have a strong consumption base. These products are the backbone that can ensure a healthy and positive cash flow for the company to finance most of its expense, research and development and dividends to shareholders. For Cash Cow

products, company are recommended to maintain a stable investment to passively “milk” these products. With a high market share, Star products can also bring in good income for the company. However, with a high growth rate, they also require high investment as well. If the company can continue to invest in these products until they mature and the growth slows down, Stars can gradually become company’s additional Cash Cow product. Finally, Question Marks have high growth rate but little to no market share. Due to this characteristic, company need to make decision whether to continue to invest in Question Marks so that they can steadily become Stars (and ultimately Cash Cows) or to drop the business and sell to others (Martin, 2020).

These strategies will be the main background for the planning of a demand planner. For Cash Cow products, since they are the foundation of the company’s positive cash flow, the demand planner needs to make sure most of these products are maintained as Make to Stock and forecast should be synchronized tightly with the sales’ business plan. In addition to that, there should be an ample amount of safety stocks for these products as well. There are two main reasons behind this approach. Firstly, safety stocks can help the company cover all the requirements from the customers as much as possible, even when receiving peak, unexpected or urgent orders from the consumer side. However, these cases should be minimal as Cash Cows products have already matured and well-established on the market. Thus, we should expect a stable consumption for a long period of time. Secondly, due to this steady and long-term demand, Cash Cows would carry the least amount of risk when holding safety stocks. In contrast, Dog products, with low growth rate and low market share, will typically have a sporadic and unpredictable demand from the market. With such characteristics, these products should be maintained as Make to Order (if possible) to make sure no excessive amount of stock are being carried in the warehouse. Stocks without a clear plan to clear and consumed in a foreseeable future are not healthy for not only supply operation, but also to company’s financial condition (as has been pointed out in the inventory section). For Question Mark products, as stated in the name, the game plan will be a little bit trickier. Since the final decision whether these products should receive additional capacity and investment to evolve itself to a more prominent state or whether they should be dropped out of the product line-up, the demand planner should pay close attention to these products and collect related

market intelligence on a regular basis. The goal is to make the adjustment to the planning as soon as possible when the final decision of Question Mark products is given out. The follow-up action can be ramping up (if the Questions Marks are allocated more capacity) or phasing out (if the Question Marks are withdrawn from the market) the inventory accordingly. Either way, the sooner the changes are reflected and communicated to the supply chain side, the more efficient the operation is. The same strategy should be applied for Star products as well. Tight coordination between demand planning and marketing team is strongly required so that supply chain can support the market team as its best to increase the product's impact on the business scene. Furthermore, a flexible approach should also be favored to adapt the actual growth rate of Star products. An example could be when the company decide to further increase the market share through marketing campaign and promotion. Such activities should be informed to the demand planner in advance (at least according to lead time) so that necessary stocks can be prepared on time to ensure sales opportunity is not missed. Ultimately, as mentioned above, when the market is saturated, Stars can gradually become new company's Cash Cows. Hence, the same strategy can be applied again when the time comes.

One of the other roles is the demand planner needs to work out with all sales representatives to consolidate the sales pipeline. A sales pipeline is a data picture which can help a company visualize different stages of their sales process and clearly present them what are their prospects and opportunities in each stage. From a well-constructed sales pipeline, the sales department can view how many deals each salesperson are expected to close in a period of time (could be a week, a month or a year depends on the scale of discussion) and the sales current situation compared to target revenue (Kulbyte, 2020). As mentioned, a sales pipelines consists of different stages of sales process. Based on an article on Freshworks ("The Complete Guide to Building a Sales Pipeline", n.d.), there are a total of six stages in sales pipeline, which can be demonstrated through Figure 5.

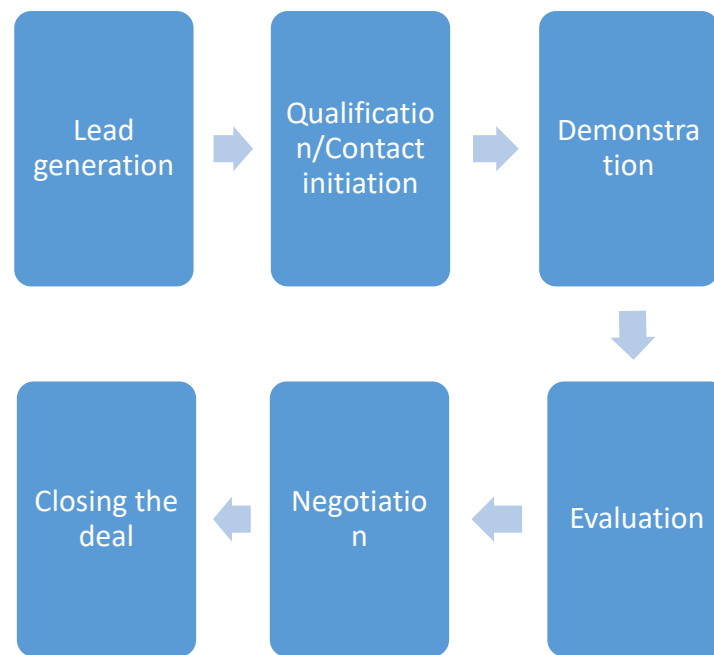


Figure 5. Stages of a sales pipeline

In the above article along with another one (“The Ultimate Guide to Sales Process: What, Why, How & More!”, n.d.), Freshworks also deeply discussed the activities involved at each stage. With Figure 1, we can see a step-by-step development throughout the whole sales process, which all begins with lead generation (or also known as prospecting). At this stage, through analyzing ideal customer profiles and understanding the target market segment of company’s product or service, sales department can identify who are the most potential customers (also known as leads) in a sea of buyers. In addition to that, the company can also attract more leads through organizing campaigns and promotions to increase company’s brand awareness. After the first stage, such leads (along with their basic information) should be recorded and sales should initiate contact with those potential customers. The purpose is to identify what are the customers’ requirements and thus, deciding whether company’s products or services can solve customers’ pain point or not. After which, if the leads are convinced with what are introduced to them, a demonstration should be organized so that customers can understand how they can employ the relevant features and specifications to meet their needs and overcome their problems. An evaluation period should be given to customers so that they can have time to do testing and experiment with the products before reaching the final negotiations, in which several aspects need to be agreed upon between stakeholders. These aspects

can vary from pricing, terms of usage to warranty and aftersales support. Finally, the deal will be closed with final contract be signed by both sides.

Even though at first sight, these processes are heavily market-biased and totally not related to supply chain topic, it is an important requirement that the demand planner should be kept updated closely on the progress of the sales pipeline. Unlike the majority's misconception that forecasting can be done solely on complex mathematical algorithms combined with a huge load of data (also known as big data), this method is proven to be impractical for majority of the cases, even for multinational corporations. The reason for that is because this approach requires an extensive capacity investment in terms of human resource (highly trained and experienced personnel) and data management system (to run complicated simulations), which in the end, the return of investment may not be favorable for the company's business result (further problems tied to this approach will be discussed on the later of this thesis). However, on the other hand, by only consolidating and receiving updates on the sales pipeline, the demand planner can already analyze the sum of required products from the market side for a specific period.

In addition to that, instead of straightly follow the plan from sales and marketing team, a demand planner should also act as a "so-called" consultant to evaluate the received business plan. In fact, having a diverse approach in problem solving and discussion is a huge advantage for the team, especially in pushing the limit and analyze all the possibilities. According to Robinson (2020), diversity in workplace can increase the exposure to different perspectives and opinions. This is one of the main reasons why company encourage to have great synchronization between members with differences. In this case, the difference is coming from different in skills and background between supply chain team and business team. The demand planner, who has a wide view of planning function, can provide valuable feedback to planning related topics and in some cases, challenge the business team if necessary. By collecting and analyzing historical sales, the demand planner can compare with the overview planning (which is compiled from sales pipeline and marketing plan) to determine whether the figures are feasible or not. In some cases, the sales target for a product range is really ambitious (double compared to last year revenue for instance), the demand planner should bring up his or her concern and challenge the business team on the feasibility

of the plan. If the demand planner ignores such factors and straightly follow what the business has been scripted, excessive inventory may come out as the result. The demand planner can also enhance the planning scene with their expertise in inventory and product supply management. With their know-how in this area, they can give a heads-up to the sales and marketing team as soon as there is any product range in critical condition.

Being equipped with a variety of information, which consists of both future game plan (through market intelligence and sales pipeline) and historical sales data, the demand planner should already have a well-established information flow to draft a valid forecast, at least for short-term period (6 to 12 months). At this stage, it is important for the demand planner to involve manager level in the discussion. Being presented with the whole operation and inventory planning, the manager can have a comprehensive view of the planning and operation, which can support to drive a wise strategy. The discussion should also include controller and financial department so that necessary investments (such as stock preparing activities) and profitability of the planning can be evaluated and assessed to ensure a continuous cash flow for the company.

Carrying a various of roles in the organization, it is hard to deny a fact that demand planning can gain a big interest for the company. According to Ostdick (2018), there are three main benefits coming from a well-organized demand planning.

First of all is the efficient in supply chain operation, especially in terms of production and transportation planning. As discussed previously, after collecting sufficient information from all of involved stake holders, a demand planner can form a future forecast, which can be used to communicate accordingly with factories and/or suppliers (which depends on the outsource strategy of the company). Through the received forecast, production side can, at least, estimate the requirement for each specific SKU, especially for seasonal and marketing-campaign-required products. With such information, production side can prepare necessary raw materials and sub-components beforehand. Thus, not only a more optimized production scheduling can be set up but also the production team would be more flexibility to adapt changes happen at market side. The same improvement can also be seen in transportation sector where a consolidated shipment is greatly preferred to multiple shipments (with the

same transported quantity and same delivery route). With an ahead preparation from the production side, the needed products can be prepared for shipping in full quantity to utilize transport material (pallet or intermodal container) as much as possible. Such cost saving activities, through economies of scale, can help the company save a great amount of transportation cost. This financial benefit is even more emphasized for company who operate in special requirement goods (such as dangerous goods) where goods cannot be consolidated with other types of products. For such case, the company have to pay for the whole container load even when the container is not fully used. Arranging shipments in advanced can also smoothen the operation, especially during holiday seasons and warehouse down time period (inventory counting for example), in which most of the time, all warehouse activities (including inbound and outbound) are suspended and delayed. This factor is considerably important for urgent shipments or year-end closing, where business team will try to get as much required stocks as possible to reach sales quota and contract.

Secondly, demand planning will also put the company in the driving seat of inventory related topics. As discussed above, through close coordination with production side, material availability of required products is ensured. Therefore, unnecessary stock-out situation can be prevented. Difficulties from production side (such as bottleneck issue) can be communicated promptly and transparently to the demand planner and market team. By doing so, market team can evaluate the situation and react quickly to those difficulties to overcome the struggle. For example, if production lead time is prolonged, the demand planner can discuss with business side whether a new delivery schedule for the affected products can be accepted or not. If not, the uncertain product can be alternate with a more supply-reliable product range. In addition to that, the demand planner can also analyze (by comparing forecast and real market consumption) and collect feedback from the sales team to determine which product category is behind target. With this feedback, the demand planner can closely monitor those categories to modify the forecast so that factories and suppliers can adjust the production line as well. In the end, not only redundant stocks can be avoided at raw materials and components level but also at finished product level as well. Preventive of excessive stocks, particularly for finished products since they have lesser chance to be reused for other purpose, is crucially important in maintaining a healthy

inventory. Inventory related cost can, therefore, be reduced and controlled effectively.

Finally, a good demand planning can also drastically improve customer service level. As every product or service requires a specific lead time to prepare, having a proper forecast can help the company prepare enough stocks to deliver the customer at the right time and at the right place. Thus, tangible value, such as gross sales and related administrative cost, can be achieved according to company's target. In addition to that, intangible values can also be granted. These values, as discussed previously, can ranging from company's reputation to leverage advantages over competitors.

However, achieving all these mentioned benefits is not an easy task. There are numerous challenges that a demand planner will face when executing all the necessary roles. In an article written by Fritsch (2015), the author has stated some main dilemmas when performing demand planning.

Firstly, monitoring all the products with their stocks level is a huge challenge that can occur at all level of corporations. For small and medium scale companies, even though the number of products can be short in list, the problem can arise if the company do not have a proper tool to receive the goods accurately and provide an up to date view of the current stock situation. The mentioned tool can be an ERP system, which are expensive for those companies to invest and get a return of it. On the other hand, for large scale companies who have more capital to invest in such digital system, the problem can lie on the large amount of part numbers that the demand planner needs to take care of. With such huge information, it is one of the main concerns for a demand planner to keep tracking of changes in the inventory, especially when companies have several distribution centers located in different locations.

Secondly, not only the demand planner has to be in control of current stock in the warehouse but also, he or she would need to ensure the forecast required stocks are available at the right time with the right quantity. This is extremely challenge since no supplier or production line can promise to operate at a one hundred percent production rate. Numerous problems can arise at production side (due to both subjective and objective reasons), which in the end, can create potential of loss of sales due to delay in delivery to end customers. Just in Time methodology (or lean

manufacturing) has been popularized and well-known along supply chain management experts. The core of this philosophy is to order and prepare the goods only when there is a firm requirement received from the customer and not before that (Carlson, 2019). Even though this methodology provides a relatively low inventory related cost (no requirement for beforehand preparation and less chance of dead stock) and healthy cash flow (less capacity is tied to inventory), it is proven to be extremely risky, especially when there are high uncertainties coming from production side. Thus, normally, an amount of safety stock is required for fast running and important products in case vendor lead time is not met as contracted. However, determine a sufficient level of safety stock would involve a deep understanding in the operation scene of both supply and demand side.

Finally, the demand planner will also find struggle in planning and forecasting itself. For existing products, this may due to the high inconsistent in consumption from the market. In case the product portfolio is a huge compound of product groups and part numbers, setting up and maintaining logistic-related information, especially at part number level, could be a difficult puzzle to solve as well. Table 2 shows a few examples of set up that the demand planner needs to take into consideration for the most optimized operation.

Table 2. Examples of logistics set up

| Logistic related information | Remark |
|------------------------------|--|
| Stocking policy | Make-to-stock or Make-to-order is the most suitable for a part number |
| Safety stock level | Involve a deep understanding in the operation of both supply and demand side |
| Vendor information | Ensure correct vendor information is maintained |
| Vendor lead time | Should include buffer time to compensate for potential delay at source |
| Shipping route | The most economic shipping route |
| Standard mode of shipment | Road, air or sea freight would be the most suitable for operation |

As can be seen, the information can cover a wide variety of elements and factors. In addition to that, these set up should be proactively maintained and ensured that the information is up to date. For example, the demand planner should review and if possible, align the stocking policy with market team on SKU level. As business can change from year to year, the review can be carried out on annual basis to reflect the current business situation. On the other hand, new products tend to lack of necessary information such as historical sales data, which is one of the most useful information to form future forecast. For those new products, it would require a high coordination from demand planner with involved stakeholders to prepare enough stock for initial order from the customer.

3 Methodology

The objective of this thesis is to compare the difference in operation after restructuring the demand planning and forecasting process and how effective the project is. As have been discussed previously, since the writer has the opportunity to obtain necessary resources, both quantitative and qualitative research approach were chosen for this thesis.

According to Bhatia (2018), quantitative research is a great support for researchers in getting an objective and definite answer. With the help of company X in approving and providing raw data for analysis purpose, the qualitative method should be considered as a good choice. However, to protect the firm's identity and prevent its confidential information from being disclosed, agreements have been made in exchange for support from company X. Most obviously, the company's real name will not be stated and instead, will be anonymously called as company X as we have been using so far. Since the raw data is heavily business oriented (which is normally sensitive regardless of company), an exact copy of data is not allowed for the thesis. Instead, the data needs to go through several modifications and adjustment. To assure the data is still usable for analyzing and reporting purpose, such changes should be done rationally with a defined factor, especially in terms of scale and value of data. By doing so, in the end, the data still can reflect the general situation of the business, which increase the effectiveness and accuracy of used data, without leaking company's confidential information.

To summarize, our qualitative research will be done like the following steps. First is to collect essential raw data for the study. Secondly, as has been mentioned previously, such data will need to be modified rationally to keep the original meaning of the data without disclosing company X's business data. Thirdly, data will be analyzed so that situation of each period, especially before, during and after the restructuring of demand planning and forecasting process, can be compared and visualized easily. Finally, conclusions can be made based on the analysis to answer our research questions.

As has been mentioned previously, the result of the restructured process should not only be determined simply by the statistics, but we should also look into human factors, which is extremely complicated to compute with any kind of formulas or numbers. Thus, in parallel with quantitative research method, qualitative research method will be conducted as well. The purpose of using qualitative method is to learn involved stakeholders' opinion about the implemented project. To be more precise, we will conduct interviews with members of related departments regarding of the demand planning process (both before and after) and examine their feedback in a hope that the whole view of the project can be created.

There will be four main steps when proceeding qualitative research method. Firstly, a list of participants needs to be created. It is utmost important that the participants should have knowledge or involvement regarding of the research topic, so that collected data is relevant for the study. Secondly, to make the most out of each interviewee, the interview should be conducted individually at their most comfortable time. By doing so, each question can be examined and dig deeply as much as possible to get the whole aspect from the interviewee's point of view. In addition to that, influence from interviewee on each other can be fully avoided as well. Thirdly, the interviews will be fully transcribed into text format. And finally, necessary analysis should be done based on the interviews and relevant verdicts can be concluded to enhance the view of the study.

Since interviews would be the main data for the qualitative research, there are points that need to be considered when conducting the interviews. First and most important, the interviewer should ensure that all the questions are clearly understood by the interviewees. To avoid irrelevant and out-of-topic answers from the

interviewees, questions should be phrased clearly in a way that no other meaning or interpretation can be extracted from the questions themselves. If in doubt, clarifications should be made before and during the interview. According to “General Guidelines for Conducting Interviews” (n.d.), during the interview, questions should be asked one at a time to avoid confusions and content of the questions can be discussed as much as possible. In addition to that, to avoid influence on the interviewees, interviewer should be as neutral as possible. In other words, interviewer should avoid showing strong emotional reactions and using words that might affect the outcome of the questions. Between major topics, there should be a smooth transition as well by using phrases like “Since we have been discussing on (some topic), I would like to move on to (some topic)”. Finally, the interviewer should always be in control of the interview. Encouraging for involvement of the interviewees is a good thing to do during the conversation. However, also according to “General Guidelines for Conducting Interviews” (n.d.), the interviewer should also know when the interviewees are heading to different subject and lead them back to the original topic.

In this particular case, to make the qualitative research methodology relevant for our study, interviewees are the ones who involve directly in the project and get the immediate experience when the effect of the project starts to “kick-in”. Table 3 below will summarize the participants of the conducted interviews.

Table 3. Summarize of interviewees

| Interviewee No. | Department | Role in the department | Remark |
|-----------------|-----------------------|------------------------------------|---------------------|
| 1 | Supply Chain Planning | Demand Planning | Head of the project |
| 2 | Supply Chain Planning | Source Planning | |
| 3 | Trade Marketing | Head of Trade Marketing department | |
| 4 | Trade Marketing | Responsible for FMCG products | |

| | | | |
|---|-----------------|------------------------------------|--|
| 5 | Trade Marketing | Responsible for technical products | |
|---|-----------------|------------------------------------|--|

Depends on the location of the interviewees, the interviews were conducted either via video calls or face-to-face meeting. As part of the confidential agreement with company X and privacy request from the interviewees, audio recording was not permitted. Thus, all the interviews were taken note and transcribed directly during the interviews. As mentioned above, the interviews were conducted separately from each other. The interviewees have been informed about the subject and related information (such as timeline and duration of the interview) at least two weeks before the meeting. However, to avoid pre-scripting the answers and get the most honest opinion from the interviewees, detail of the questions was not communicated prior the interview. The subject of the interviews would be the interviewee's impression about planning operation before the project implemented. After that, their feedback and review about the project would be collected as well so that we can determine how successful the restructuring was from the operation staff's point of view.

4 Automotive Aftermarket's supply chain

As mentioned above, company X have a widespread of activities exist all over the world. This characteristic is even more emphasized when looking at the supply chain map of company X, which also includes AA business. Considering finished products, not only AA have their own production plants to produce their products, but they also outsource to numerous suppliers for multiple product categories. These owned production plants and external suppliers are locating all over the world. To even more complicating the situation, the demanding customers are also locating in different regions as well.

With such business set up, it is obviously a huge requirement for the supply chain to satisfy and adapt. If the logistics team do not resolve the problem well, especially the Economic Order Quantity (or EOQ) model, logistics costs (such as transportation, handling and inventory) may even overwhelm the allocated budget. A various of difficulties that the logistics team need to settle with can be demonstrated in Figure 6.

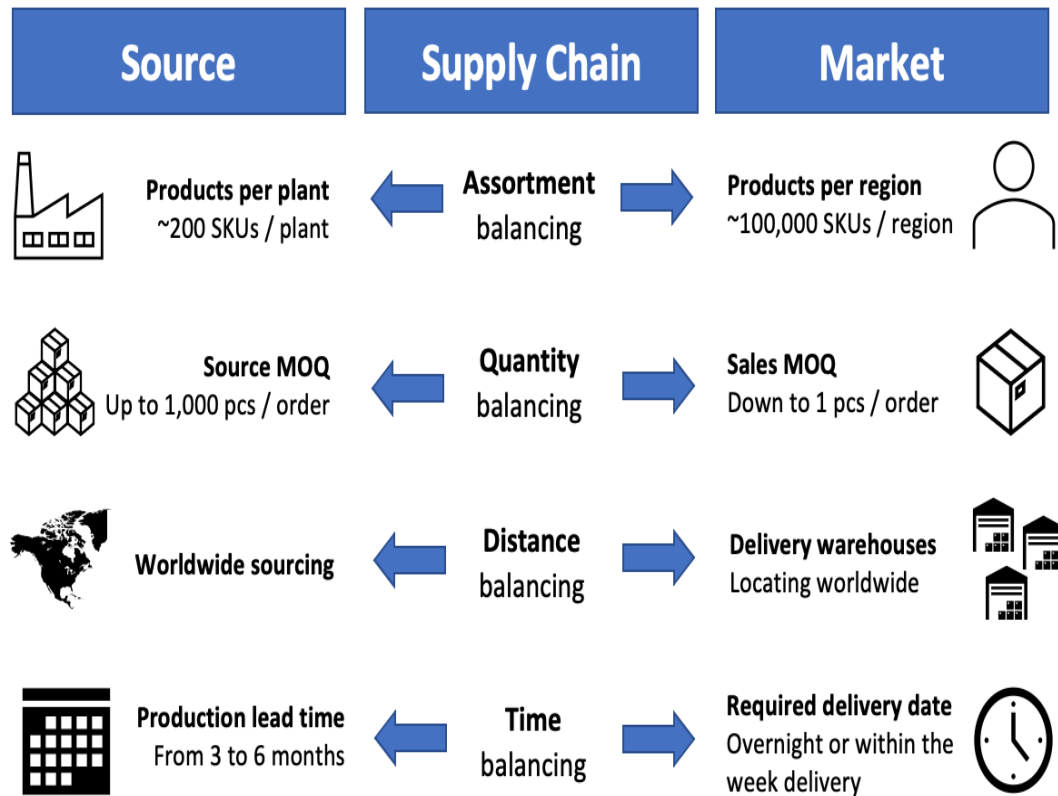


Figure 6. Requirements for supply chain

Due to factory set up, each plant is only specialized in producing a few numbers of product range. However, at each country, AA have to offer full product categories to the market to attract and collect all potential sales. This would require supply chain team to assort the SKUs to match each country's requirement. Since both the sources and delivery warehouses are located all over the world, supply chain team also have to set up the most optimal goods flow to reduce transportation cost as much as possible. In addition to that, to utilize the economies of scale, sources are designed (or contracted) for a worldwide consumption, not for a specify region or country. This means that the source's MOQ are usually way more than the demand of a country. For some SKUs, one order batch (according to source's requirement) could take a country ten years to fully consume the batch. Finally, even though production lead time can average from two to six months, the market would still demand for fast delivery, especially for fast moving goods. In urgent cases (vehicle off road for example), overnight (or express) delivery is also required as well.

To solve all this headache issues and compromise both source and market's requirements, AA have heavily built its supply chain based on one model called Hub-and-

Spoke. According to Sarma (2020), regarding the supply chain, a Hub-and-Spoke model resembles the wheel of a motorcycle (hence the name) where the distribution center (or the hub) is at the center while the spokes represent the exist delivery points in the system. Figure 7 can help us visualize the Hub-and-Spoke model more clearly.

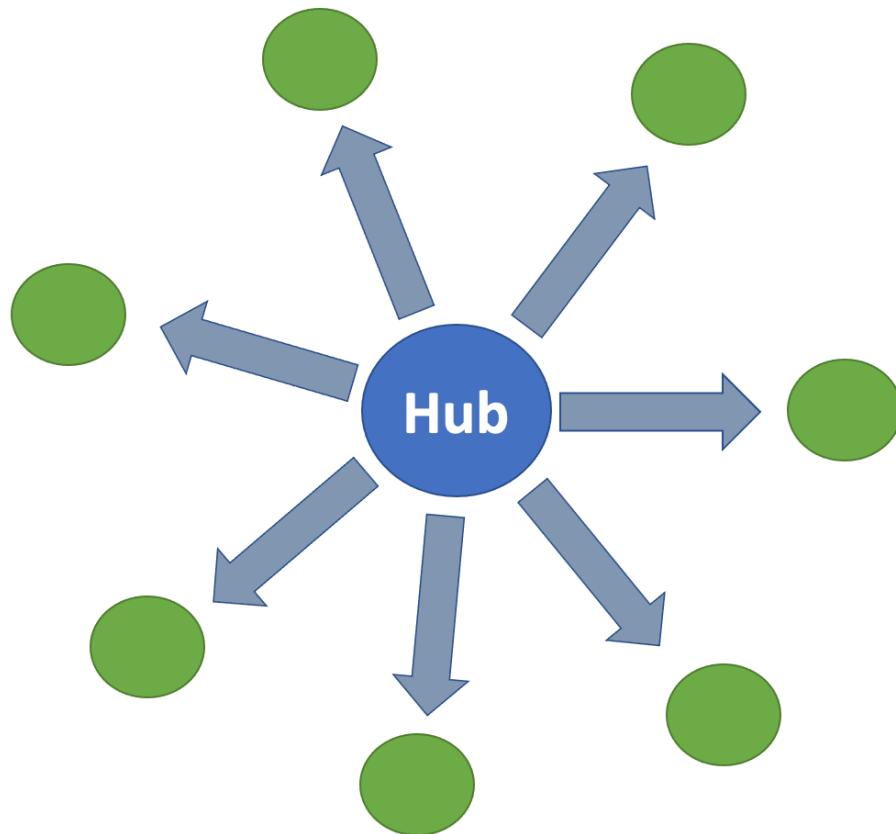


Figure 7. Hub-and-Spoke model

AA have also set up their supply chain similarly to this model. For each region, there will be at least a centralized warehouse that is placed strategically in the region. Such warehouse is called an Area Distribution Center (or also known as ADC). In addition to that, there will a smaller warehouse set up at each country, which is called a Local Distribution Center (or also known as LDC). Similar to Hub-and-Spoke concept, the ADCs play three main roles in AA's supply chain. First of all, an ADC needs to receive the products from the sources located in the same region. In this case, this ADC also functions as a Worldwide Distribution Center (or also known as WDC) for these specific products as other regions will receive these products from the mentioned ADC via their respective ADCs. This means that besides receiving products directly from the sources, an ADC can also receive the products from other ADCs as well. Secondly,

an ADC needs to consolidate as much goods as possible and deliver these consolidated shipments to the LDCs located in its region accordingly. In theory, the supply chain is set up to minimize direct delivery from source to the LDC as much as possible. Only in special cases, for example, there is only one country has demand for an SKU in the region, then that specific SKU will be shipped directly from source (or WDC) to the country's LDC. Finally, the ADC will also hold the majority of the region's inventory. Each country will try to minimize holding of goods as much as possible in its LDC. The LDC's inventory should mainly be (again, in theory) stocks for fast moving goods only, which usually worth around one to two months of stocks based on average consumption rate. Besides this, LDC will basically function as a bulk breaking point to deliver to specific customers of the country.

AA's supply chain map can be demonstrated via Figure 8 below.

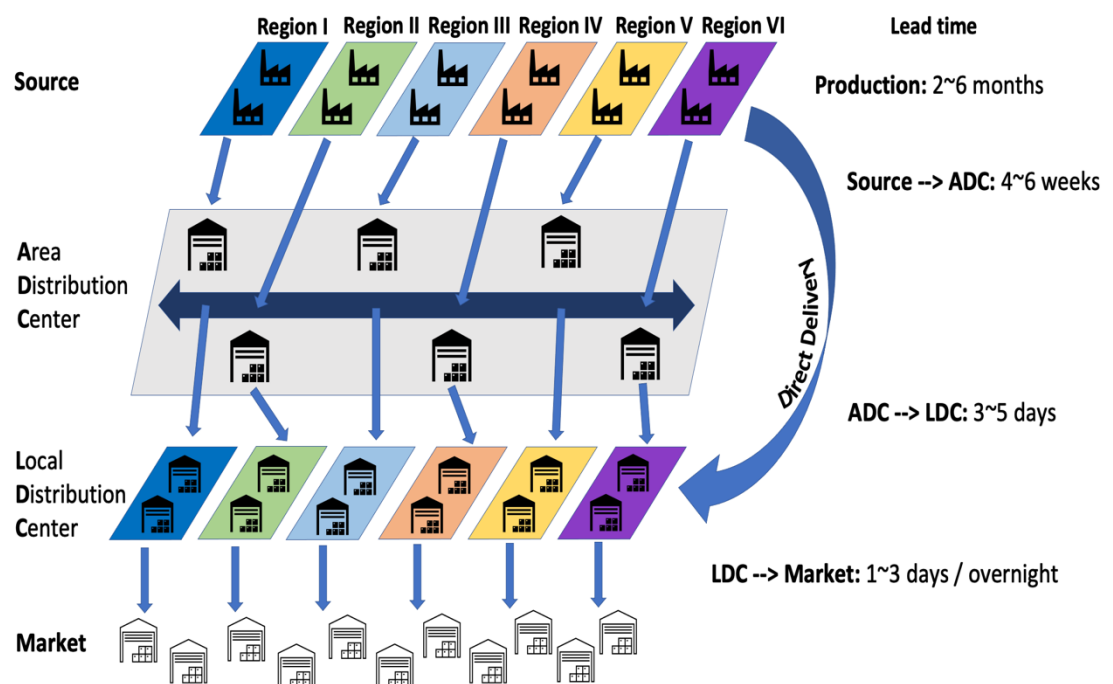


Figure 8. AA's supply chain map

With such set up, AA have found a solution for most of the problems in their supply chain. First of all, with the established connections between ADCs and from ADCs to LDCs, now the market can ensure to receive all the necessary products in the most efficient way regardless of source's location. In addition to that, special lanes for direct shipment from source to LDC for special cases (as mentioned above) are also ready. Secondly, since the ADCs receive orders from their respective LDCs and other

ADCs in other regions, the worldwide demand can be consolidated more easily. This would, at least, provide the source a general view about AA's consumption as a whole so that they can have a better preparation for capacity and raw material planning. Consolidating orders also solves the problem in balancing the source's MOQ (per order) and independent market consumption. The Hub-and-Spoke set up also minimizes handling and shipping cost for supply chain. Instead of shipping product by product to different LDCs, ADCs now can consolidate all the products from different sources and ship to LDCs per their requirement. Thus, more volume can be shipped out per shipment and less handling activities (such as breaking bulk) are needed. Thirdly, since the majority of each region's inventory is centralized at its respective ADC, the supply chain team can have a better view of inventory across the regions and implement necessary adjustments in inventory management. Finally, through stocking the products at ADCs, especially for fast moving goods, AA will faster adapt to demand fluctuation that happens at market level without compromising handling and shipment cost. Based on Figure 8, we can see that it will only take approximately 3 to 5 days for an ADC to ship the goods to its respective LDC. Thus, in case there is stock out situation occurs at LDC (due to peak order for example), the supply chain can react fast to the situation by replenishing necessary to the LDC via ADC.

However, as every coin has two sides, beside the benefits that were mentioned above, a Hub-and-Spoke model also brings some disadvantages for AA. The biggest problem is coming from the complexity in terms of administrative of different layers and different levels. To ensure the whole organization is well managed, AA have structured the departments to two main functions, which are called One-face-to-source (or also known as OFTS) and One-face-to-market (or also known as OFTM). Such organize set up by AA can be demonstrated via Figure 9 below.

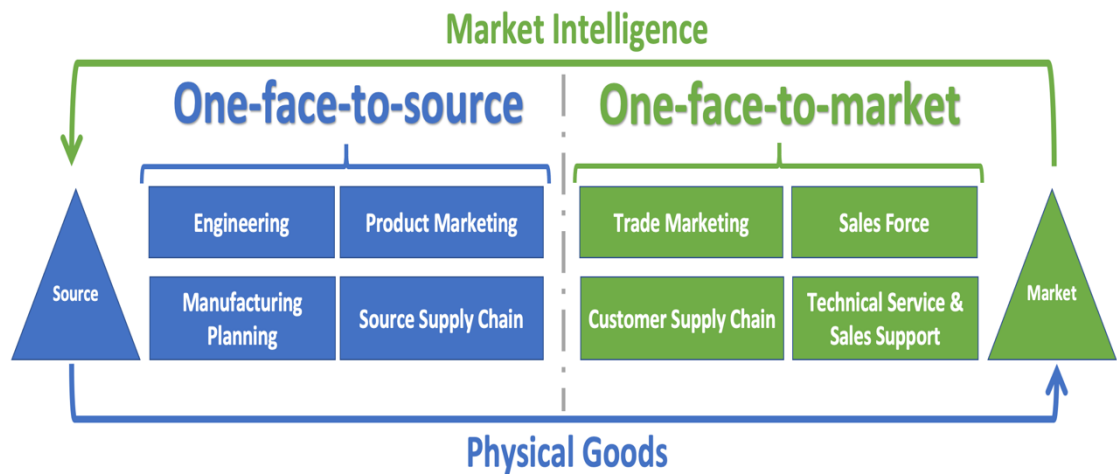


Figure 9. OFTS and OFTM structure

As demonstrated in Figure 9, each side of the organization has their own unique functions that the other does not have. In this case, for OFTS are engineering and manufacturing department and for OFTM are the sales force, technical service and sales support. However, in addition to these unique functions, there are multiple departments in AA that have their own team split up according to the involved stakeholders and responsibility. For example, the OFTS of marketing department (or product marketing to be more specific) would act as a business unit, in which they need to study what are the products that are required (through cooperating with OFTM side) at each market. Based on these requirements, they would work with potential source to identify the product specifications and determine the cost and price that these products can operate profitably at the desired market. While the trade marketing team (OFTM of the marketing department) have to strategize how to phase in these products (for example, through special discount) at the market. This would require them to have a tight connection with the sales force to build a suitable game plan for each program throughout the year. Such similar set up is also applied for the supply chain team, in which the team are split to OFTS and OFTM function as well. The customer supply chain (or demand planning), in addition to manage the inventory at their respective region, would also need to work closely with the trade marketing and sales force team collect necessary market intelligence and their campaign in the foreseeable future. Based on these forecast and current inventory level, the source supply chain (or source planning) will plan the orders accordingly to the sources and track these orders to ensure that stocks will arrive on time for market's requirement.

Even though both sides under the same department have different responsibilities and different stakeholders to work with, they would still need to work closely with each other to achieve the same goal. For the supply chain team, there are multiple KPIs in order to validate their operation. These KPIs can be ranging from specifically for each team only (such as forecast accuracy for demand planning and vendor backlog for source planning) to shared KPIs (such as overall logistics cost). However, in this study, we will focus solely on two main KPIs, which are inventory level and CSL.

For inventory, AA would mainly base on the inventory value and inventory coverage to evaluate their current inventory status. Inventory value will be calculated based on the formula below:

$$\text{Inventory value} = \text{Landed Cost} \times \text{Quantity}$$

In which landed cost is the production cost of the item (contracted price in case the source is an external supplier) plus costs such as handling, transportation, customs and duties and in some cases, currency exchange fees. However, inventory value should not be considered as the sole KPI to determine an inventory condition. For example, small cost products that have an excessive amount in the warehouse with no foreseeable plan to clear will always be more critical than those high cost products that have a healthy amount of safety stocks with a consistent consumption. Thus, beside inventory value, AA also use Total Coverage Time (or also known as TCT) as a second KPI to evaluate the current condition of inventory. The formula to calculate the TCT (in days) is as below:

$$TCT = \frac{\text{Reporting Month's End Inventory Value}}{\text{Average COGS (Cost of Goods Sold)}} \times 30$$

In which:

$$\text{Average COGS} = \frac{\sum \text{COGS for the Reporting Period}}{\text{Number of Reporting Months}}$$

$$\text{COGS} = \text{Landed Cost} \times \text{Sold Quantity (of a period of time)}$$

Besides inventory, AA also measure their supply chain operation based by using CSL. However, at AA, depends on different stage of the order delivering process, there would be different CSLs to be measured. To be more precise, there are 3 CSLs in AA, which are called CSL1, CSL2 and CSL3 respectively. The different in these CSLs can be demonstrated via Figure 10 below.

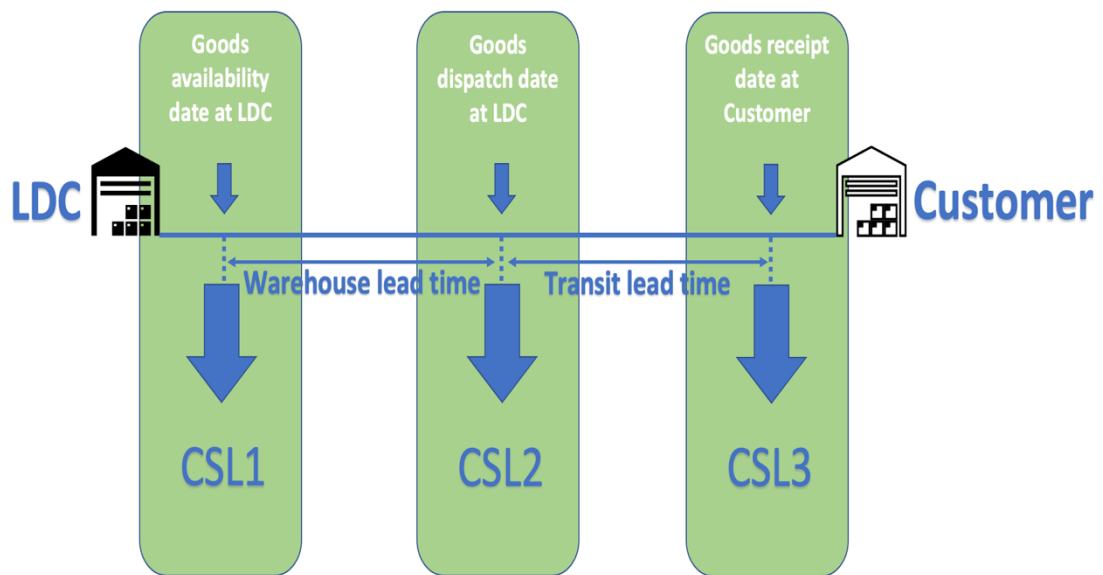


Figure 10. CSL explanation

Based on Figure 10, we can see that CSL1, CSL2 and CSL3 represent for three different dates during the order delivery process, which are goods available date at LDC, goods dispatch date at LDC and goods receipt date at customer respectively. One of the characteristics of AA is that they heavily rely on ERP system for their daily operation. When a customer order is keyed in the ERP system, a required goods receipt date at customer site will be defined accordingly. This date will be used as a CSL3 measurement date, which means that if the customers do not receive the order (at least) on this particular date, this customer order will be considered as a failed order line. From this CSL3 date, by using the already maintained transit lead time from LDC to the customer, the ERP system will automatically do a backward calculation for a CSL2 date, which is the required goods dispatch date at LDC. The assumption behind this calculation is that if the warehouse team cannot dispatch the product on the required date, the goods cannot arrive at customer site on the required date, which lead to a failed order line as a result. Similarly, from CSL2 date, the system can also

calculate for a CSL1 date, which is the date goods need to be at least available at LDC to ensure a success order line. However, instead of using transit lead time to calculate backward from CSL2 to CSL1, the system will use warehouse lead time, which is mostly the pick and pack lead time required from the warehouse team. For AA, since the demand planning's scope is only ensuring goods are available at the required date, CSL1 will be used as a KPI to evaluate AA's service level. The formula to calculate CSL1 is as below:

$$CSL1 = \frac{\text{Actual Quantity Available at Target Availability Date}}{\text{Target Quantity Available at Target Availability Date}} \times 100 \%$$

In which, both the actual quantity and target quantity have to be measured in the same period of time (in the same month or same year for example).

5 Case Study

5.1 Question 1: What was the situation of AA before the restructure of demand planning and forecasting?

Before stepping in and discuss about the result of the project, we would need to first truly understand the situation of the supply chain operation, more particularly in OFTM side, before the restructure of demand planning and forecasting.

One of the biggest problems at OFTM side at the time was that there was low to no coordination between supply chain team and other OFTM stakeholders, in which the most important ones are the trade marketing and sales force team. During this time, both the supply chain and trade marketing department did not really communicate thoroughly on each other's activities and planning. For the marketing team's perspective, they do not really know how the demand planning team can truly support their strategy and business plan. In the words of interviewee No. 4:

"To be honest, at the time, I didn't know what the real function of demand planning department was. Normally, I would only contact the [previous]

demand planner for stocks checking and incoming shipments of some specific products.”

In addition to that, due to lack of supply chain knowledge and experience, some misconceptions were also popped up during the operation as well, especially the complete picture of the supply chain from end to end and how would sources prepare the goods for the market. As quoted from interviewee No. 5:

“At some points, we [the marketing and sales team] thought that MTS products were a synonym for “always have stocks” [...] stocks should be available at all time regardless of our requirement [...]. If we did not have stocks, it would have been solely due to the incapability of the logistics team.”

When asking about factors such as lead time (of production and transportation, the result was not positive as well:

“Lead time was very a minor point during our planning [...]. We simply thought that we could just request the demand planner to change the stocking policy to MTS [in the ERP system], provide our required quantities and we should have stocks at most in one month.”

Additionally, Interviewee No. 5 also mentioned about the frequency of collaboration between trade marketing and demand planning department:

“Besides those monthly meetings between us [trade marketing members] and him [the previous demand planner] and some occasions where I would need to check stocks availability, I rarely discussed any other topics with him frankly speaking.”

Due to such low cooperation, the market intelligence has not flown consistently and early enough for the sources to react to market’s requirement and business plan. This led to a relatively low CSL1 performance in the fiscal year of 2018, which can be shown in Figure 11.

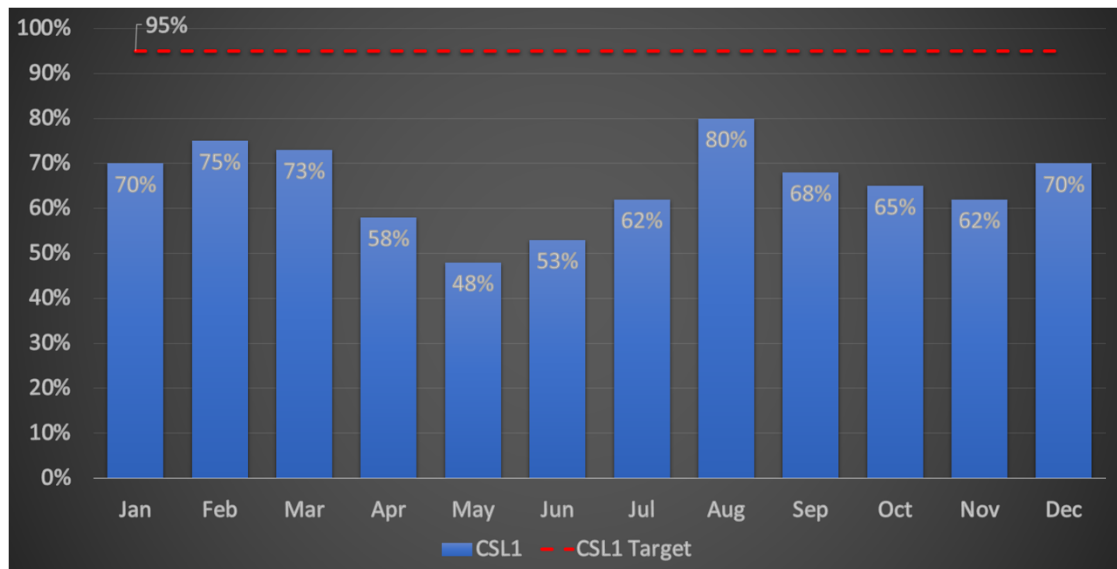


Figure 11. Country's Y CSL1 in 2018

For company X, the target for CSL1 is set as 95 % for all the business sectors, which is not an exception for AA as well. However, since the figure is a universally used, whether such KPI is an achievable target or not remains unsolved, especially for a business where the only thing consistent is the inconsistency like AA. Regardless, we would keep the mentioned figure as the target for our case study. From Figure 11, we can see that even with the highest result (approximately 80 % in August 2018), country Y was still far away from the required target. Especially from May to June 2018, where the CSL1 reached even below average level (approximately 48 % in May 2018). When studying deeper about the root cause of such low performance in Q2 2018, the root cause was due to short notice to the supply chain about a marketing campaign for a seasonal FCMG product. Thus, the outcome, which according to interviewee No. 4, “a severe stock out for several months”, was unavoidable as sources did not have enough lead time to prepare for such sudden peak demand from the market side. When being asked about this incident, in the words of interviewee No.2, who is the source planner for the mentioned product at the time:

“This incident created a lot of stress on the source side. Even though with escalation and pressure from high management, the situation did not improve much [...] the supplier still need time to produce the required quantity [...]. It was hard for me to negotiate with the supplier as it wasn't their fault that led to this problem”

However, to lead to such poor performance, the problem was not only lying at the trade marketing and sales team but also at the demand planning itself as well. With how the organization is set up, the demand planning position is designed to work as a window point between market and supply chain side. Thus, such problem was particularly highlighted in how the demand planning department approached business team for cooperation and alignment. According to interviewee No. 1:

“He [the previous demand planner] was really knowledgeable about the [ERP] system. He could “play” with the system and knew where to extract all the information he needed. However, there was a lack of summarization and visualization of such information effectively with the [trade] marketing team.”

Due to difference in background, finding a mutual voice that can harmonize both the supply chain and marketing team was a considerable obstacle as well. An important topic that requires such harmonization is to set up the stocking policy for each SKUs in the ERP system. The rule of thumb is that those SKUs with high running rate, consistent demand or generating a good amount of income for the company (which are typically Cash Cow and Star products) should be kept as MTS to ensure a steady and smooth delivery flow to customers. In special cases where agreements between involved stakeholders are needed, some SKUs can also be kept as MTS without having the mentioned attributes. On the other hand, MTO products are those that have sporadic demand and relatively low value for AA (which are mainly Dog products). However, these products are still needed for the business so that a full range of products can be offered for the customers. To avoid disturbance in the supply chain from switching of stocking policy constantly, mass maintenance of stocking policy is recommended to be done at most once per year based on alignment and discussion done between the demand planning and trade marketing department. However, due to low cooperation between the two teams, such maintenance was not done properly that in the end, affected directly (in a negative way) to both customer service and inventory level. According to interviewee No. 3:

“I remember there was one point I checked some part numbers with him [the previous demand planner] and found out that a lot of part numbers should have been maintained as MTS, but they weren’t [...]. Luckily, the situation was not so critical even though we still had no stocks here and there.”

As a standardized process set up by AA, at the end of every month, a demand planner is required to upload forecast in the next six months for every MTS SKU. To ensure these forecast figures are business related, the demand planner would need to collect necessary market intelligence and feedback. Thus, most of the time, these forecast figures are formed based on the discussion and alignment between demand planning and trade marketing department. This cycle of forecasting will gradually build up a running forecast for every MTS part number, whom would have forecast in the past six months saved in the AA's data base. These rolling forecast figures are used as one of the components to calculate Forecast Accuracy Index (or also known as FAI), which is specified in Table 4.

Table 4. FAI's components

| Reporting month | Lag | Meaning | Weight of each Lag |
|-----------------|------------------|---|--------------------|
| t | Lag ₀ | Actual sales | N/A |
| t-1 | Lag ₁ | Forecast of 1 month before reporting month | 0.1 |
| t-2 | Lag ₂ | Forecast of 2 months before reporting month | 0.15 |
| t-3 | Lag ₃ | Forecast of 3 months before reporting month | 0.25 |
| t-4 | Lag ₄ | Forecast of 4 months before reporting month | 0.5 |
| t-5 | Lag ₅ | Forecast of 5 months before reporting month | 0 |
| t-6 | Lag ₆ | Forecast of 6 months before reporting month | 0 |

From Table 4, we can see that each rolling forecast version is a "Lag" according to the relative month that the forecast has been uploaded. For example, if the reporting month is May 2020, then Lag₃ would be the forecast that has been upload for May 2020 in February 2020 (which is three months before May 2020). Each Lag would have different weight with the higher the Lag is, the heavier the weight (except for Lag₅ and Lag₆, which are not considered for FAI calculation). For example, Lag₄ has the highest weight (0,5) while Lag₁ has the lowest weight (only 0,1). The reason for such set-up is because most the products that AA provide have an average production lead time ranging from two to six months (excluding necessary transportation lead time). Thus, the sooner the demand planner can provide an accurate forecast, the more effective the forecast is. For example, even if Lag₁ has an 100% accuracy (compared to actual sales), the figure would still not be considerably useful since sources could only have at most one month to prepare for the mentioned forecast.

In theory, a lead-time-reference weighting method (in which the weight of each lag is adjusted based on the lead time of the calculating SKU) would provide a much more accurate result. However, considering the required capacity to carry out such complexity calculations, it would not worth the effort even when the process is done automatically in the background by AA's system. In addition to that, during the operation, lead time for each SKU is subjected to change as well (due to source change or new contracted lead time from the supplier for example).

The formula to calculate FAI for each SKU is as below:

$$FAI = \sum_{t=1}^4 \left\{ \max \left(0; 1 - \frac{|Lag_t - Lag_0|}{Lag_0} \right) \times \alpha_t \right\} \times 100 \%$$

In which:

α_t is the weight factor of Lag_t

An example of calculating FAI for an SKU with actual sales finalized in May 2020 can be found in Table 5 below:

Table 5. FAI calculation for an SKU

| Weighting factors | | | | | |
|----------------------|----------------------|----------------------|----------------------|-------------------------|--------|
| 0.5 | 0.25 | 0.15 | 0.1 | | |
| Lag4 01.2020 | Lag3 02.2020 | Lag2 03.2020 | Lag1 04.2020 | Lag0 05.2020 | |
| Forecast for Lag0 | Forecast for Lag0 | Forecast for Lag0 | Forecast for Lag0 | Actual Sales (Lag 0) | FAI |
| 15 | 26 | 23 | 35 | 32 | 63.59% |

This FAI calculation is only used to calculate the forecast accuracy for an SKU. To evaluate the accuracy of forecast as a whole, AA have used FAI in junction with turn-over ratio instead. This method can be demonstrated in Figure 12 below:

| | | Weighting factors | | | | | | | | | | |
|-----|-----------------------------|-------------------|-------------------|-------------------|-------------------|----------------------|-------------------|--------|---------------------------------------|-------------------------|----------------|-------------------------|
| | | 0.5 | 0.25 | 0.15 | 0.1 | | | | | | | |
| | | Lag4 | Lag3 | Lag2 | Lag1 | Lag0 | | | | | | |
| | | 01.2020 | 02.2020 | 03.2020 | 04.2020 | 05.2020 | | | | | | |
| SKU | Average Selling Price/Piece | Forecast for Lag0 | Forecast for Lag0 | Forecast for Lag0 | Forecast for Lag0 | Actual Sales (Lag 0) | Weighted forecast | FAI | Max (out of Lag0 & weighted forecast) | Turnover (Based on Max) | Turnover ratio | FAI with turnover ratio |
| A1 | 92 € | 15 | 26 | 23 | 35 | 32 | 20.95 | 63.59% | 32 | 2,944 € | 3% | 2.12% |
| A2 | 49 € | 55 | 43 | 55 | 25 | 44 | 49 | 78.86% | 49 | 2,401 € | 3% | 2.14% |
| A3 | 34 € | 9 | 158 | 176 | 66 | 145 | 77 | 42.21% | 145 | 4,930 € | 6% | 2.36% |
| B5 | 105 € | 13 | 9 | 5 | 2 | 8 | 9.7 | 52.50% | 9.7 | 1,019 € | 1% | 0.61% |
| B7 | 88 € | 58 | 60 | 72 | 49 | 80 | 59.7 | 74.63% | 80 | 7,040 € | 8% | 5.95% |
| C8 | 60 € | 2 | 5 | 4 | 7 | 6 | 3.55 | 55.83% | 6 | 360 € | 0% | 0.23% |
| C6 | 96 € | 600 | 450 | 550 | 300 | 450 | 525 | 76.67% | 525 | 50,400 € | 57% | 43.76% |
| D2 | 54 € | 145 | 179 | 110 | 104 | 130 | 144.15 | 80.50% | 144.15 | 7,784 € | 9% | 7.10% |
| D4 | 80 € | 164 | 3 | 9 | 158 | 38 | 99.9 | 5.53% | 99.9 | 7,992 € | 9% | 0.50% |
| F9 | 27 € | 77 | 161 | 299 | 33 | 21 | 126.9 | 4.29% | 126.9 | 3,426 € | 4% | 0.17% |
| Sum | | | | | | | | | | | | 64.93% |

Figure 12. FAI in junction with turnover ratio

The theory behind this method is that the more turnover a product generates, the greater of its impact (either positive or negative) on the business result. For this method, we would still need to calculate the FAI for each SKU as has been discussed previously. However, in addition to that, we would need to calculate a figure called weighted forecast by using below formula:

$$\text{Weighted forecast} = \text{Lag}_4 \times \alpha_4 + \text{Lag}_3 \times \alpha_3 + \text{Lag}_2 \times \alpha_2 + \text{Lag}_1 \times \alpha_1$$

After that, for each SKU, we would take the biggest figure between Lag_0 (which is actual sales) and the weighted forecast. This is also the “Max” column in Figure 12 above. The reason why we would take the biggest value between the two instead of the actual sales or minimum value is because regardless of which value is higher, there will be a negative impact in the supply chain. If the weighted forecast is higher than the actual sales, there is a high chance that we have prepared more stocks than the quantity that we would need (which is the actual sales quantity). Vice versa, if Lag_0 is higher than the weighted forecast, most likely CSL1 would be impacted due to shortage of required stocks. Thus, by using “Max” value, both of the cases will be penalized (through the KPI figure) accordingly.

After this stage, a “so-called” turnover will be calculated based on the formula below:

$$\text{Turnover} = \text{Max} \times \text{Average Selling Price/Piece}$$

Turnover ratio for each SKU is calculated accordingly based on the sum of turnover of all the SKUs. Then, the FAI with turnover ratio is for each SKU is calculated as below:

$$FAI \text{ with turnover ratio} = FAI \times \text{Turnover ratio} \times 100 \%$$

The sum of all FAI with turnover ratio will be used to evaluate the forecast accuracy of AA as a whole.

Even though FAI is part of the official KPIs for AA to evaluate the supply chain efficiency, there is a reason (which will be discussed later on) why the writer did not include this as an indicator to measure the result of the project. However, there was one point that was mentioned in the interviews regarding how the forecasts figures were discussed between demand planning and trade marketing team. According to interviewee No. 3:

“We [the trade marketing team] used to have a meeting with him [the previous demand planner] once every month to form the forecast. Normally, we would just look at the historical sales in the past two or three months, sales of the same period in previous year and customer orders that were already in the [ERP] system. And we did that for all of MTS part numbers. Just like that, no other information was used during the forecast. We even rarely looked at the product category itself [...]. I felt like we were doing just for the sake of doing it [the forecasting process].”

What interesting about this point is that it was raised by other interviewees as well, like interviewee No.1 mentioned:

“The planning was [...] a “gambling” session. There was no true reference for the team to do the forecast. They would just put in the figures based on gut feeling and “pray pray” that the result would be good.”

As a result, not only shortage of stocks happened (that impacted the customer service level), but there was also an excessive number of stocks brought into country Y's LDC as well.

5.2 Question 2: How was the project implemented?

After the discussion in section 5.1, we can recognize that one of the most critical issues that AA had to resolve was to increase efficiency of cross-functional

collaboration between different departments, especially between demand planning, trade marketing and sales department. Only when the mentioned matter is resolved, a smooth implementation of the project with favorable result can be achieved.

As a steppingstone in the mentioned direction, the supply chain manager has decided to organize different training sessions so that employees from other functions can join and learn more about the supply chain team. A various of topics have been brought up and discussed in detail. These topics varied from basic terminologies (for example, lead time and inventory) to a more deep-down study in AA's supply chain organization (for example, differences between source planning and demand planning) and operation (for example, how regional and local distribution centers were setup to create a global hub-and-spoke network). All in all, the ultimate target of these trainings was to improve the acknowledgement of AA team and to which extend, the supply chain could support others department strategy and business. In addition to that, how big the impact of inventory can be, especially in increasing customer's satisfaction, and how much cost can be leveraged when a healthy inventory is maintained was also widely acknowledged. Indirectly, maintenance of a good inventory state was highlighted as a mutual responsibility rather than a sole supply chain's problem.

After basic knowledge had been prepared across the team, relevant stake holders were in a better position to start a cross-functional discussion, especially in aligning the demand planning. Despite that previously, there was already a monthly meeting implemented to discuss about forecast. However, as discussed above, such meetings were inefficient where the only outcomes were forecast figures solely based on historical figures and gut feelings. The consequence was that there was no reference or any scientific measurement to validate the generated forecast figures. For example, if the forecast for the next three months of a product is 300 pcs, 600 pcs and 500 pcs respectively, there was no method for both the sales and marketing and supply chain team to determine whether the forecast is sufficient or how much the forecast needs to be adjusted to synchronize with the current sales business plan. The method has been proven from time to time that there were more disadvantages than benefits for the planning. Being relied heavily on the condition and behavior of the market was one of the biggest constraints of this approach. For markets with stable demand and

low fluctuation, historical-based figures could be mass applied effectively with simple algorithms and automatic calculation. However, when being applied for a country with such huge variation in demand from month to month like country Y, the approach was consistently bringing in low accuracy compared to real demand. Another drawback from this method is that historical figures could not reflect current business plan. Any new business-related activities, such as marketing promotion or increase or decrease in selling price, would create different conditions compared to ones in the past. Thus, deviations and errors will happen more highly. All in all, using historical figures should only be utilized as one of the tools to increase the efficiency (for those stable products as mentioned above) or as a reference to set expectation and appropriate figure range.

Due to reasons stated above, a different approach in terms of doing demand planning was one of the problems that needed to be solved with high priority. One of the solutions, which was later agreed between different departments, was to utilize extensively the product portfolio of company X during demand planning process. As mentioned in Theory section, marketing team can provide a good amount of market intelligence, which including product portfolio, that is extremely benefit for planning purpose if applied smartly. Much like other companies, company X also have a variety of product groups offered to the customers. In fact, since the business revolves around car's products, which can involve millions of different parts per car, company X have designed their products extensively into 12 different product groups, which are called Core Business Fields (CBFs). Within each CBF, the products are then organized into different product hierarchies, which are called Product Hierarchy 1 (PH1) accordingly. For CBFs that consist a wide range of product groups or products with highly specific technical specifications, a lower hierarchy level under PH1, which is called Product Hierarchy 2 (PH2), may require as well. With this nifty product portfolio system, demand planning team, along with the marketing team, could set up a more advanced planning process, which is heavily based on multiple levels of categorization and Pareto analysis. This new planning process can be described as below via Figure 13.

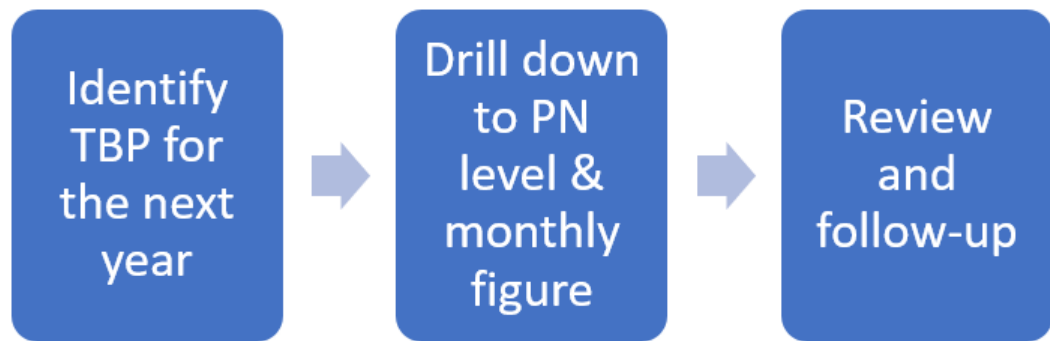


Figure 13. Overview of planning process

The first and most important step before proceeding any planning is to set an expectation where a company would want to stand at by the end of the next fiscal year. In short, the company will need to quantify a KPI for their business. In the case of AA department of company X, such KPI is called Target Business Plan (TBP). TBP helps AA department determine the annual total gross sales AA want to achieve for a specific year and at the same time, support the department to keep track of the business progress throughout the year. Like all other KPIs, TBP would outline AA's direction, especially those that heavily influence the demand planning strategy. One of the most common mistakes is the attainable degree of the target. Companies, especially those newly established ones, tend to have an overly optimistic goal, which in many cases, not only impossible for them to achieve, but also create a forecast more than market's real demand (also known as over-forecast). Vice versa scenario can also happen, which leads to under-forecast as a result. Thus, the proper the target is, the less capacity required to draft a legitimate demand planning. There are several ways to align and determine the target gross sales, depends on how the company is organized. As company X is a multinational organization with a headquarter in Europe, TBP is appointed to each country as a top-down decision instead, which is not an exception for country Y. At the beginning of quarter four each year, TBP for the next fiscal year will be sent to each region and country. With the resources to analyze the business on a global level, headquarter have the capability to steer the business on a long scheme running. However, the TBP is also often set to challenge the country for their capability. Thus, a bottom-up planning down the line to counter the initial target as well as to adjust to a more realistic target is required. This step will be discussed in later paragraphs.

After setting the TBP, the next step for AA is to do a series of data drilling. As mentioned above, AA's wide range of products are categorized into different CBFs. With a defined TBP, sales and marketing department can now strategize how to achieve the target via each CBF. This is where a more detail planning, particularly at each CBF level, is required. As different country will have different market position as well as different customer behavior, each will need to develop their own strategy that suits best for the market. Based on the local market intelligence, the country will know which CBF that they can take the most advantage of to achieve the TBP. The initial objective is to quantify how much turnover each CBF needs to generate to finally achieve the TBP. Figure 14 should demonstrate how the result should look like after this initial step.

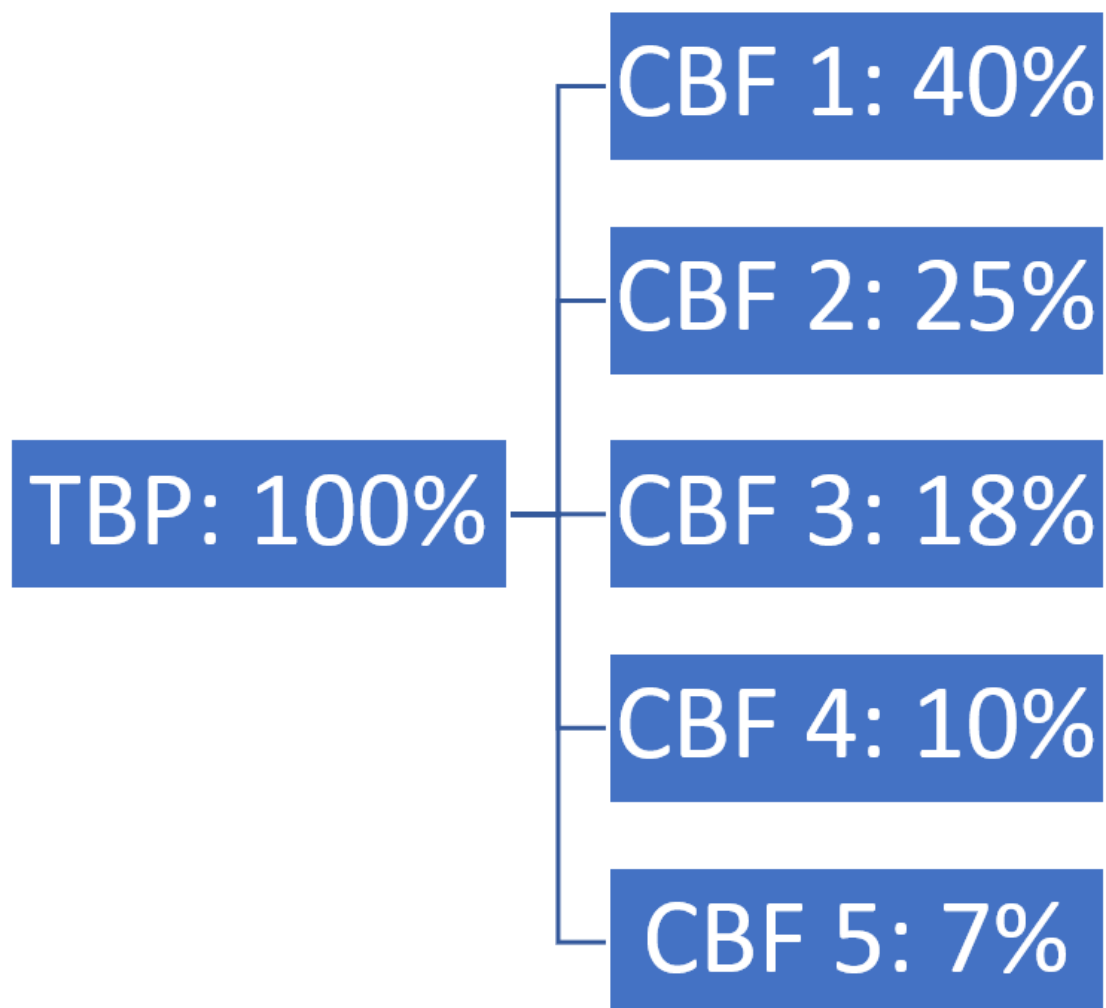


Figure 14. First level drill down

A repetitive of data drilling cycle will be repeated. Even at CBF level, the level of detail is still not sufficient to proceed a proper demand planning, considering the

automotive parts context that country Y are working on. Thus, PH1 (and PH2 in case the products are really complicated) are additionally utilized to close the gap between CBF and PN level. Similar concept in the initial concept is carried out. But now, instead of transposing TBP value to CBF level, country Y now have to further breakdown CBF target to PH1 and PH2 level. At each level, the further the breakdown, the more comprehensive planning is required from the team. At the lowest level, which is PN level, all the detail of execution, from promotion campaign to pricing strategy and anything in between, should be clearly stated and reflected. However, with a business handles a huge quantity of PNs like AA, planning particularly for all PNs is near impossible. Different analytical methods can be applied to narrow down the planning scope and resolve the issue. One of the most common methods is Pareto analysis. According to Kenton (2021), Pareto analysis is primally based on an idea that 80% of a project's business can be achieved via 20% of the work. The concept can be widely applied and interpreted in different circumstances. For the case of AA demand planning, 80% of the business can be covered by planning only 20% of available PNs. Pareto analysis can help the demand planners identify crucial products, set the priorities and plan in the most efficient way for the business. To further specify the planning priorities, by taking the last two fiscal years sales performance as a data reference, the demand planning team have categorized products into different classes based on their cumulative turnover percentage, which is demonstrated in table 6 below.

Table 6. ABC analysis for turnover

| Turnover priority | Cumulative turnover percentage |
|-------------------|--------------------------------|
| A | 80% |
| B | 15% |
| C | 5% |

In addition to classifying the products based on their turnover percentage, the demand planning team also classify the products based on their demand consistency. Through counting the months with sales in the past two fiscal years of a PN, as shown in table 7 below, the demand planning can identify the consistent in demand of the PN throughout the years.

Table 7. ABC analysis for demand consistency

| Demand stability | Number of months with sales |
|------------------|-----------------------------|
| A | $17 < x \leq 24$ |
| B | $10 < x \leq 17$ |
| C | $x \leq 10$ |

Incorporating both the turnover priority and demand stability together, the demand planner can now set up a value-volume matrix where it can support the team in identifying PNs that are critical for planning. By focusing on these critical PNs, the team can bring the most out of the limited capacity that they have. At the same time, such matrix also helps the team establish the stocking policy for the target fiscal year, which is one of the essential planning parameters that the demand planning team need to maintain. As for the case of AA division, if the PN is still active and not phased out yet, the PN's stocking policy can be maintained as either MTS or MTO.

Table 8 below shows how the value-volume matrix helps establish the base of the stocking policy. While the first character in the value-volume matrix stands for turnover priority, the second character stands for demand stability.

Table 8. Stocking policy based on value-volume matrix

| Value-volume matrix | Stocking policy |
|---------------------|-----------------|
| AA | MTS |
| AB | MTS or MTO |
| AC | MTO |
| BA | MTS |
| BB | MTS or MTO |
| BC | MTO |
| CA | MTS |
| CB | MTS or MTO |
| CC | MTO |

Standing at the top and bottom of the table are the most straight forward classes in determining their stocking policy. AA class products are high turnover generators and

at the same time, having a good demand stability. Typically, these are cash cow products that the business wants to leverage as much as possible. Thus, forecasting for following months' demand is important to ensure there will always be stocks available for delivering. In stark contrast are CC products, in which turnover is low with a sporadic demand. It was mutually agreed between sales, marketing and supply chain team that these products should only be kept as MTO. Unless there are special requirements, such as when the product is required for customer's project, at most, some safety stocks can be prepared beforehand. Next products to look at are those with A class demand stability. Different approaches can be used for these products. Since these products are having a good base for forecasting, the demand planning team decide that keeping the PNs as MTS is a feasible choice. In addition to that, since aftermarket business offer a wide range of products, some PNs are even though fast moving and required constantly from the market, the value may still not be comparable to other slow-moving products but with high value per piece. On the other hand, PNs with low demand stability (class C) are suggested to keep as MTO, even for cases where the PNs also have high turnover percentage. A lot of the time, these are one-time purchase from the customer. Thus, deep dive study on potential purchasing from customer will be required if planning is really needed. Finally, for cases where demand stability is B class, these will largely rely on the discussion as well as alignment between sales, marketing and demand planning team whether which stocking policy is the most suitable for each of them. The target by the end of this step is to fully identify essential PNs to keep stocks and their target gross sales for the fiscal year.

Based on previous discussion, the target gross sales also serves as a planned sales value where it has been validated (in terms of visibility for example) and updated (to suit the business strategy) by both the sales and supply chain planning team. However, to communicate such plan to the production plant or the supplier, these figures cannot be simply kept as sales value (€ for example). For the plant or supplier to cater AA's demand, they would need to know the specific quantity each PN would need for the fiscal year. Thus, one of the final steps for the demand planner is to convert the target sales value for each PN into quantity value so that proper communication with source can be met. The annual demand quantity (by unit of measurement, or

UOM) can be calculated by having the Total Gross Sales (or TGS) divided by the Average Selling Price (or ASP) per UOM. The formula can be seen as below:

$$\text{Annual Demand Quantity (UOM)} = \frac{\text{Target Gross Sales (€)}}{\text{Average Selling Price(€/UOM)}}$$

As every year, each PN may have different selling price, which greatly depends on the business strategy as well as other economic factors. Thus, retrieving the average selling price for each UOM of a PN from the sales and marketing department should be the most accurate method. However, calculating the average selling price in a period of time (over the past two years for example), should also provide a sufficient assumption for the demand planner in case there is no drastic difference from year to year. After calculating annual demand quantity, the next step is to allocate the mentioned quantity into each month according to the business plan. The need for phasing is to segregate the annual demand into monthly demand that can suit most to the sales strategy. Unless some specific PNs that require special treatment, to streamline the process, phasing percentage at CBF level should be more than adequate. For some product segments, the phasing can be done relatively simple just by average out annual demand equally into 12 months (which means approximately 8.3% per month). However, for products where in certain periods of the year, the demand is particularly higher than others, the phasing needs to be aligned tightly between demand plan and sales and marketing department. Example for a PN can be seen through Figure 15 below.

| | | | | | | | | | | | | |
|------------------------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| TGS (€) | 100,000 | | | | | | | | | | | |
| ASP (€) | 20 | | | | | | | | | | | |
| Annual Demand Quantity (UOM) | 5,000 | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | January | February | March | April | May | June | July | August | September | October | November | December |
| Phasing % | 9% | 10% | 12% | 9% | 15% | 15% | 7% | 6% | 6% | 5% | 4% | 2% |
| Quantity | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 |

Figure 15. PN level planning

After the discussion between relevant stakeholders, it was identified that the TGS and ASP were €100,000 and €20, respectively. From which, annual demand quantity can be calculated as 5,000 UOM. Due to seasonality, the phasing of this PN focuses strongly in first half of the year (70%), in which quarter two accounts for 39% of the year target sales. On the other hand, the final half of the year ramps down

significantly. Especially in quarter four, due to year end closing as well as shorter sales operation due to long holiday, the final quarter only accounts for 11% annual figure.

After finalizing the bottoms up planning for the fiscal year, the demand planners need to review the planning throughout the whole year. As with any planning, there will always be deviation, large or small, compared to the original plan. Especially for the initial bottoms up planning that is under discussion, since the planning was initiated two to three months before the fiscal year begins, there will definitely be more variables that can affect the result significantly. Thus, to ensure the planning is on track and adapt to the latest current business development, regular reviews (at least on monthly basis) is required for the demand planner to coordinate closely with the sales and marketing team. There are several scenarios can come up during the regular reviews. For the convenience of the readers (as well as the writer), below scenarios will take PN in figure 15 as a base of discussion, in which, the annual and monthly demand quantity can be showed in figure 16.

| | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|-----------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| Initial | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Revised | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Actual | | | | | | | | | | | | | 0 |
| Stock | | | | | | | | | | | | | 0 |
| Replenish | | | | | | | | | | | | | 0 |

Figure 16. Initial planning of a PN

In figure 16, “Initial” are monthly figures that were discussed in figure 15 while “Revised” are the revision figures throughout the year. “Actual” is the actual sales performance during each month. “Stock” is the stock quantity of the discussed PN at country Y by the end of that month. However, “Total” value will be stock quantity by the end of December (which is also year-end stock quantity) at country Y for the PN. In the following discussions, there will no safety stocks as well as inventory for the PN is set as 0 at the beginning of fiscal year. “Replenish” is the quantity that source will supply to country Y at the beginning of the month. To simplify the discussion, the supply chain and delivery is set in the most optimal condition. This means that source will fulfill 100% according to the replenish figures showed in figure 16. For example, if there are no changes made to the monthly figures, before April, country Y should

receive 1,550 UOM ($450 + 500 + 600$) from the source. In addition to that, source also have the capability to adapt to the latest requirement quantity without latency.

One of the most common scenarios during regular follow-up is to decide whether the forecast needs to be rolled over to the following months or not.

| | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|-----------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| Initial | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Revised | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Actual | 90 | 500 | | | | | | | | | | | 590 |
| Stock | 360 | 0 | | | | | | | | | | | 0 |
| Replenish | 450 | 140 | | | | | | | | | | | 590 |

Figure 17. Low sales in January with no demand revision

In figure 17, even though planning figure for January is 450 UOM, actual sales is only 90 UOM. Thus, by the end of January, we should still have 360 UOM of stocks at country Y. If there are no changes made to the planning figures, source should only need to replenish additionally 140 UOM ($500 - 360$) to fulfill February planning figures. However, in case sales have the plan to pursuit for the lost sales in January and collecting more orders in the following months to compensate for it, then, country Y will not have enough stocks to cover for the demand. This scenario can be demonstrated in figure 18 below where in February, order collection has been increased to recover the lost sales in January, by the end of February, country Y will have a backorder of 360 UOM.

| | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|-----------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| Initial | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Revised | 450 | 500 | 720 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,120 |
| Actual | 90 | 860 | | | | | | | | | | | 950 |
| Stock | 360 | -360 | | | | | | | | | | | 0 |
| Replenish | 450 | 500 | | | | | | | | | | | 950 |

Figure 18. Low sales in January compensated by increase in February sales

However, if the forecast is rolled over to February, such backorder can be avoided, as seen in figure 19 below.

| | January | February | March | April | May | June | July | August | September | October | November | December | Total |
|-----------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|-------|
| Initial | 450 | 500 | 600 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,000 |
| Revised | 450 | 860 | 720 | 450 | 750 | 750 | 350 | 300 | 300 | 250 | 200 | 100 | 5,480 |
| Actual | 90 | 860 | | | | | | | | | | | 950 |
| Stock | 360 | 0 | | | | | | | | | | | 0 |
| Replenish | 450 | 500 | | | | | | | | | | | 950 |

Figure 19. Low sales in January with demand revision

In addition to these scenarios, numerous of other possibilities can happen as well. Such as the demand throughout the year is growing more than the initial plan or vice

versa, order collection is not materialized as expected. In those cases, the demand planning needs to be ramped up or ramped down according to the business development. In reality, since there are infinite variables coming from the supply chain (production bottle neck or shortage of raw material for example), outcome of the business can be greatly affected by these factors. Thus, during regular reviews of the demand planner, concerns need to be discussed and decisions need to be aligned tightly with the sales and marketing department.

6 Conclusions

Based on the above chapter, even though the planning process was only scattered on the surface, a lot of concepts and possible scenarios have been brought up. Due to the huge number of variables as well as we, normal people, cannot foresee exactly what lies in the future, planning, particularly supply chain demand planning for the case, can never go exactly according to what will actually happen. However, this does not mean that planning is a meaningless task and can be totally forfeit. Because of all these unknown factors, a proper and careful planning should be done ahead of time to provide a strong foundation for the business to operation. With a solid plan, changes, when needed, can be done more efficient with a lot less turnover time as well as additional cost to implement the changes.

From the writer point of view, a good supply chain demand planner does not solely prioritize logistics KPI (such as FAI and inventory level). In fact, the demand planner should prioritize how to support the business in the best of his or her capability. To do so, tight and consistent coordination across the whole organization, especially between the supply chain and sales and marketing department, is required.

References

- Amadeo, K. (2020, May 19). *Economies of Scale*. The Balance. Retrieved October 19, 2020, from <https://www.thebalance.com/economies-of-scale-3305926>
- Banton, C. (2020, September 25). *Raw Materials*. Investopedia. Retrieved October 15, 2020, from <https://www.investopedia.com/terms/r/rawmaterials.asp>
- Bhasin, H. (2019, November 7). *BCG Matrix Explained – Boston Matrix Model Analysis and Advantage*. Marketing91. Retrieved August 30, 2020, from <https://www.marketing91.com/bcg-matrix/>
- Bhasin, H. 2020. (2020, July 27). *What is Product portfolio management*. Marketing91. Retrieved August 26, 2020, from <https://www.marketing91.com/product-portfolio/>
- Bhatia, M. (2018, June 11). *A Complete Guide to Quantitative Research Methods*. Humans of Data. Retrieved November 2, 2020, from <https://humansofdata.atlan.com/2018/06/quantitative-research-methods/>
- Burch, J. (2018, May 11). *What Is a Macro Trend*. AZ Central. Retrieved August 8, 2020, from <https://yourbusiness.azcentral.com/macro-trend-8289.html>
- Carlson, M. (2019, June 10). *Just-In-Time (JIT) Inventory Management*. The Balance Small Business. Retrieved October 4, 2020, from <https://www.thebalancesmb.com/just-in-time-jit-inventory-management-393301>
- Consumer Trust in Online, Social and Mobile Advertising Grows*. (2012, April 11). Nielsen. Retrieved July 26, 2020. Retrieved from <https://www.nielsen.com/us/en/insights/article/2012/consumer-trust-in-online-social-and-mobile-advertising-grows/>
- Copley, L. (2017, May 18). *6 Reasons why Customer Satisfaction is Important*. The Call Takers Blog. Retrieved July 26, 2020, from <https://www.allaboutcalls.co.uk/the-call-takers-blog/6-reasons-why-customer-satisfaction-is-important>
- Demand Planning Defined: what's the role of a demand planner*. (n.d.). John Galt. Retrieved July 26, 2020, from <https://blog.johngalt.com/demand-planning-defined>
- Dennysal, S. (2019, March 1). *Improve Your In-Store Sales with Visual Merchandising*. Gogoprint. <https://www.gogoprint.sg/blog/improve-your-in-store-sales-with-visual-merchandising-sg/>
- Finished goods inventory*. (2019, March 14). Accounting Tools. Retrieved October 15, 2020, from <https://www.accountingtools.com/articles/2017/5/10/finished-goods-inventory>
- Fritsch, D. (2015, August 20). *4 Inventory Replenishment Tactics That Increase Profits*. Eazy Stock. Retrieved October 4, 2020, from <https://www.eazystock.com/blog/4-inventory-replenishment-tactics-that-increase-profits/>
- General Guidelines for Conducting Interviews*. (n.d.). Free Management Library. Retrieved November 12, 2020, from <https://managementhelp.org/businessresearch/interviews.htm>

- Hanlon, A. (2020, May 6). *How to use the BCG Matrix model*. Smart Insights. Retrieved August 30, 2020, from <https://www.smartinsights.com/marketing-planning/marketing-models/use-bcg-matrix/>
- Hayes, A. (2020, June 30). *Work-in Progress (WIP)*. Investopedia. Retrieved October 15, 2020, from <https://www.investopedia.com/terms/w/workingprogress.asp>
- Kenton, W. (2021, April 10). Economies of Scale. *Investopedia*. Retrieved May 5, 2021, from <https://www.investopedia.com/terms/e/economiesofscale.asp>
- Kenton, W. (2021, April 16). Inventory. *Investopedia*. Retrieved May 5, 2021, from <https://www.investopedia.com/terms/i/inventory.asp>
- Kenton, W. (2021, August 23). *Pareto Analysis*. Investopedia. Retrieved November 11, 2021, from <https://www.investopedia.com/terms/p/pareto-analysis.asp>
- Kierczak, L. (n.d.) *Customer Satisfaction: 5 Reasons Why is Important in 2020*. Survicate. Retrieved July 26, 2020, from <https://survicate.com/customer-satisfaction/importance-customer-satisfaction/>
- Kulbyte, T. (2020, July 14). *10 Ways To Manage Your Sales Pipeline*. Super Office. Retrieved August 2, 2020, from <https://www.superoffice.com/blog/sales-pipeline-management-tips/>
- Leonard, K. (2019, March 5). *Advantages & Disadvantages of Excess Inventory*. Chron. Retrieved October 22, 2020, from <https://smallbusiness.chron.com/advantages-disadvantages-excess-inventory-21908.html>
- MacCarthy, B L., Brabazon P G. (2018). *Order Fulfillment In High Variety Production Environments*. Operations Management Division, Nottingham University Business School, University of Nottingham. Retrieved from <https://nottingham-repository.worktribe.com/output/1026322>
- Martin, M. (2020, June 16). *What Is a BCG Matrix?* Business News Daily. Retrieved August 31, 2020, from <https://www.businessnewsdaily.com/5693-bcg-matrix.html>
- Ostdick, N. (2018, March 29). *The Benefits of Forecasting in Planning and Production*. Flexis. Retrieved September 19, 2020, from <https://blog.flexis.com/the-benefits-of-forecasting-in-planning-and-production>
- Product portfolio definition*. (2020, March 11). Accounting Tools. Retrieved August 14, 2020, from <https://www.accountingtools.com/articles/what-is-a-product-portfolio.html>
- Riserbata, R. (n.d.). *How Marketing Intelligence Will Make Your Marketing Team More Agile*. HubSpot. Retrieved August 2, 2020, from <https://blog.hubspot.com/marketing/market-intelligence>
- Robinson, B. (2015, March 17). *Diversity and Why It is Important in Today's Work Culture*. Robinson Robinson. Retrieved September 13, 2020, from <https://rob2rob4jobs.com/diversity-and-why-it-is-important-in-todays-work-culture-2>

Ross, J. (2019, April 1). *How Macro Trends Shape the Market's Future*. Visual Capitalist. Retrieved August 8, 2020, from <https://www.visualcapitalist.com/how-macro-trends-shape-the-markets-future/>

Saleh, K. (n.d.) *Customer Acquisition Vs. Retention Costs – Statistics And Trends*. Invesp. Retrieved July 26, 2020, from <https://www.invespro.com/blog/customer-acquisition-retention/>

Sarma, S. (2020, April 24). *The Rise of Hub and Spoke Distribution Model in Modern Supply Chains*. Locus. Retrieved November 16, 2020, from <https://blog.locus.sh/hub-and-spoke-distribution-model-in-modern-supply-chains/>

Streefkerk, R. (2019, April 12). *Qualitative vs. quantitative research*. Scribbr. Retrieved October 24, 2020, from <https://www.scribbr.com/methodology/qualitative-quantitative-research/>

The Complete Guide to Building a Sales Pipeline. (n.d.). Freshworks. Accessed on 2 August 2020. Retrieved from <https://www.freshworks.com/freshsales-crm/sales-pipeline/>

The Ultimate Guide to Sales Process: What, Why, How, & More!. (n.d.). Freshworks. Retrieved August 2, 2020, from <https://www.freshworks.com/freshsales-crm/sales-process/>

Types of Inventory. (n.d.). Wall Street Mojo. Retrieved May 15, 2020, from <https://www.wallstreetmojo.com/types-of-inventory/>

Williams, F. (2019, March 8). *The Effects of Government Policies on Businesses*. Chron. Retrieved August 14, 2020, from <https://smallbusiness.chron.com/effects-government-policies-businesses-65214.html>