Demand Planning and Forecasting Process Improvement for Head and Shoulders Brand of P&G

MOT1531 Digital Business Process Management
Group – 23

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Management Summary

P&G's vision and mission is focused on delighting and serving consumers, customers, society, and shareowners. To fulfil their purpose, P&G's Head & Shoulders has implemented an integrated growth strategy that emphasizes on customer intimacy by strengthening their Supply & Demand area as one of their focuses. Currently, Head & Shoulders is facing a problem in Supply & Demand area, specifically in Demand Planning & Forecasting process which is inaccurate result of demand planning & forecast activities that are performed manually using excel.

To analyze the current Demand Planning & Forecasting process, several assumptions are made. First, currently Head & Shoulders still collect data for forecasting manually from customers. Second, data analysis for demand planning & forecast is conducted manually using excel. Lastly, the demand forecast is performed for medium term (1 year). The current process has several weaknesses to be focused on, which are high probability of data mismatch between company and customers, invalid data input, the presence of error in the data analysis results, difficulties in coordination, and high difficulty in data tracking.

The study has shown that the improvement of integrated systems of data collection between customer and P&G lead to an increase in demand forecast accuracy. The new method also increases the responsiveness of the systems towards the change of the actual demand due to real time data collection. From the BPMN, the reduction of swim lane and manual process can be seen, substitute with the automation of the process. Despite the benefit given, there are several tradeoffs of using Machine Learning, those are high investment in terms of computer performance and highly skilled labor. However, we conclude that the support of machine learning in these systems could reduce the loss due to wrong forecast and reduction in workload of demand planners, which is a good solution for a long-term process.

Analysis revealed that the root cause of inaccurate demand planning & forecast result is caused by the absence of integrated systems for data collection and analysis. By considering requirements on the process and customers' wish, combined with the root cause analysis, applying Machine Learning in all demand unit departments is chosen as a solution. Agile methodology combined with Business Process Re-engineering (BPR) are chosen to improve the current business model.

The improved business model applies automated and integrated system using Machine Learning that improves the accuracy of the result and flexibility of the overall process as data collection and analysis can be performed more accurately and respond to changes better.

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1. Company's Background (the selected company and branch)

1.1 Company Profile

Procter & Gamble (P&G) has a focused portfolio of daily-use products for cleaning, health, and hygiene benefits. The Company was established in Ohio in 1905 and was first built from a business founded in Cincinnati in 1837 by William Procter and James Gamble. The products are sold in approximately 180 countries and territories through many channels as well as direct-to-customer.

Their main customers consist of merchandisers, e-commerce channel, grocery stores, membership club stores, drug stores, department stores, distributors, wholesalers, specialty beauty stores (including airport duty-free stores), high frequency stores, pharmacies, electronics stores and professional channels.

P&G's brands are trusted in millions of living rooms, kitchens, laundry rooms, and bathrooms— and have been passed down from generation to generation. P&G is committed to "A Force for Growth and A Force for Good", to improve the health and well-being of the communities, making peoples' lives better in small but meaningful ways, every day. As P&G grows, it stays grounded in its purpose, values, and principles and a deep-rooted understanding between each other and doing its best for the people who buy its products, for one another, and for the world around it, which will lead to mutual success.

1.2 Company Strategy

P&G's vision and mission unifies them in a common cause to improve more consumers' lives in small but meaningful ways each day. It inspires P&G people to make a positive contribution every day. P&G's vision is **"To have consumers reward us with leadership sales, profit and value creation, allowing our people, our shareholders and the communities in which we live and work to prosper"**, while its mission is **"We will provide branded products and services of superior quality and value that improve the lives of the world's consumers, now and for generations to come."**

P&G's values reflect the behaviors that shape the tone of how P&G people work with each other and with their partners. P&G's values are Integrity, Leadership, Ownership, Passion for Winning, and Trust. P&G also holds to principles that articulate its unique approach to conducting work every day. P&G's principles are: (1) We Show Respect for All Individuals, (2) The Interests of the Company and the Individual Are Inseparable, (3) We Are Strategically Focused in Our Work, (3) Innovation is the Cornerstone of Our Success, (4) We Value Mastery, (5) We Seek to Be the Best, (6) We Are Externally Focused, and (7) Mutual Interdependency is a Way of Life.

P&G is focused on delighting and serving consumers, customers, society, and shareowners through five strategic and integrated choices: a portfolio of daily use products in categories where performance drives brand choice; superiority across product, package, brand communication, retail execution and value; productivity in everything it does; constructive disruption across the value chain; and an agile, accountable, and empowered organization.

One of the most important things about P&G's strategy which is portfolio, superiority, productivity, constructive disruption, and an empowered, agile and accountable organization, is that it is inherently dynamic, not static. It requires being responsive to changing consumer needs and habits. It demands to serve evolving customer needs in rapidly transforming channels. Going forward, P&G has identified four areas to be even more deliberate and intentional about pursuing to further strengthen the execution of our strategy.

- The first is **Supply**. P&G is improving its supply chain capacity, agility, cost efficiency and resilience for a new reality and a new age. P&G needs to ensure it has multiple qualified suppliers for key inputs, sufficient manufacturing capacity to satisfy growing demand and flexibility to meet the changing needs of all types of retailers.
- The second area is **Environmental Sustainability**. P&G is integrating sustainability into our product, packaging and supply chain innovation work to develop irresistibly superior offerings for consumers that are better for the environment.
- Third, P&G is increasing its **Digital Acumen** (i.e., digitization of manufacturing lines, using artificial intelligence, using blockchain technology) to drive consumer and customer preference, reduce cost and enable rapid and efficient decision making.
- Fourth, a **Superior Employee Value Equation** for all gender identities, races, ethnicities, sexual orientations, ages, and abilities — for all roles — to ensure P&G continues to attract, retain, and develop the best talent.

1.3 Business process selection

1. Demand Planning and Forecasting as Business Process that Matches P&G's Strategy

As a company which focuses on Customer Intimacy as a Strategy, we recognize P&G's critical risk to meet costumer's need. P&G must successfully manage the demand, supply and operational challenges associated with the effects of a disease outbreak, including epidemics, pandemics, or similar widespread public health concerns. The impact factors of this risk are:

1. Significant reductions in demand or significant volatility in demand for one or more of our products
2. Inability to meet our customers' needs and achieve cost targets
3. Failure of third parties on which we rely
4. Periods of disruption that limit the ability to access the financial markets or which increase the cost of liquidity
5. Significant changes in the political conditions in markets

As a Fast-Moving Consumer Goods company which focuses on customer intimacy strategy it is vital for them to provide the product of the right quantity, the right time, the right condition, the right customer, the right place, and the right cost. To achieve those goals, we proposed the business process improvement in the area of Demand Planning and Forecasting for one of the P&G products, which is Head & Shoulders.

Our Proposal is also supported from the data provided by APQC. It is one of the world's foremost authorities in benchmarking, best practices, process and performance improvement, and knowledge management. APQC concluded its annual Supply Chain Management Priorities and Challenges research in 2023. The purpose of this research is to learn about organizations' supply chain management priorities, performance, and trends with 347 valid global participants. According to APQC, in 2023 Supply chain planning is in the top spot as a priority for the coming year (selected by 86 percent of respondents), considering the needs to build resilience and flexibility.

In supply chain planning, the number-one focus area is demand planning and forecasting (30 percent), followed by automation and digitization (28 percent). Demand planning and forecasting are key to success in supply chain planning, especially in the face of continued disruptions. Automation and

digitization can enable the organization to make faster decisions, leveraging larger quantities of data, while freeing up staff for more value-added activities.

2. Demand Planning and Forecasting for Head & Shoulders

Referring to top focus areas within Supply Chain Planning based on research conducted by APQC, which is Demand Planning and Forecasting, we limit our business process selection on the Demand Planning and Forecasting of one of the brands that P&G has, which is Head & Shoulders in the Netherlands. Head & Shoulders is a brand that specializes in anti-dandruff shampoo and creates a variety of products tailored to all hair types. Head & Shoulders claim that they are the world's number one anti-dandruff shampoo based on Nielsen sales data (source: Head & Shoulders website). Therefore, demand planning and forecast process must be more effective and efficient.

We analyze that Head & Shoulders is facing problem in this area. According to Bob Herzog, Global/Regional Planning Digital Solutions Leader at P&G, planners at P&G's business units (including Head & Shoulders) were always looking backwards at time, trying to solve problems from the day before. They spent so much time on transactional work, like data mining and transformation, that they couldn't proactively prepare for what was coming down the pike. They still had a lot of people doing manual work in what they would affectionately call 'Excel nation' and they needed to do something about that. The company embarked on a transformation of its supply chain to enable control tower capabilities, automate manual processes, and gain end-to-end visibility into its network.

Good demand planning & forecasting is vital for all business planning (book: Global Supply Chain and Operation Management). If estimates are too high, Head & Shoulders will overproduce goods that cannot be sold. On the one hand, this is unnecessary production and increases costs for resources such as raw materials, workforce, or storage space. On the other hand, underproduction can result in shortages and lost business opportunities, and a potential loss of customers who cannot be served. Forecasts are generally expressed in terms that are also useful for capacity management, production, and Supply Chain planning. The aim is not only to be as accurate as possible but also to know the difference between the plan and actual data. This range can help to improve forecasts in the future and to estimate which forecasting techniques perform better. Moreover, forecasts are made for the close and long-term future.

2. Current process description

2.1 Stakeholders' analysis

The stakeholder analysis for Head & Shoulders product will be based on the value or interest of the stakeholder behind the relationship with the company. Then we analyse the influence of each stakeholder towards the company, supported with their expectation that might be conflict with others and expectation that considered as requirement in order to build a relationship. Then we analyse the power-interest matrix which can be seen on the Figure 2.1. below.

Consumer: The consumer in this analysis is constrained in national scope, which is Netherland market. Consumer has interest to buy the product in order to fulfil their needs, leads into consumer welfare. They have a strong influence towards the company since they are the main source of profit trough product sales in the market. In contrast, the consumer also become the main information of demand and preference for the Head & Shoulders product supply and development. P&G is expected to fulfil their

needs by buying the goods in the market with the lowest price possible. However, it is conflicting with the interest of the company (and investor) which looking for a higher profit on their business. Despite having a conflict with the company, consumer has a high power when they have a similar preference in a large group. On the other hand, individual consumer has a little power to affect the Head & Shoulders on their business and product. Despite having a high power in a large group of consumers, they have a little interest to the company since they only focus on the product to fulfil their needs. Thus, they might prefer to buy another product other than Head & Shoulders if they are not satisfied.

Suppliers: The supplier in this business provides the raw materials to product the goods (shampoo and other haircare). They come up with raw material such as bottle, labels, and chemical ingredients and deliver it to Head & Shoulders' Factory in Blois, France. They are looking for a profitable and productive relationship with Head & Shoulders through the business. It might lead into a conflict with Head & Shoulders where they are trying to make the production cost as low as possible. A win-win solution between both party in terms of business contract thus need to be achieved. Despite having a conflict in interest, the suppliers have a high power towards Head & Shoulders goods production. They supply the raw materials needed for manufacturing, which very essential in the business process. However, they have a little interest with the company since they only focus on the profit and business between both parties.

Customer: Customer looking for a profitable and sustainable business with P&G. They sell Head & Shoulders product to the consumer through online and offline store, for example, Jumbo, Albert Heijn, Kruidvat, Bol.com, etc. In order to maintain their ongoing business, they are expected to have an on-time Head & Shoulders supply with enough number of goods. By doing so, they won't miss out any business chance because insufficient supply from Head & Shoulders for consumer demands. The insufficient supply and poor timing might affect their business profit. Since they are looking for a high profit through sell, it might be conflicting with consumer that looking for a lower cost of goods. As the one who sell it directly to the consumer, customers have a high power on P&G business since it will also determine the company revenue through sells. However, customers have a little interest towards the company since they only focus on consumer demand of goods. Therefore, they might leave out Head & Shoulders if there is no sufficient demand from the market.

Dutch Government: The Dutch government that responsible for the sector of haircare product is Netherland Food and Consumer Product Safety Authority (NVWA). They focus on the public welfare, safety, and environmental impact. NVWA act as the regulator for a business that manufacture and sells cosmetic product. The regulator expected the company to comply with the existing regulation, based on European Cosmetic Regulation and Dutch 2011 Commodities Act Decree cosmetic products. The Dutch government as a whole also expected the Head & Shoulders could support their people's need from the product of Head and Shoulder. As the regulator of the region where Head & Shoulders operates, the Government has a high power towards the company. However, they have low interest towards Head & Shoulders, since they only expected the company to comply with the regulation, especially if there are several competitors in the same sector.

Employee: The employee is the actor that worked inside the company to fulfil the company's vision. They are looking for profit (income), but also interested in the company's performance in the market and their impact towards society. They also expected to have a higher effectiveness and efficiency of work, and good working environment. Employees have a high power on Head & Shoulders business process, since they are the main actor that works inside the company itself. Their performance also will determine the

output of the company. They also have high interest towards the company since they are considering company performance and its impact towards society.

Community: The community is constrained as the community where the Head & Shoulders operates, which is Netherland and Europe. Head & Shoulders give the societal impact back towards society from their campaign such as donation, quick response during disaster, education, kids and women care, etc. The way company manage their environmental impact will also affect the community trust and company image. Community is interested in their public welfare. The community will influence the company branding, trust and support from local and regional residence. Therefore, the community has a low power towards company, since they are the one that influenced more by Head & Shoulders. However, the community has high interest towards Head & Shoulders community program and impact, which means they always need to be informed.

Investor: The Investor are the one who fund the company and contribute on the company decision making process. The top investor of P&G's Head & Shoulders are The Vanguard Group, Inc.; BlackRock, Inc.; State Street and Global Advisors, Inc. They are looking for profitable business, business innovation and its impact towards society. It leads to their expectations to having a high performance in the market, sustainable innovation in business process and give positive influence on society. As the one who funds and part of the company decision maker, they have a high power and high interest in the P&G's Head & Shoulders stakeholder analysis.

Competitor: They could disrupt Head & Shoulders business process and strategy. They have a high interest towards P&G's Head & Shoulders strategy, which can influence their strategy in the market. In specific cases, the price-setter competitor will also have high power that can disrupt P&G's Head & Shoulders business process. Thus, this stakeholder needs to be monitored to maintain Head & Shoulders position in the market and to determine the next strategy ahead.
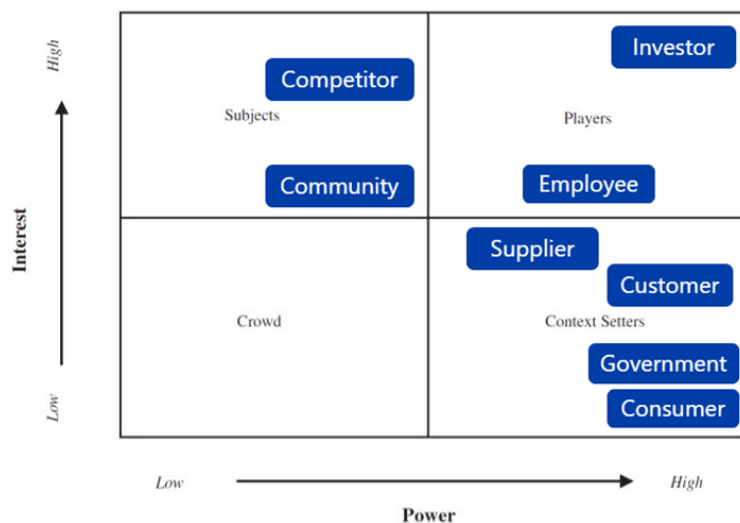

Figure 2.1. Stakeholders Power-Interest Matrix

2.2 Performance indicators

There are two ways of defining the performance indicators: through Balanced Scorecard and Key Performance Indicator. A Balanced Scorecard is a framework that includes four perspectives on a company's strategy; they are Financial, Customer, Internal Business Process, and Learning and Growth

(Clearpoint Strategy, n.d.). It is also a system that aligns a company's strategy with its activities, which is reported structurally. Meanwhile a Key Performance Indicator is a measurable value that helps determine how effectively an individual, team or organization is achieving a business objective (Investopedia, 2023).

2.2.1 Balanced Scorecard

The Balanced Scorecard of P&G is based on the annual report of the company itself, and it is designed according to the vision and mission of the company in the annual report. The following balanced scorecard is shown below.

Area	Objectives	Measures	Target	Initiatives
Financial	Growth	Sales Revenue	30% per year	Improve customer service level
		Market Share	10% per year	Expand distribution in the small retails and online
		Adjusted free cash flow productivity	90% or greater	Maintain good investor relations
Customer	Satisfaction	Delivery	On-time delivery	Improve delivery services and options
		Customer complaints	24-hour response time	Responsive customer service in every shift
Internal Business Processes	Production excellence	Demand Planning	Decreased inaccuracy of demand plan vs actual by 10%	Intensify data gathering and validation
		Product schedule vs Plan	On-time execution	Improve manufacturing process time
Employee & Organization Innovation & Learning	Human Capital	Diversity and equality	40% multicultural representation	Consider the diversity of the employees in recruitment process
		Training and development	Perform training and skill development programs annually	Allocated budget to execute the training for the employee's development of skills

Table 2.1. Balanced Scorecard

Based on the initiatives in the financial area, specifically in growth objective, it is mentioned that their goal is to improve customer services level by 30% per year. Customer service level is related to how the company is able to fulfill and respond to customers' demand. We acknowledge that the role of demand planning and forecasting is significant to increase the customer service level by enabling the ability to capture demand accurately.

2.2.2 Key Performance Indicators

The Key Performance Indicators on P&G's Head & Shoulders in the Demand Planning and Forecasting, are defined by its area, objectives, and measures; and its area is divided into 2 categories, namely reliability and agility. The performance indicators used are based on the SCOR model (SCOR, 2023). The table below shows the list of KPIs used for more details.

Area	Objectives	Measure
Reliability	Better predict future revenue and expenses	Forecast Accuracy
Reliability	Reduce defects in production	Yield
Reliability	Proportion of services that are completed in 24 hours	Fill Rate
Reliability	Delivered items to customer are matched according to customer's order without extra items provided	Delivery Item Accuracy to the Customer
Reliability	Accurate items received from supplier according to order	Delivery Item Accuracy from the Supplier
Agility	Optimize the duration of manufacturing each item to meet production target	Current Transform Volume
Agility	Improve the quality of products	Current Fulfill Return Volume
Agility	Increased shipping volume	Current Delivery Volume
Agility	Increased accuracy of orders with on-time delivery and accurate documentation from suppliers	Demand Sourcing – Supplier Constraints

Table 2.2. Performance Indicators

The Reliability area addresses the ability of a firm, in this case P&G's Head & Shoulders, to perform their tasks as required. Meanwhile the Agility attribute describes the ability to respond to unplanned external influences, disruptions and/or events (SCOR, 2023). The Reliability metrics are based on the order fulfillment which consist of: Perfect Customer Order Fulfillment, Perfect Supplier Order Fulfillment, and Perfect Return Order Fulfillment. In terms of Agility, its metrics are only the Supply Chain Agility itself. Based on the metrics above, we could define the KPIs for the P&G Sales and Operation Processes as mentioned in the table.

As described in the table above, there are five KPIs in the reliability area (Forecast Accuracy, Yield, Fill Rate, Delivery Item Accuracy to the Customer, and Delivery Item Accuracy from the Supplier) and four KPIs in the agility area (Current Transform Volume, Current Fulfill Return Volume, Current Delivery Volume, and Demand Sourcing – Supplier Constraints).

In the Reliability area, Forecast Accuracy is measured to get better revenue and expenses. To reduce defects in production, Yield is used as a measurement, where it is defined as the ratio of usable

output from a process to its input (SCOR, 2023). Third, Fill Rate is used as a measurement with the objective. The fourth and fifth KPIs measure accuracy on delivery item from the Supplier and to the Customer.

Meanwhile, in the agility area, Current Fulfill Return Volume is used as a measurement to improve the quality of products. Finally, optimizing the duration of manufacturing each item to meet production targets is measured through Current Transform Volume which is the amount of each item manufactured. The Current Delivery Volume is used as a measurement to determine the increase of shipping volume due to fulfilled production targets. Lastly, the Demand Sourcing – Supplier Constraint is used to measure the accuracy of orders as well as the documentation from the supplier.

2.3 As-is process

P&G's Head & Shoulders is a make to stock company. As a means to analyze as-is process for demand planning & forecasting at one of P&G's brands, Head & Shoulders, we made several assumptions based on the available information and literature study. First, currently Head & Shoulders still collect data manually from customers for forecasting by requesting it to them. There is also no integrated system for data collection between customers (wholesalers and retail) and the company. Second, in the current process, data analysis for demand planning & forecast is conducted manually using excel, therefore manual data analysis and several manual adjustments must be performed. Lastly, the demand forecast is executed for the medium term (one year).

There are three units based on their channels which consists of units of wholesalers, retailers, and direct sales demand. Each unit does their own forecasting process, which consists of 3 steps that involves data collector, forecast model analyst, and forecaster. The total personnel needed for the whole process is 12 people from internal P&G and 2 personnel required from external (wholesalers and retails) as the data provider. The data collector works at the preparation stage, while the forecast model analyst and forecaster work at the modelling and forecasting stage. Each task was colored based on the tasks that can be removed, combined, or stay the same after the implementation of machine learning. The green color indicates the important tasks that cannot be removed, even after the implementation of machine learning. The yellow color indicates the tasks that can be combined with machine learning process. The orange color indicates the tasks from each three units that can be minimized into one task for all three units. Lastly, the red color indicates the tasks that can be removed if the machine learning is implemented in the new business process.
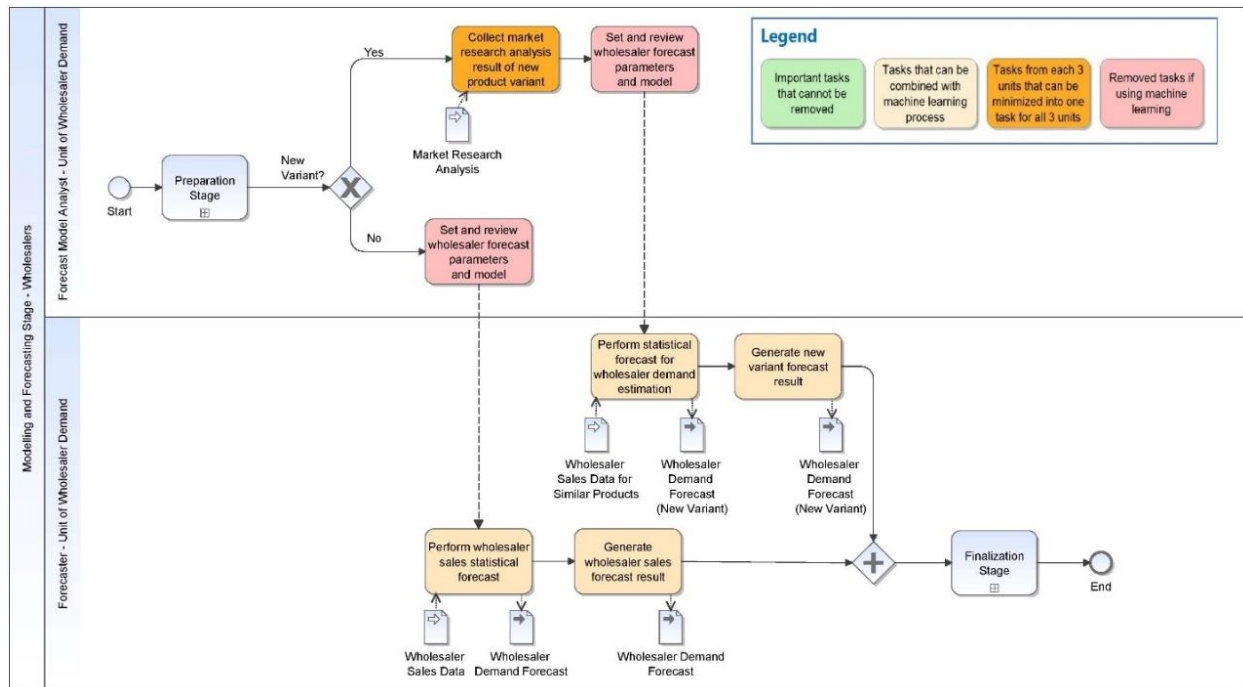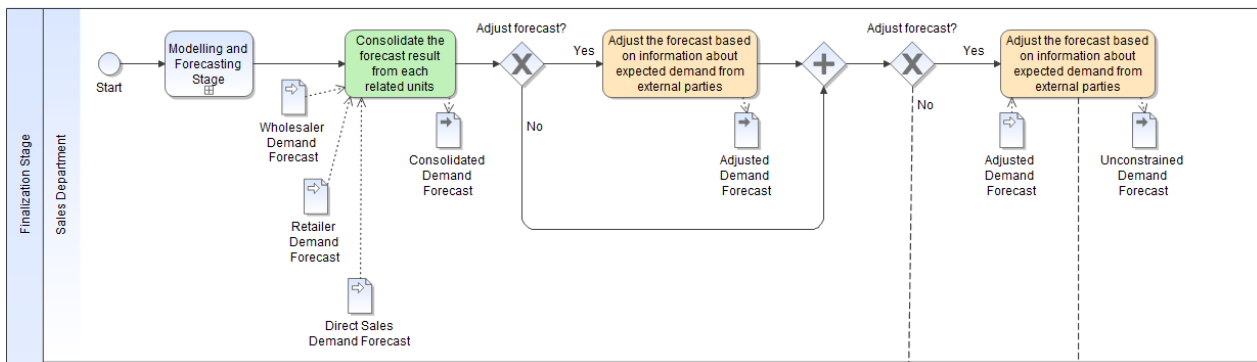
Figure 2.2. A Snip of As-Is Process Diagram (1)

Figure 2.3. A Snip of As-is Process Diagram (2)

2.4 Evaluation of the process

Based on the BPMN, the current process of demand forecast and planning for P&G product Head & Shoulder has several weaknesses to be focused on. The first weakness is the manual methodology to collect the data from customers (wholesaler, retailer & direct sales). This method has a high possibility of error since there is no integration and sophisticated standard for data collection from customers. This can lead to data mismatching due to the possibility of incomplete data collection between customers and P&G's expected demand for Head & Shoulders. This condition can lead to decreasing the accuracy of the demand forecast. Moreover, the data collection process might be invalid or not performed correctly which makes the data input for performing demand forecast analysis inaccurate. This will lead to errors in data analysis results for demand planning & forecasting activity. Second, in the existing process, data analysis for demand planning & forecast is conducted manually using excel, which might increase the probability

of error or deviation in the data analysis results due to miscalculation, wrong data interpretation, or other human errors.

Third, there are huge amounts of activities and actors during the processes, shown with the multiple blocks and swim lanes (Appendix D). There is a probability of error during the communication due to the large amounts of actors. Similarly, coordination and control between each actor are conceivably hard to achieve. The next important thing is that each unit has different data input but similar data analysis processes along the way. Therefore, it is not effective considering the amounts of workers doing the same task on each unit. The sequential and huge amount of process on data analysis also increases the duration of the process. The huge amounts of actors involved also makes coordination and control over the process difficult to perform. Lastly, the current process does not have sophisticated data transparency and integration for internal usage. By doing so, this resulted in a high difficulty in data tracking during the processes, especially for other divisions that might use the data for decision making.

2.5 Requirement and customer wish for the new situations

1. Requirement on the Process

Based on APQC, several factors need to be considered for Demand Planning and Forecasting Technologies. The first one is Reliability (chosen by 82.2% of respondents in APQC research). Technology should be able to consistently perform to provide desired benefits as well as detecting inconsistencies and anomalies, enabling teams to focus on critical business aspects. Secondly, Security (74.5%). The technology should be consistent across various interfaces (including mobile devices) and compliance processes to prevent unauthorized access and data leaks. The third is Ease of Implementation (64.9%). The technology is capable of being implemented in several stages is preferable, giving users more time to become accustomed. The last is Ease of Integration (57.3%). The technology should be able to fully integrate into existing legacy tools across various functions to save a company from investing to upgrade its legacy systems. Accordingly, several characteristics also have to be considered to create good demand plan and forecast, such as:

1. Accuracy, should be determined to make a comparison with other alternative forecasts.
2. Reliability, the user should establish some degree of confidence.
3. Timely, set a certain amount of time to respond to make some change if necessary.
4. Easy to use and understand, users should find the forecast comfortable to work with.
5. Cost-effective, the cost should not be higher than the benefits obtained from the forecast.

2. Customer's Wish

Based on the Market Analysis report from European Commission (2012), they defined the global consumer trends to shampoo and other haircare.

- **Selective Consumers:** selective and reluctant to buy a product that not fit their lifestyle. They are more interested to a more simple, natural, and trustworthy product.
- **Specialization:** specialized product which satisfy their specific needs (e.g., dandruff shampoo)
- **More Natural Product:** They concerned with the chemical ingredients inside the shampoo
- **Environmental awareness of consumers:** more intended to buy environmentally friendly product
- **Convenience:** The consumer is interested in a simple product that can be used quickly and directly, which is shown in development in product packaging.

- **More consciousness about health and safety:** They are well more informed and considering the side effect of hair care for their health.
- **Growth in ages-consumers products:** new product which can fulfil the needs of each age.

Furthermore, by balancing market demand and supply, the company can aim to establish an optimized supply chain by "manufacturing products when needed", "producing only the necessary quantity", and "delivering to customers in a timely manner". In conclusions, as a customer-oriented company, P&G's Head & Shoulders business should be agile and responsive with consumer preference. Their preferences could come from product type, packaging size, and convenience. P&G's Head & Shoulders product divisions, should be able to understand and collect the information of the consumer preference at the Dutch Market to improve their response and agility in the process. This approach also can fulfil the consumer preference to buy product with a more environmentally friendly in the process.

3. Diagnosis and improvement directions

3.1 Root cause-analysis (RCA)

As mentioned before in the first chapter, the major possible problem for Head & Shoulders Shampoo supply chain is the low accuracy in Demand Planning and Forecasting result. Therefore, this issue will become our main focus of problem for this study.

3.1.1 Fishbone diagram

The first method we used to identify the root cause of low accuracy in Demand Planning and Forecasting result is fishbone diagram. The purpose is to identify several causes which expedite the existing problem. The analysis shows that the problem of low accuracy in Demand Planning & Forecasting result of Head & Shoulders Shampoo can be visualized for its causes across different chains, as shown in the Figure 3.1. Based on root cause analysis, the primary problem origins have been found from several dimensions such as time, data, inventory, condition, customer, and control.
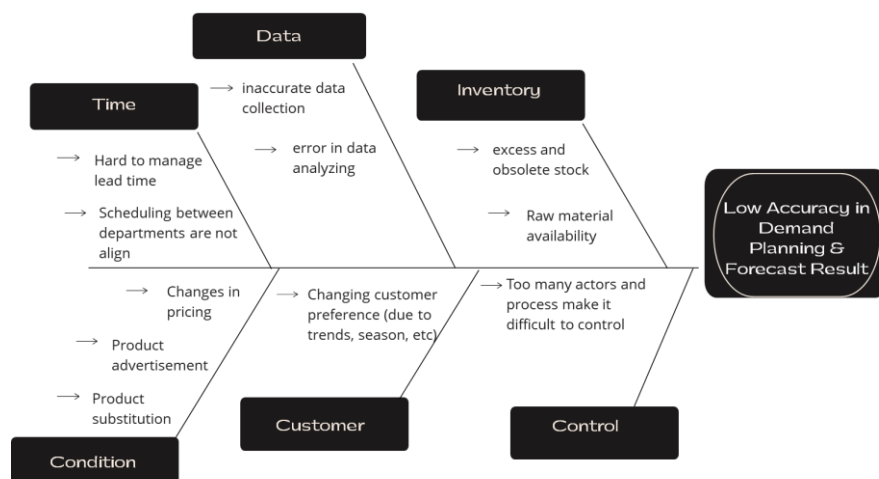

Figure 3.1. Fishbone Diagram

3.1.2 5-Whys

Based on RCA using fishbone diagram techniques, it is identified that various causes for all dimensions have a similar impact on the Head & Shoulders Shampoo problem. Therefore, it is essential to verify and identify the major cause that effectively impacts this problem in this scenario. So, RCA techniques of 5 whys analysis are used to determine the major cause for these problems further (Figure 3.2).
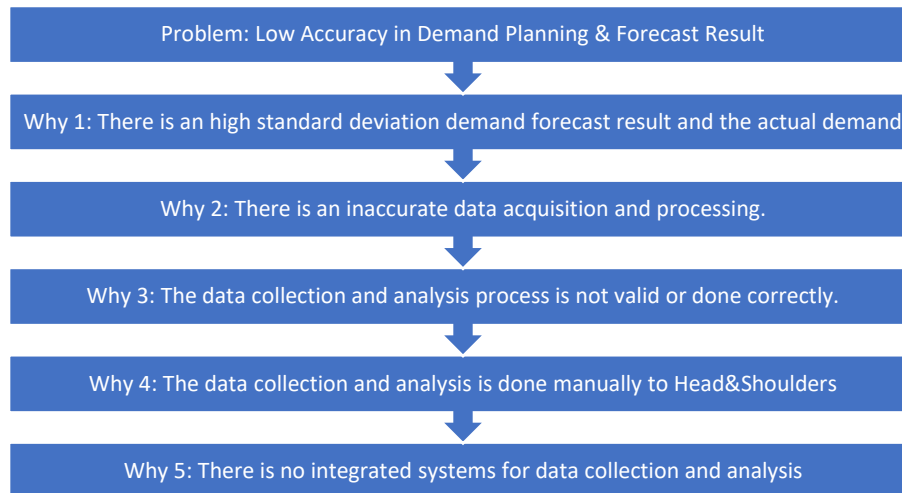

Figure 3.2. 5-Whys Diagram

Based on the root cause analysis, we identify that the root cause of low accuracy in demand planning and forecasting results is the absence of an integrated system for data collection and analysis between Head & Shoulders Shampoo and the customer. Therefore, we propose to apply Machine Learning in all demand unit departments so that the data collection between customers and Head & Shoulders Shampoo can be integrated. The machine learning will also be applied to adjust demand based on the parameter needed from unit sales department and for doing demand review adjusted with finance, procurement, production, and sales team.

4. Future process description
4.1 BPMN process model (To-be)

For the future business process model, Agile methodology can be used and combined with Business Process Re-engineering (BPR). Agile is more focused on responding to the requirements of a given customer. What a product needs to be done for a customer and the process focuses on what truly is necessary for a customer and get that done through fast feedback and time to deliver. As previously described in fishbone diagram, demand planning and forecasting process faces problems such as changing customer preferences, price changing, changing lead time, changing raw material availability, and changing conditions because of product advertisement and product substitution. As Agile emphasizes more on speed, reaction, flexibility, short time to market, minimum viable product, unpredictable behavior, and beekeeping, Agile methodology is suitable for business processes that must respond quickly to changes. Therefore, Agile can be chosen as a method for improvement of Head & Shoulders' demand planning & forecasting process to resolve above mentioned problems.

Business Process Re-engineering (BPR) is a framework that adopts fundamental and radical ways of restructuring business processes to improve the organization's performance (Bharosa et al., 2015). BPR is focused on outcomes, not tasks, while using technology to support the redesigned process. It is important to distinguish that the use of technology is not to automate the old process but to revolutionize them and start from a clean canvas (Hammer, 1990). Based on root cause analysis that has been conducted using 5 whys, the absence of integrated systems for data collection between Head & Shoulders Shampoo and customers has been identified as the root cause of the main problem, which is inaccurate demand planning & forecast. Currently, data collection is done by customers independently and shared manually to Head & Shoulders. Data analysis is also done manually using excel which is time-consuming and prone to standard deviation within the analysis. Therefore, we propose changing the whole system from manual to automated and integrated system using Machine Learning. Because of the use of technology for automation (Machine Learning) and the business process will be restructured radically from manual to integrated system, BPR is a fitting method for this improvement.
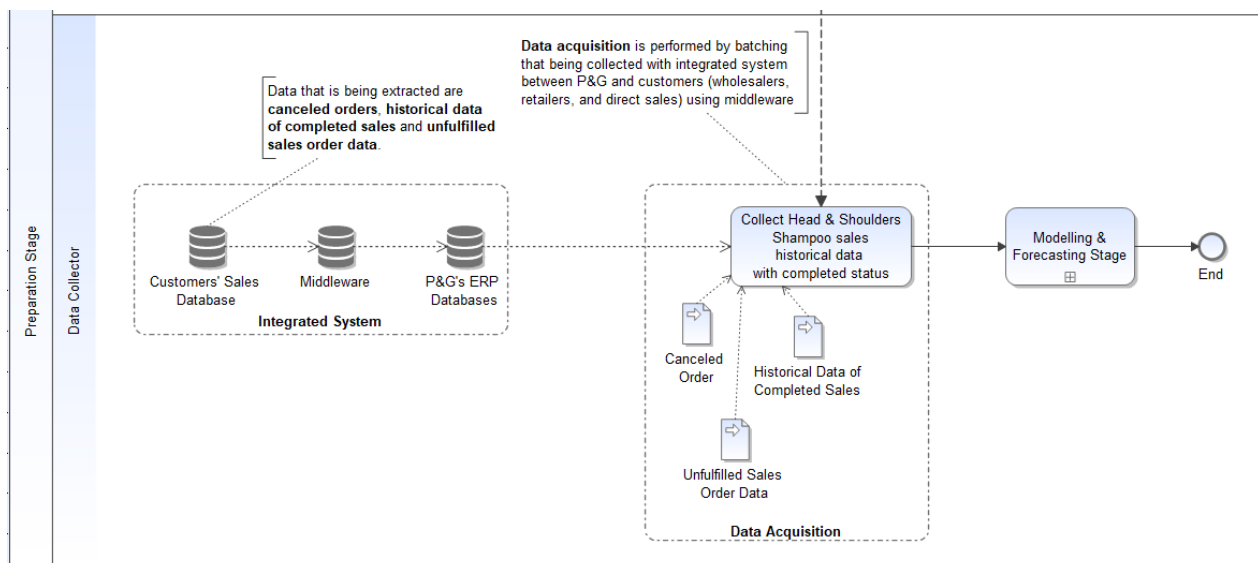

Figure 4.1. A Snip of To-Be Process Diagram (1)

The process in the new business process will experience automation with the use of machine learning and integrated system. For the results, the number of tasks and actors needed to operate the whole process will be reduced. Firstly, data collectors which previously existed within each unit will be performed by only one person for the whole unit. Secondly, some activities that previously were done manually are combined due to their replacement with automation by machine learning. The activities that are combined such as adjust the forecast as well as perform and generate the forecast (Figure 4.2).
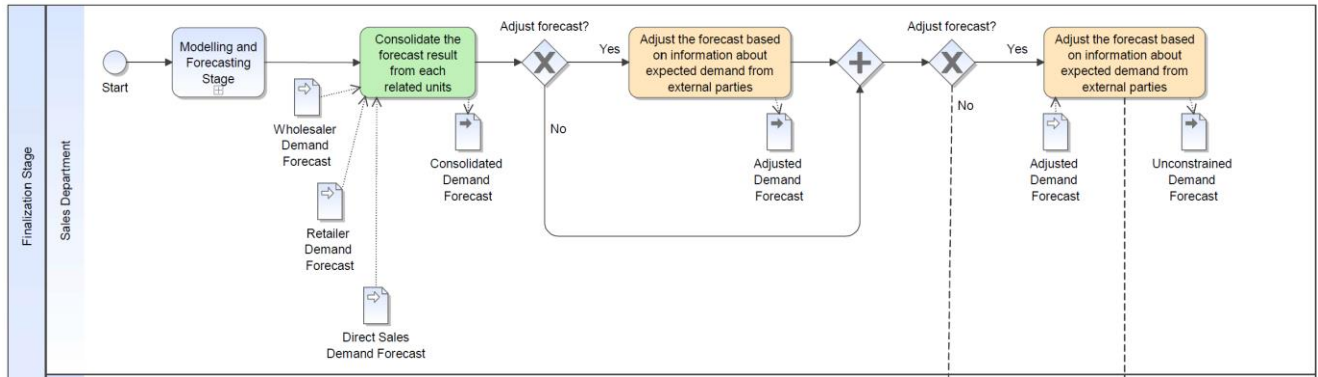
Figure 4.2. Example of As-Is Process Diagram which will be combined

Thirdly, there are some activities that are eliminated due to the implementation of machine learning. For instance, on Figure 4.3 activities is eliminated due to the implementation of integrated system between customers and P&G. In this case, we assume that all P&G's customers have their own system to manage and store their sales data (Figure 4.1). Hence, the improvement will be related to the first point where the data collection will be centralized to one person. Other activities such as, "Set and review forecast parameters and model", and "Document the final consensus demand" are also removed from the process. Machine learning will cover that process and all the documentation can be accessed on a dashboard.
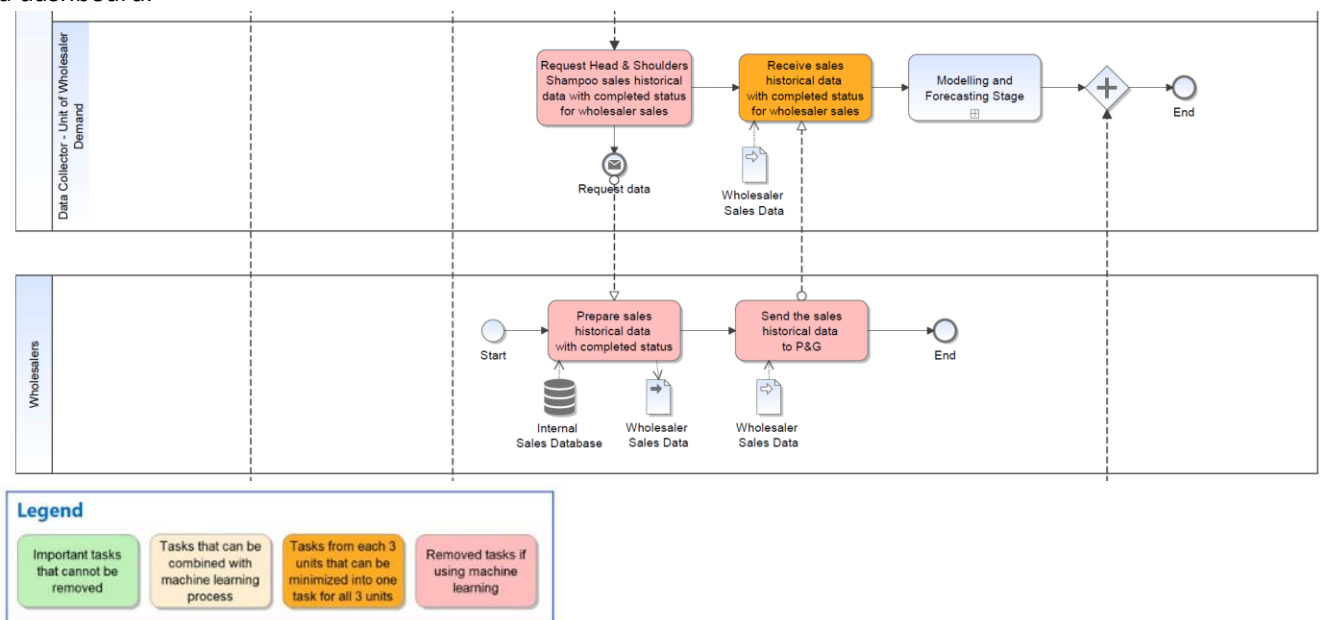

Figure 4.3. Example of As-Is Process Diagram which will be removed

Lastly, the unit of wholesaler and retailer that previously consisted of four people and unit of direct sales that previously consisted of three people will only need one person each to do the forecast. As a result of the use of machine learning, the swim lanes will be reduced from 14 to 7, and the number of processes reduced from 50 to 37. The complete To-be process diagram can be referred to Appendix E.

4.2 Machine Learning Architecture

The machine learning architecture implements the learning algorithm based on the input to perform the demand forecast (Pradhan and Singh, 2020). The type of the Machine learning used will be a Supervised Learning, means that the analysis will use pair of input and output that used to train the machine learning system to understand the pattern and correlation between input and output (Gartner, 2017).
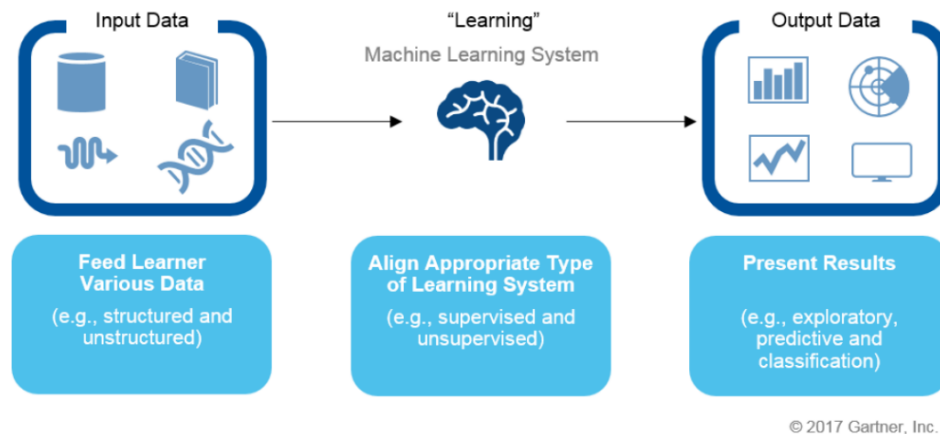

Figure 4.4. Machine Learning Architecture (Source: Gartner, 2017)

The basics of machine learning can be seen in the figure below. The input data will be the main source for the machine learning analysis. For the first machine learning process of demand forecast, the input will be based on the sales historical data with completed status for regional sales. Then, it will consider the "new variant" option before going to the "Learning" process, in this case is the Supervised Learning type. Later, the output will be the demand forecast based on the level of unit demand (wholesaler, retailer, and direct sales).
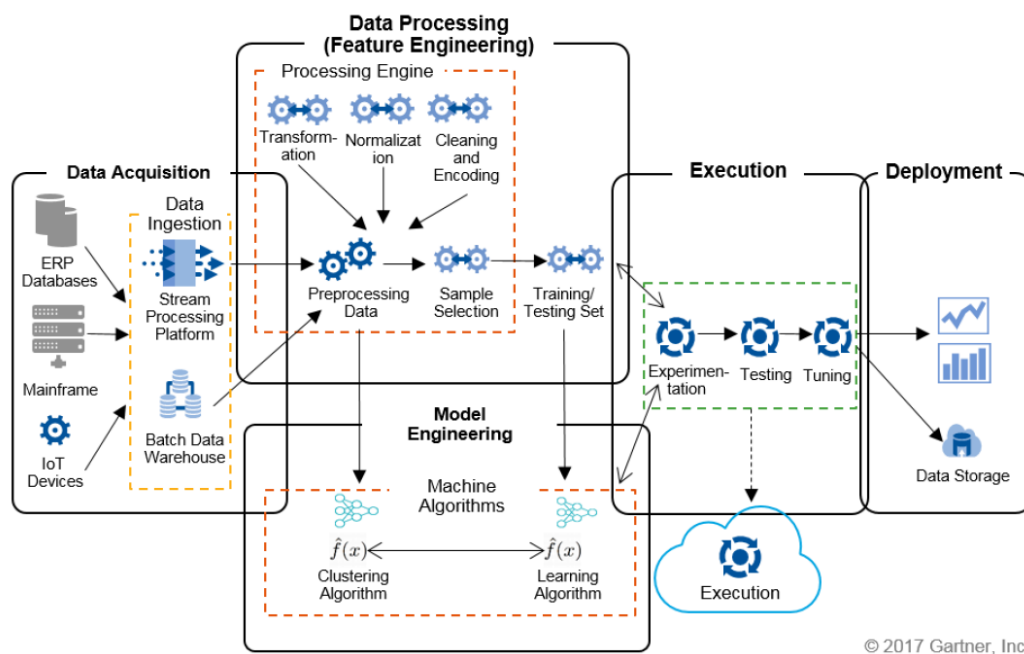

Figure 4.5. Detailed Diagram on Machine Learning Architecture (Source: Gartner, 2017)

Based on the report from Gartner Technical Professional Advice, there are five infrastructure area functions needed in Machine Learning architecture. Those are:

- **Data Acquisition:** the steps where data is collected and prepared for the next process.
- **Data Processing:** the steps for preprocessing, sample selection and datasets training for execution
- **Data Modelling or Model Engineering:** the steps for data modeling and machine learning algorithm for data processing
- **Execution:** the steps for process the data using the machine learning routine
- **Deployment:** the result of the machine learning process. In this case is the demand forecast

The detailed Machine Learning Architecture from Gartner report of Technical Professional Advice can be seen on the figure 4.5. The data input will be based on sources such as ERP database, mainframes or part of the IoT (Internet of Things). The data will come in continuous flow, meaning the data input will be in real time using the help of IoT devices or cloud system. The option of real-time data input is used to support the responsiveness of the company towards the change in the demand. Therefore, for the P&G's Head & Shoulders Shampoo new proposed BPMN, the machine learning architecture could be simplified as design in Appendix E (Figure E.1, Figure E.2, Figure E.3 and Figure E.4).

4.3 The main trade-offs made and considerations, calculation for process improvement

4.3.1 Calculation for Process Improvement

As can be compared from As-is BPMN and To-be BPMN, there is reduction in process which can be depicted by the reduction of blocks. The number of processes is reduced from 50 (As-Is) to 37 (To-be). This reduction of process happens because of the use of integrated system and Machine Learning. Data collection processes from wholesaler, retailer, and direct sales can be combined into one integrated system and those data are not collected manually. Data analysis process from setting and reviewing forecast parameter and model, performing statistical forecast, and generating forecast results from wholesaler, retailer, and direct sales can also be combined into less process with the help of Machine Learning system. On Sales Department Unit, the adjustment of forecast results based on the parameters needed (e.g., information about expected demand from external parties, promotional planning, or other judgement) can be simplified into one single process by using Machine Learning. In our To-be BPMN, there is also a reduction of swim lanes. Swim lanes reduced from 14 (As-Is) to 7 (To-Be). With the fewer process, actors involved in the process are also reduced. The other effect of the reduced actors is that there are fewer transfer points within the process.

The use of machine learning techniques for forecasting provides more accurate forecasts than simpler forecasting techniques (Carbonneau et al., 2007). Machine learning allows real time analysis and forecasting with large volume of that is not possible to do manually (Agarwal and Jayant, 2019). The use of Support Vector Machine (SVM) technique could reduce the error in demand forecast by up to 10% with high combination of multiple products which can result to huge financial savings (Carbonneau, 2007). For reference, based on report from Capgemini in 2019, Danone implemented machine learning in demand forecast and obtained 30% reduction in lost sales, 30% reduction in product obsolescence, 20% reduction in wrong forecast and 50% reduction in workload of demand planners.
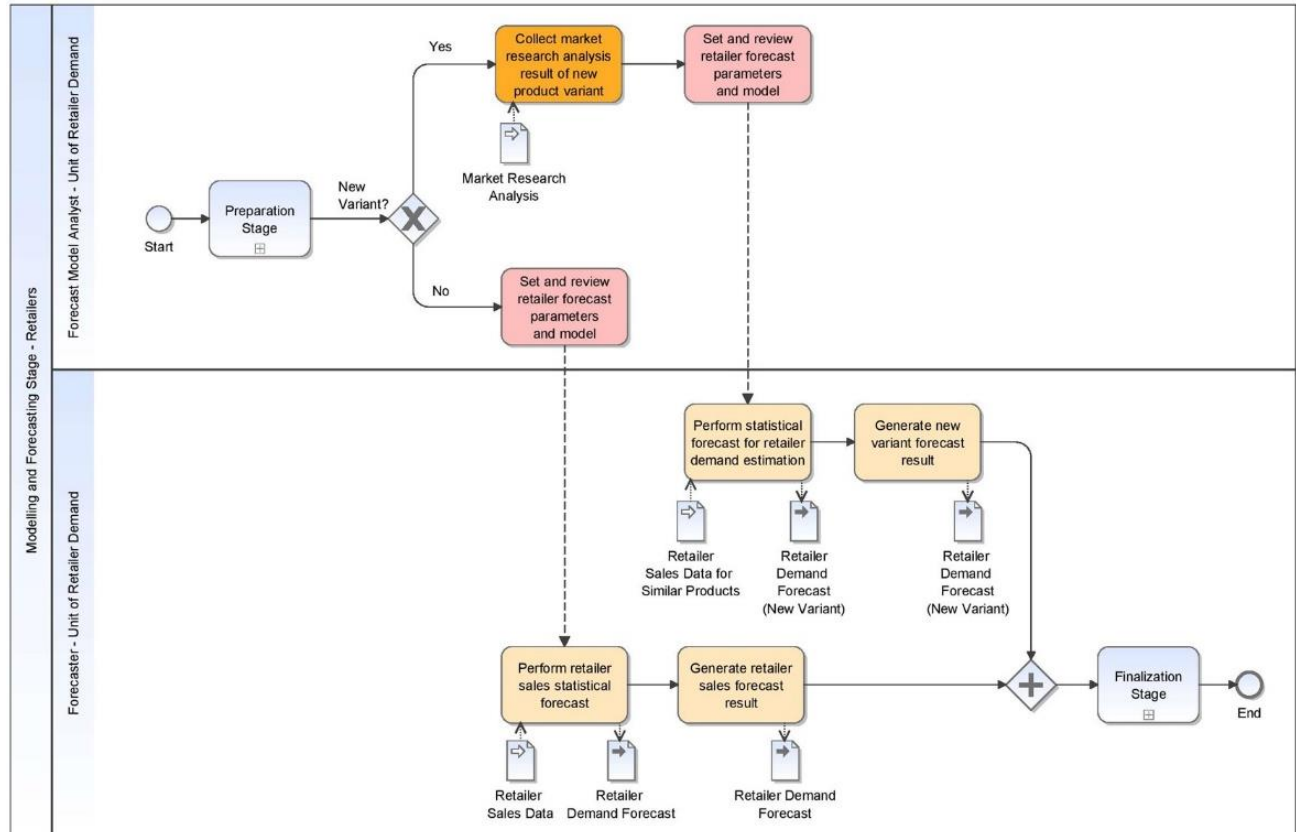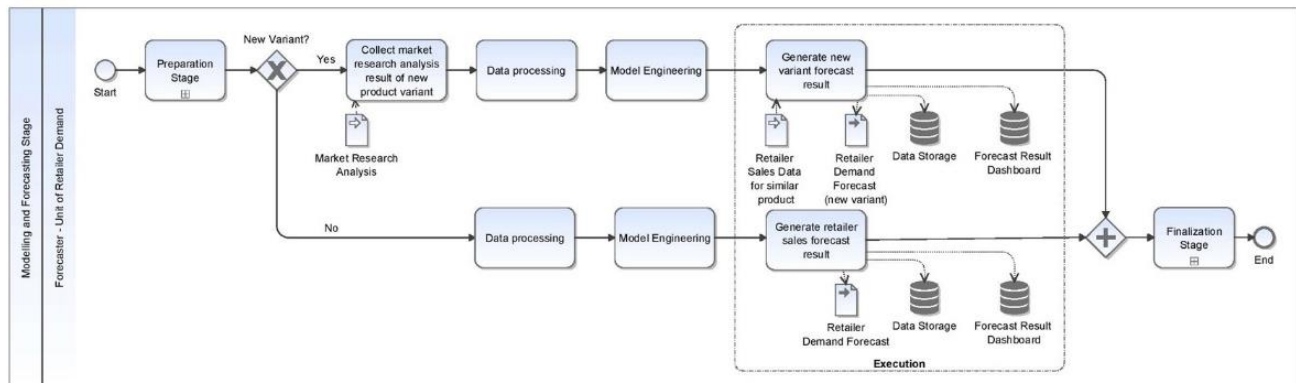
Figure 4.6. The Reduction of Lanes and Tasks with the Use of Machine Learning

4.3.2 Trade-Off of To-be process

After conducting root cause analysis, a set of improvements were drafted up to improve several aspects mentioned above. However, there are several trade-offs to our proposed improvements. Firstly, the automated and integrated system does improve the accuracy of the forecast result because data collection can be done more accurately, and data analysis can be performed automatically by Machine

Learning. The improved process can also reduce bias because the probability of over-forecast or under-forecast can be minimized by more accurate data collection and analysis. Additionally, it improves the flexibility of demand planning & forecasting process because it can respond to changes better (changes in pricing, customer preferences, lead time, etc.).

However, the implementation of machine learning in Head & Shoulders Shampoo business will require sufficient data and computer power since the system used a complex algorithm which required a high computer performance (Gartner, 2017). On the other hand, developing one's own machine learning will require a lot of knowledge, resources, and processes. Technical professionals should prepare the Machine Learning process and technical architecture. The process is highly iterative shown in the figure below, means it's more of a cyclic process so as to improve the learning system (feature engineering, model engineering and model evaluation) (Gartner, 2017).
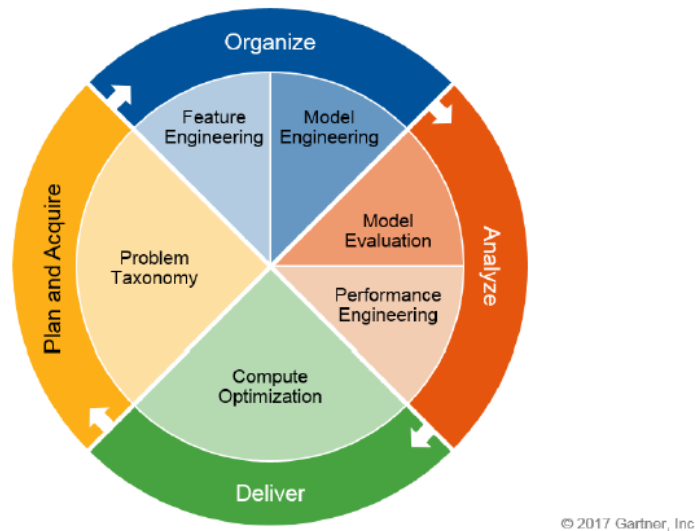

Figure 4.7. Life Cycle of Machine Learning (Gartner, 2017)

Second, we acknowledge that our proposed solution can increase the responsiveness of the process because the integrated system between the company and customers reduces the possibility of data mismatch between them and makes data collection more accurate. Machine learning also allows real time analysis and forecasting with large volume of that is not possible to do manually. However, it would make the IT architecture more complex and requires more effort to build a compatible system between customer and Head & Shoulders. Additional experts are also needed, and high-performance computers and clouds are essential to keep the system working during the process.

5. Implementation and risks analysis

5.1 Activity-Based Costing

To have a better understanding of the effect of implementing the proposed solution, it is important to identify and assess the risks associated with it. Therefore, calculating the cost-benefit is essential for a new product or service to bring improvement to the company, and one of the right ways to do it is to use Activity-Based Costing. Activity-Based Costing is a costing method that links the cost of performing organizational activities to the products and customer where these activities are performed (Cooper & Kaplan, 1992). Using this method requires an overview of the cost of each activity, which could be

organized in activity pools and drivers. Further details on cost calculation will be shown in Appendix C. The visualization of the cost pool and drivers is demonstrated below.
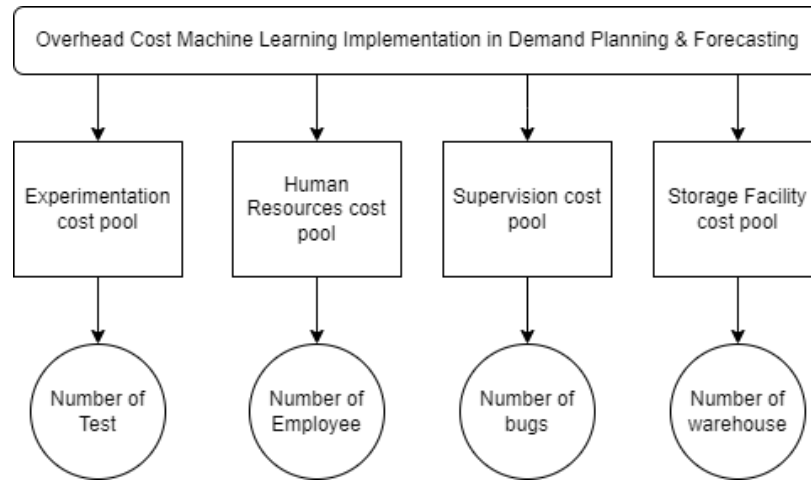

Figure 5.1. Activity Based Costing Analysis

In the context of Machine Learning Implementation in Demand Planning and Forecasting, experimentation, human resource, supervision, and storage facility cost pool are associated with it. There are three technologies which will be required to be implemented such as Integrated Data Collection, Machine Learning System and Data Storage.

5.2 Risk Analysis

In regard to the risks associated with the proposed solution, there are several types of risks that may occur such as: inventory, information systems, and demand forecast error (Lawless, 2021). Further details on examples of each category are displayed below:

1. Inventory: Excess inventory, Possibility of stock out occurrence
2. Information Systems: Failure in system integration between company and customers
3. Demand Forecast Error: Poor handling of data and information, innately high volatility of demand, poorly organized and poorly managed forecasting processes

To mitigate the risks, there are strategies that could be considered to reduce the occurrence of the risks. These are the following mitigation strategies according to TriplePoint Technology:

a. **Trends and Anomalies**
   o Statistical forecast based on historical sales: Understanding the sales pattern could help to increase the forecast accuracy, since statistical analysis of historic sales may reveal hidden trends.
   o Aggregation of items that are difficult to forecast: for the purpose of maturating the forecasting, the company should be able to aggregate data elements that are difficult to forecast.

b. **Collaboration**
   o Collaborative forecasting with customer: This indicates the participation of the front-line sales since they have the most reliable information. In this case, the wholesaler, retailer, and direct sales unit are the focus of the collaboration to collect the historical data sales.
   o Customer providing automated forecast input: This method could reduce the duration and effort of the data collection, while increasing the accuracy and quality of the data. The data input could

be in real-time, which means it could improve the company responsiveness towards change in demand.

c. **Structure and Workflow**
   o Forecasting horizon: Frequent forecasting is required as a means to increase responsiveness and make a decision making for a long-term planning. From the suggestion given by TriplePoint Technology, a three-month tactical forecast is considered as optimal in terms of balance between forecast complexity and preserving ability in long-term planning.
   o Frequency of formal forecast collection: As a way to complete the demand forecast, the company needs to collect the input data which is obtained from the customer (wholesaler, retailer and direct sales unit). Frequent data collection is needed, where the ability to collect data in real time could improve the demand forecast accuracy and responsiveness.

d. **Advance forecasting model:** By using the more advance forecasting model such as machine learning, the company could work on high volume of real time data (Datta et al., 2008) This method could increase the forecast accuracy, where every 1% improvement in forecast accuracy could reduce the number of inventories to 1-2% (TriplePoint Technology)

e. **Integration with downstream planning and scheduling**
   o Integration of sales forecast with downstream S&OP planning process: The real value of an accurate demand forecast is only realized if the company could meet the demand. Therefore, the integration of demand with supply and delivery planning process is needed. The change in demand plan should be followed by adjustment of production and distribution plans and schedules.
   o Demand plan review and revision in downstream planning processes: The marketing and production planning teams should work together to track the forecast. Thus, the transparency of forecast data is required to support such a decision making.

6. Conclusion

Head & Shoulders Shampoo is a shampoo brand produced by P&G. In this report, the business process analyzed is the demand planning and forecasting since it's one of the vital business planning activities to be responsive and adaptive to fulfill customer's demand, in order to support the vision and mission of P&G that aims to serve consumers, customers, society, and shareowners. The scope of analysis is limited to fulfill customers' demand in the Netherlands, consists of wholesalers, retailers, and direct sales. Therefore, the business process modeled was the product forecasting of Head & Shoulders Shampoo brand for P&G.

The existing process of demand planning and forecasting for Head & Shoulders Shampoo is done manually by excel, making the process has lots of adjustments, reviews, and similar tasks. There are 3 units based on their channel which consists of units of wholesaler, retailer, and direct sales demand. Each unit does their own forecasting process, which consists of steps that involve data collector, forecast model analyst, and forecaster. Through the diagnosis process, we found that the root-cause of the analysis is the low accuracy in demand planning and forecast result.

For the future business process model, agile methodology can be used and combined with the Business Process Re-engineering (BPR). The proposed business process is to implement machine learning and integrated systems, so that the process experiences automation. From the improvement, some changes are applied. Firstly, some activities that previously were done manually are combined due to their

replacement with automation by machine learning. The activities that are combined such as adjust the forecast and perform and generate the forecast.

Secondly, data collectors which previously existed within each unit will be performed by only one person for the whole unit. Thirdly, the unit of wholesaler and retailer that previously consisted of four people and unit of direct sales that previously consisted of three people will only need one person each to do the forecast. As a result of the use of machine learning, the swim lanes will be reduced from fourteen to seven, and the number of processes reduced from fifty to thirty-seven. In conclusion, the model suggested in this report lead to the recommendations that can lead to improvements of the overall demand planning and forecasting process of the Head & Shoulders Shampoo brand of P&G.

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Appendix

Appendix A: Detailed Stakeholder Analysis

Consumer's Expectation	Requirements
Low Cost	Minimize the production cost
Good quality product	Privacy
Meet customer preferences	Good market research and data collection
Suppliers' Expectation	**Requirements**
Profitable relationship	Win-win solution in contract
Customer's Expectation	**Requirements**
Profitable relationship	Win-win solution in contract
Smooth supply chain for P&G goods	Niche demand forecast for the product, thus the goods will always ready and available for each customer store
Government's Expectation	**Requirements**
Comply the EU cosmetic regulation	Comply European Cosmetic Regulation
Comply the Dutch cosmetic manufacture and sell regulation	Comply Dutch 2011 Commodities Act Devree cosmetic products
Employee's Expectation	**Requirements**
Higher effectiveness & efficiency	Optimized the process on the business process, which can be achieved with the additional of technology if necessary.
Satisfied Consumer	Feedback loop in consumer needs
Satisfied Customer	Feedback loop in customer needs
Satisfied Supplier	Feedback loop in supplier needs
Community's Expectation	**Requirements**
Positive impact towards society	Identified the societal problems in location of operational, and give a positive impact towards society (ex: donation, education, kids care, etc.)
Investor's Expectation	**Requirements**
Profitable business	Have a high performance in the market with niche planning and operation. This can be achieved by creating a sustainable business innovation which can optimized their process in the business.
Impact towards society	Similar to Community's expectation
Competitor's Expectation	**Requirements**
Better product quality	Differentiate from competitors in a way that the consumer has a higher willingness to pay
Better demand forecasting	Increase the accuracy and duration of the demand forecasting to maximize the profit of the business.

Appendix B: CATWOE Analysis

C	Customer	The customer of this business is the end consumer in Dutch market. The target people have an interest in buying the product in order to fulfil their needs. The Head & Shoulder product developed by P&G should match their requirements since they are the main source of profit and the subject of the demand in the future.
A	Actor	There are three main actors in this business. The first one is the P&G employee itself, specifically in the Head & Shoulder product section. The second actor is the supplier who provides the raw material and ingredients needed for production. Lastly, there is the customer (such as Jumbo, Albert Heijn, Kruidvart, etc.) which sold the product directly to the end consumer.
T	Transformation	The transformation will occur in the demand forecast and planning. The accuracy of demand forecast is essential to maximize the revenue of the business and minimize the financial risk from error. A sufficient method to collect and analyze the data is needed to reduce time, increase accuracy and provide transparency for other divisions in the process.
W	World	The world view is already described from the power interest grid provided in this report.
O	Owners	The owner of Head & Shoulder is the P&G company itself. The management of the company has the right to make decision making on the process, optimize the process and make several changes in order to achieve the company vision.
E	Environment Constraint	The constraint is based on the regulation provided by the Dutch Government (Netherland Food and Consumer Product Safety Authority (NVWA)) and EU.

Appendix C: Activity-Based Costing

Summary of Total Estimated Cost

Azure (Monthly)	Expense Category	Original Price	Converted to Euro
Analytics	Experimentation	$ 1.788,92	€ 1.645,81
Maintenance	Maintenance	$ 1.000,00	€ 920,00

Total Activity Based-Costing		
Expense Category	Current State	Future State
Experiment	€ -	€ 24,687
Human Resources	€ 717,411	€ 338,376
Maintenance	€ 28,000	€ 44,800
Storage Facility	€ -	€ 126,774
TOTAL	**€ 745,411**	**€ 534,637**

Estimated Cost Breakdown

1. Integrated Data Collection

- **Experimentation Cost**
  In this section, it is required to calculate the cost of implementing Machine Learning in Supply and Demand Forecasting, which is defined through experimentation cost. This experimentation in this section exists due to the condition that customers have their own respective system, thus requiring middleware which is implemented through integrated data collection. This requires the installation of Microsoft Azure, which will be used for this activity. This activity would last for 3 months. Given the large database and real-time data acquisition, the DS type on Microsoft Azure is used due to high memory which will help processing the large amounts of data. Furthermore, a 3-year guarantee option is used for this service due to its lower cost as well as a better option to evaluate the service after 1 year of use. The monthly cost of this service is €1.645,81; thus, it will cost €4.937,00 in three months.

- **Human Resources Cost**
  To have the project running, calculating the number of human resources required to implement this project is essential. As referred to the current business process, there are around 3 people working as marketeers which collect data from various customers with the average annual salary of each employee €40.659,00 (Glassdoor, 2023). If calculated, the total cost spent in human resources is around €121.977,00. On the other hand, future business processes indicate that there are reductions in human resources, as it only requires 1 person to operate in the data collection. Thus, the total cost spent will be €40.659,00.

- **Supervision Cost**
  As a way of mitigating risk associated with errors in analytics made by machine learning, having supervision cost pool is required. Supervision cost pool is defined by number of bugs, which means that it requires external/internal resources to mitigate such issue. Given the circumstances, resources that will be used originated externally through Microsoft Azure. By having a support

option in the service package, Microsoft Azure will provide technical support during the use of the Microsoft Azure Machine Learning System. This technical support would help maintain the quality of data delivered by machine learning as well as reducing and mitigating any errors made by machine learning itself. With a €920,00 monthly fee, the total fee for three months would be €2.760,00 for this service.

Integrated Data Collection (Middleware)				
Expense Category	**Current State**		**Future State**	
Experiment	€	-	€	4,937
Human Resources	€	121,977	€	40,659
Maintenance	€	-	€	2,760
TOTAL	**€**	**121,977**	**€**	**48,356**

2. Machine Learning System

- **Experimentation Cost**

  Creating a new Machine Learning System requires experimentation cost. Microsoft Azure will be used for Machine Learning environments. Using the same type as in the integrated data collection, the monthly cost of this service is €1.645,81, which means that in a year this service will cost €19.749,68.

- **Human Resources Cost**

  As referred to the current business process, there are around 14 people working as analysts with various roles with the average annual salary of each employee €42.531,00 (Glassdoor, 2023). If calculated, the total cost spent in human resources is around €595.434,00. As the proposed business process has shown efficiency in manpower, it only requires 7 people to operate after implementation of machine learning, therefore costing would be €297.717,00 per year.

- **Supervision Cost**

  Using the support option in the service package, Microsoft Azure will provide technical support during the use of the Microsoft Azure Machine Learning System. This technical support would help maintain the quality of data delivered by machine learning as well as reducing and mitigating any errors made by machine learning itself. With a €920,00 monthly fee, the total fee would be €11.040,00 for this service.

Machine Learning System				
Expense Category	**Current State**		**Future State**	
Experiment	€	-	€	19,750
Human Resources	€	595,434	€	297,717
Maintenance	€	-	€	11,040
TOTAL	**€**	**595,434**	**€**	**328,507**

3. Data Storage
- **Storage Facility Cost**

  Implementation of Machine Learning requires sufficient data storage to be able to operate smoothly. In this case, it requires a physical and technical investment. As the company already has its own data storage facility, it only needs to upgrade its current data storage. The estimated cost for 1 storage facility in a data center is €126.774,00 for 1 year.

- **Supervision Cost**

  Upgrading data storage facility requires supervision cost as well to maintain quality of the service. Therefore, a maintenance fee is required to reduce and mitigate any errors made during the upgrading process as well as maintaining it. The current cost of maintenance in the existing data storage facility is 28.000,00 per year. The maintenance cost of upgrading the facility would be €31.000,00 yearly.

Data Storage		
Expense Category	**Current State**	**Future State**
Storage Facility	€ -	€ 126,774
Maintenance	€ 28,000	€ 31,000
TOTAL	**€ 28,000**	**€ 157,774**

Appendix D: Existing Business Process of Demand Planning and Forecasting of Head & Shoulders Shampoo Brand for P&G
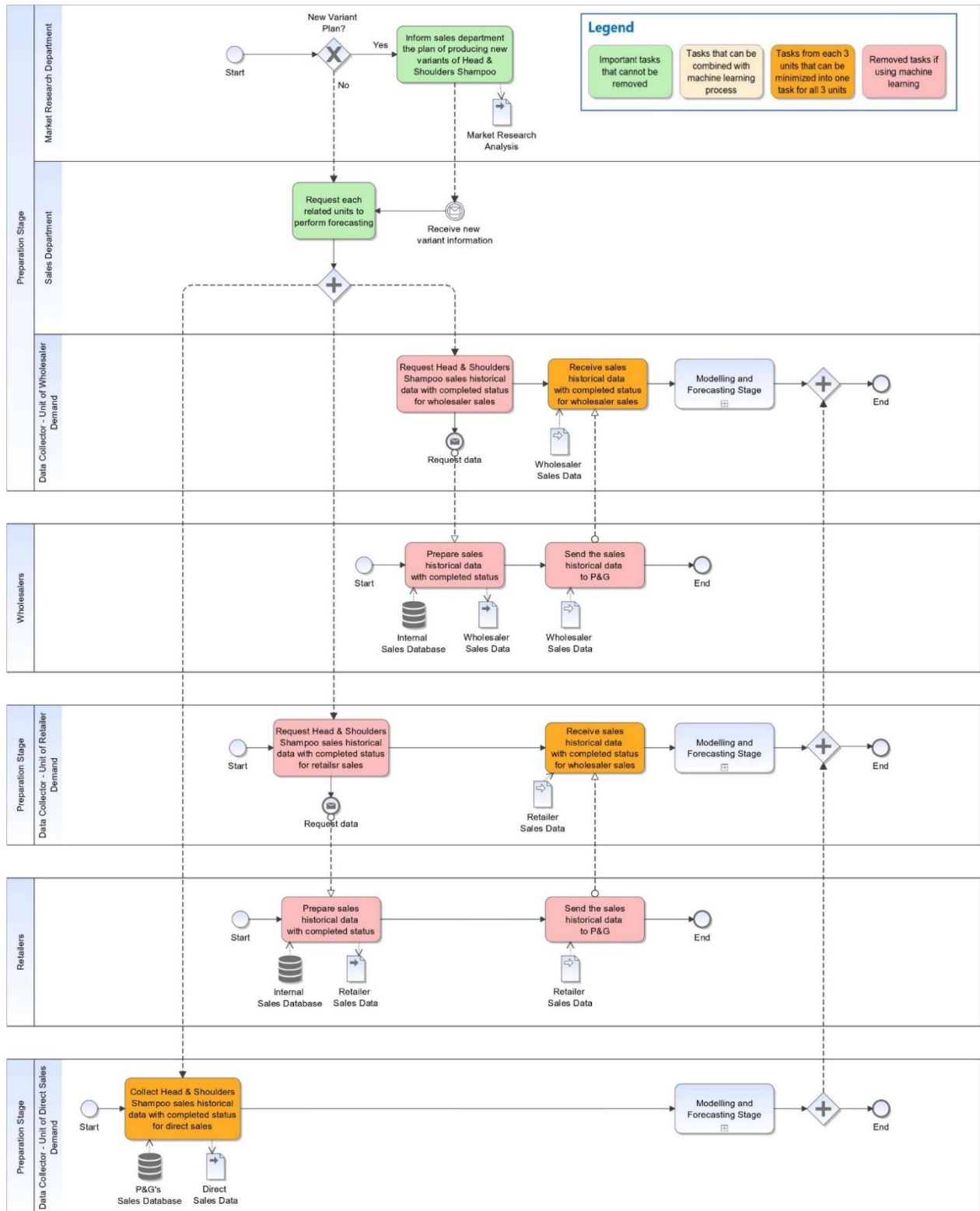

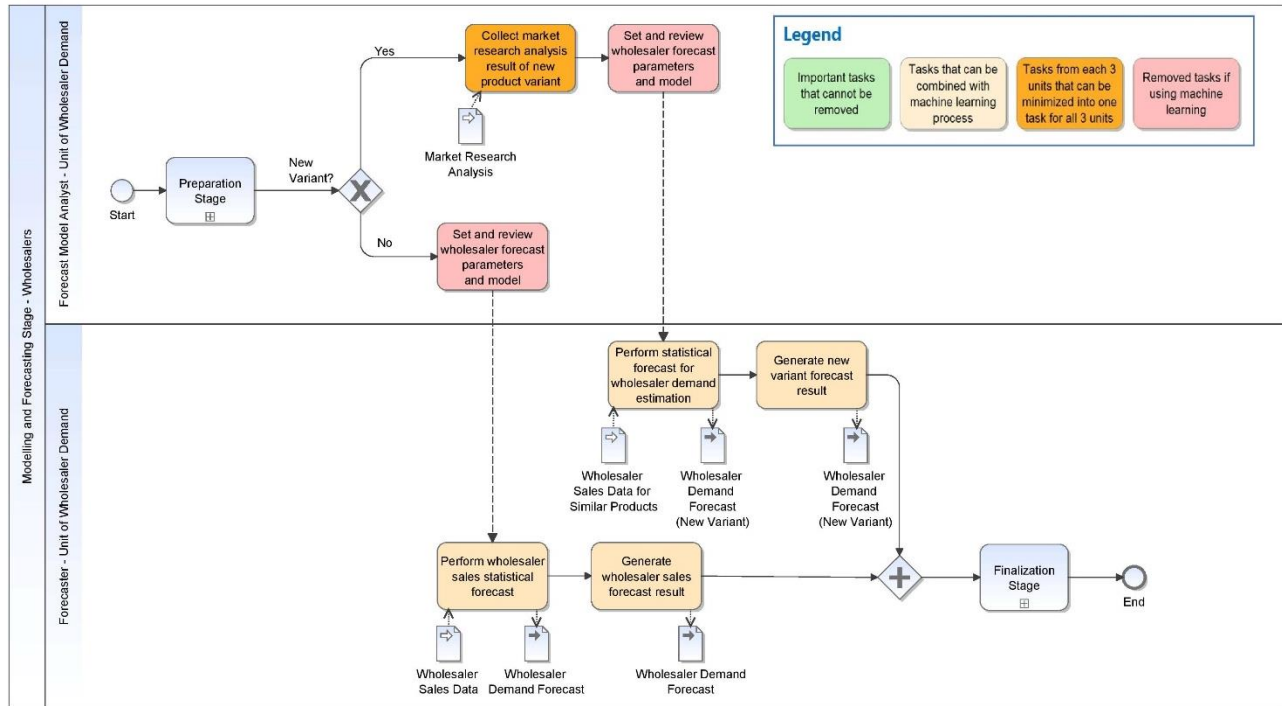Figure D.1. Preparation Stage

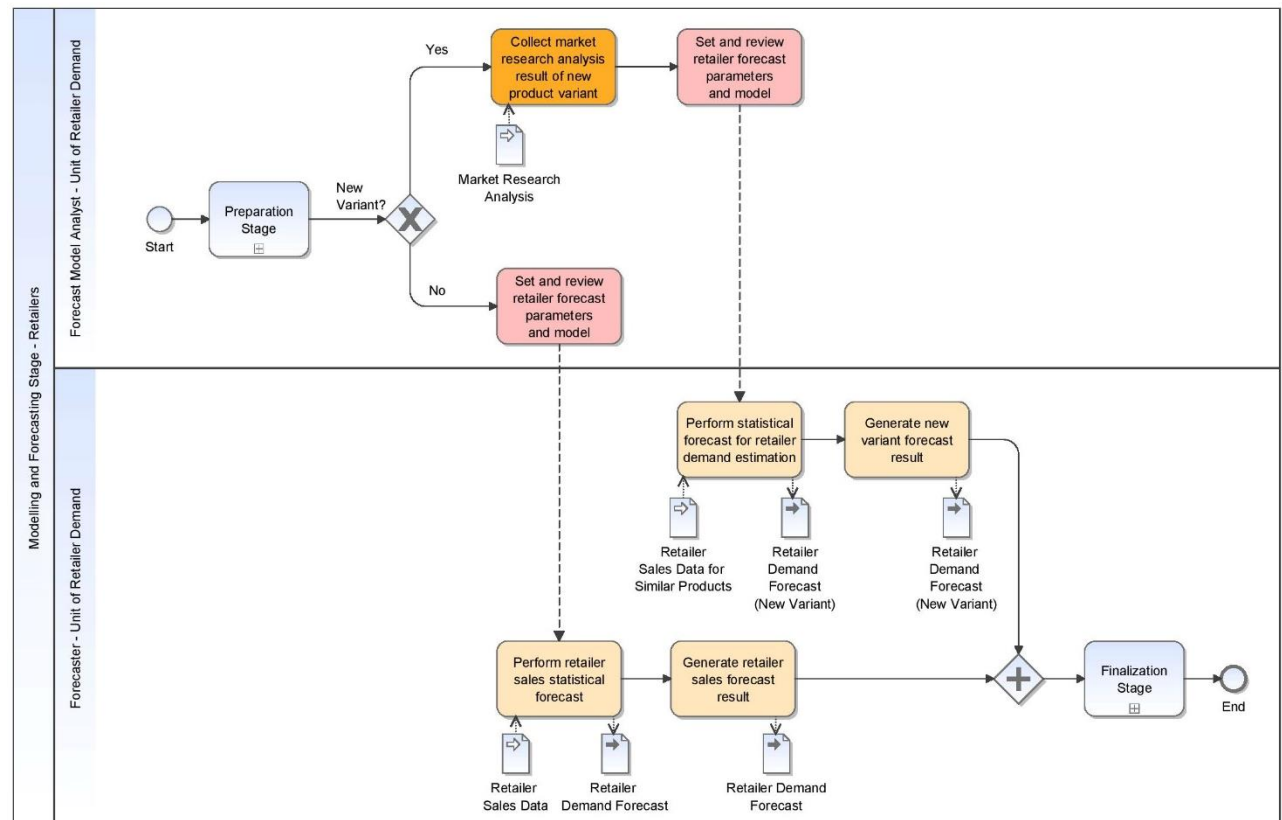Figure D.2. Modelling and Forecasting Stage for Wholesalers

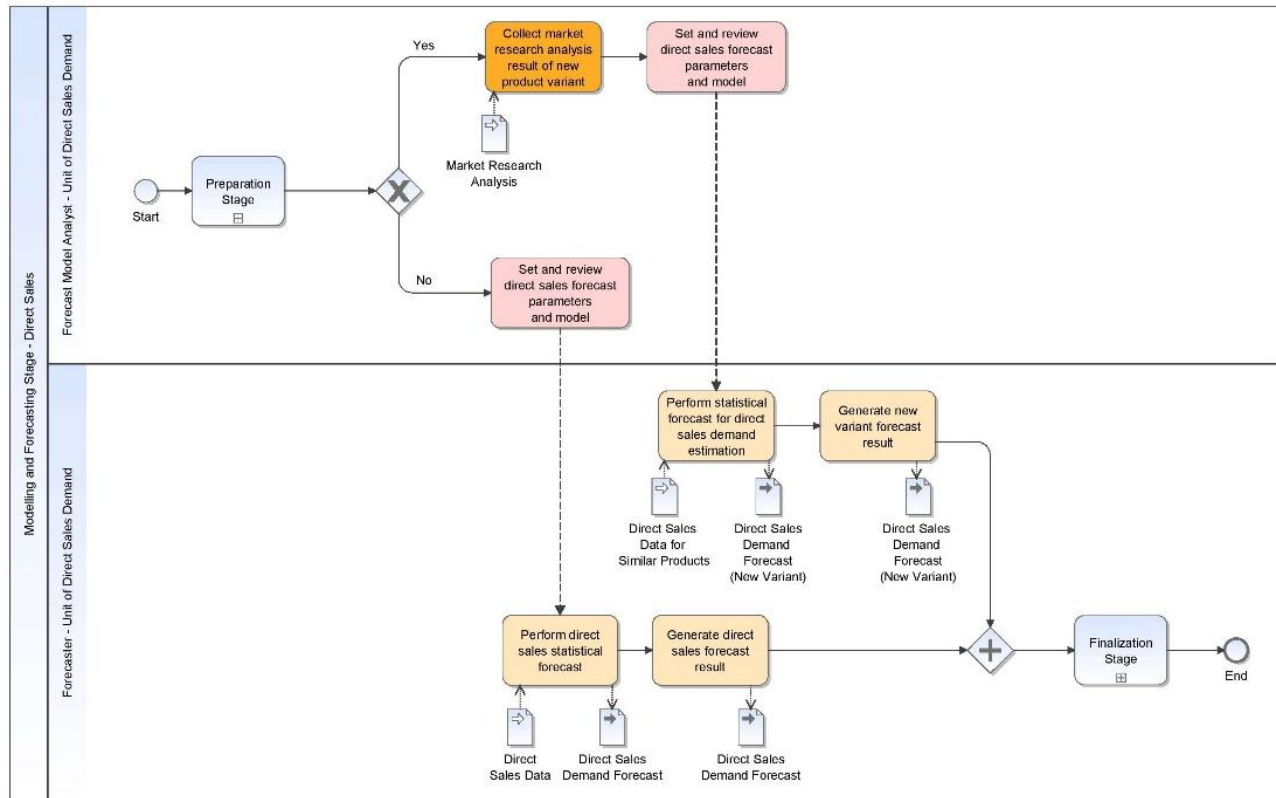

Figure D.3. Modelling and Forecasting Stage for Retailers

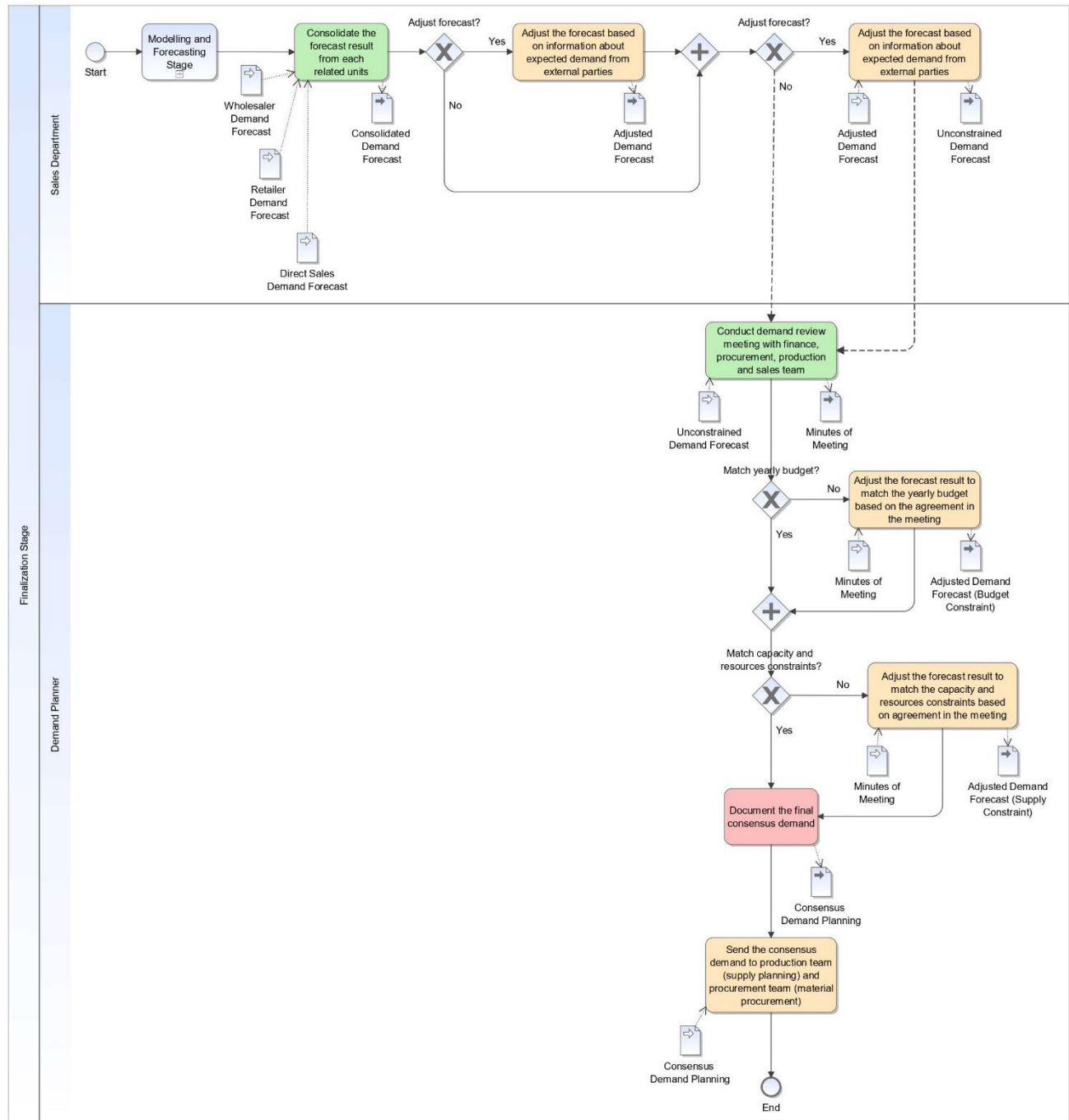Figure D.4. Modelling and Forecasting Stage for Direct Sales

Figure D.5. Finalization Stage

Appendix E: New Business Process of Demand Planning and Forecasting of Head & Shoulders Shampoo Brand of P&G based on BPR and Agile Improvement
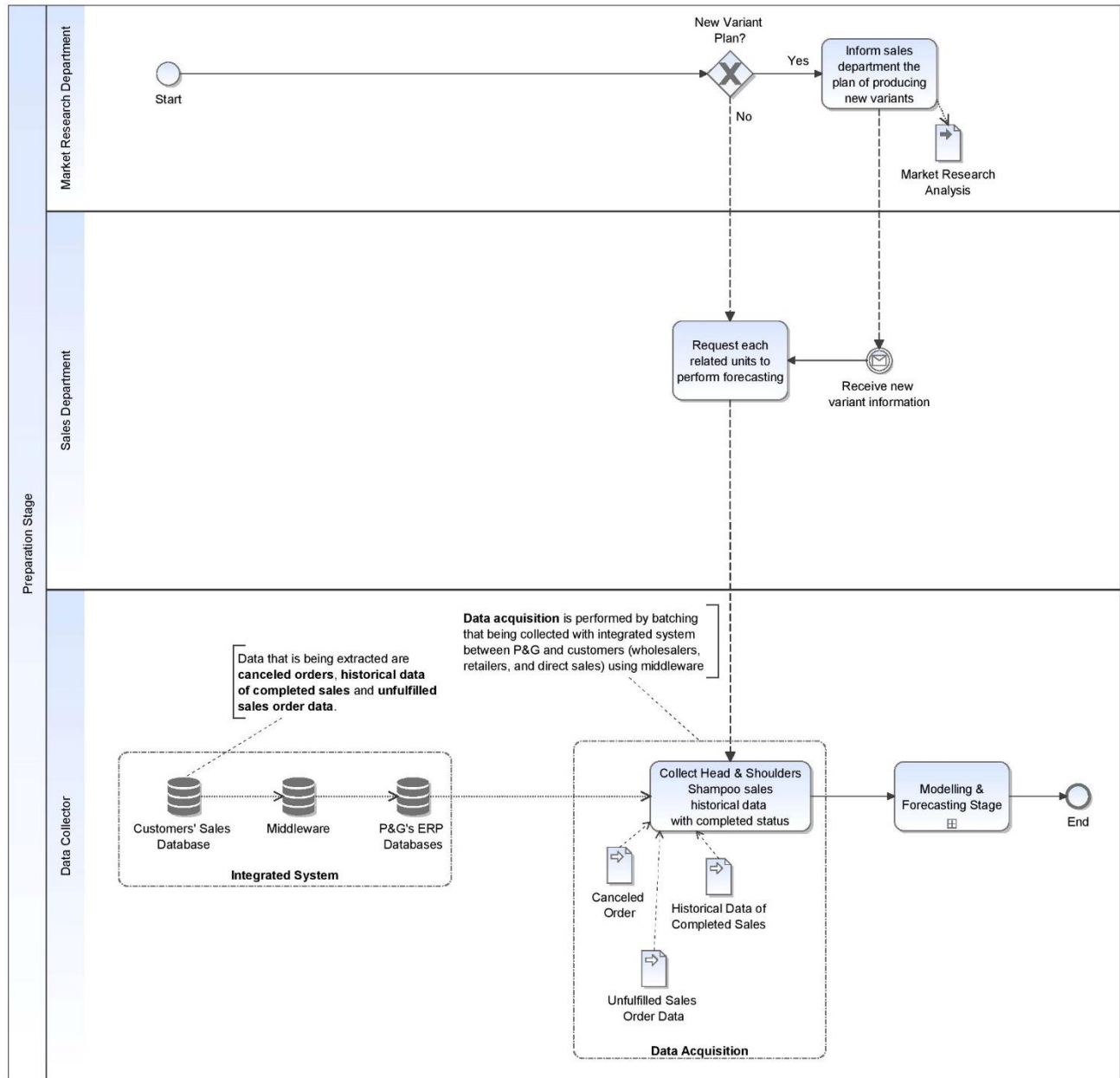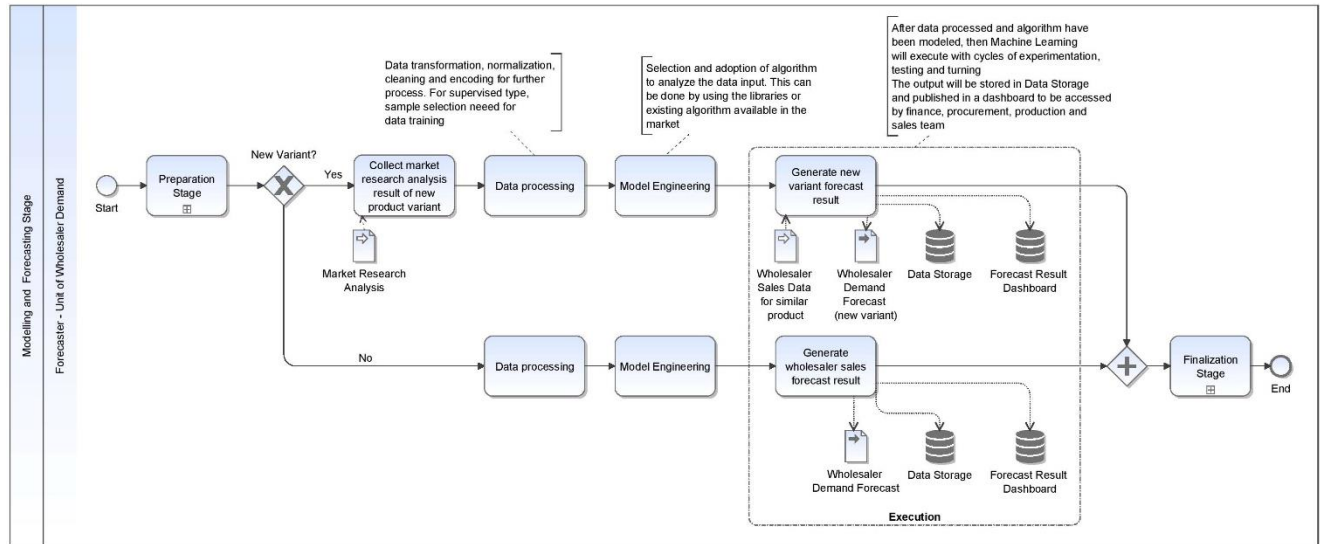

Figure E.1. Preparation Stage

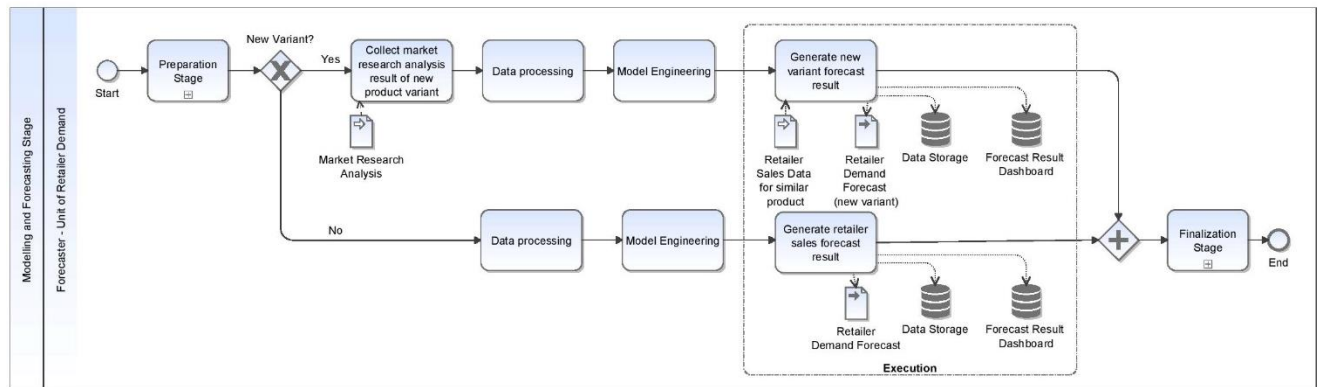Figure E.2. Modelling and Forecasting Stage of Wholesalers

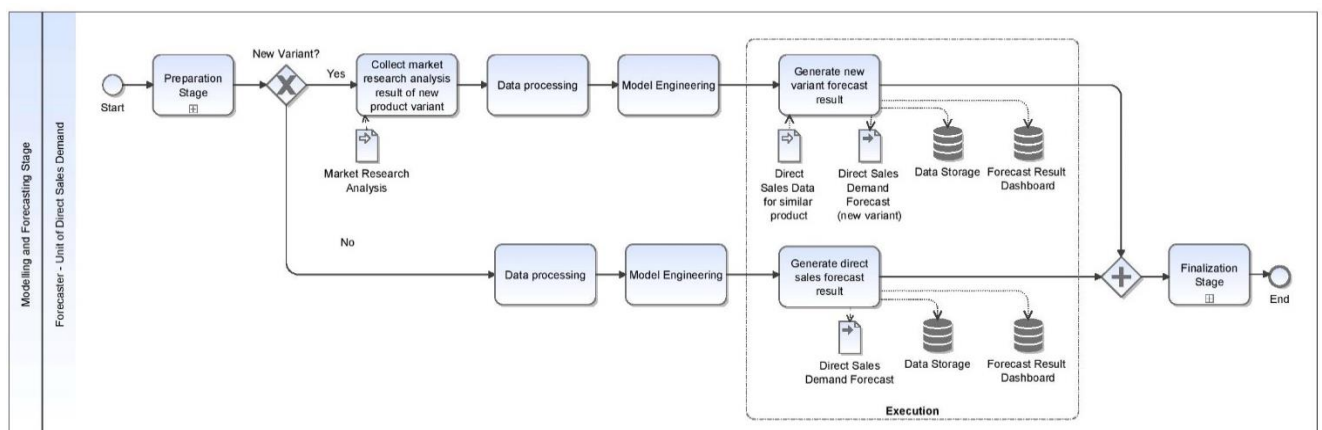Figure E.3. Modelling and Forecasting Stage of Retailers

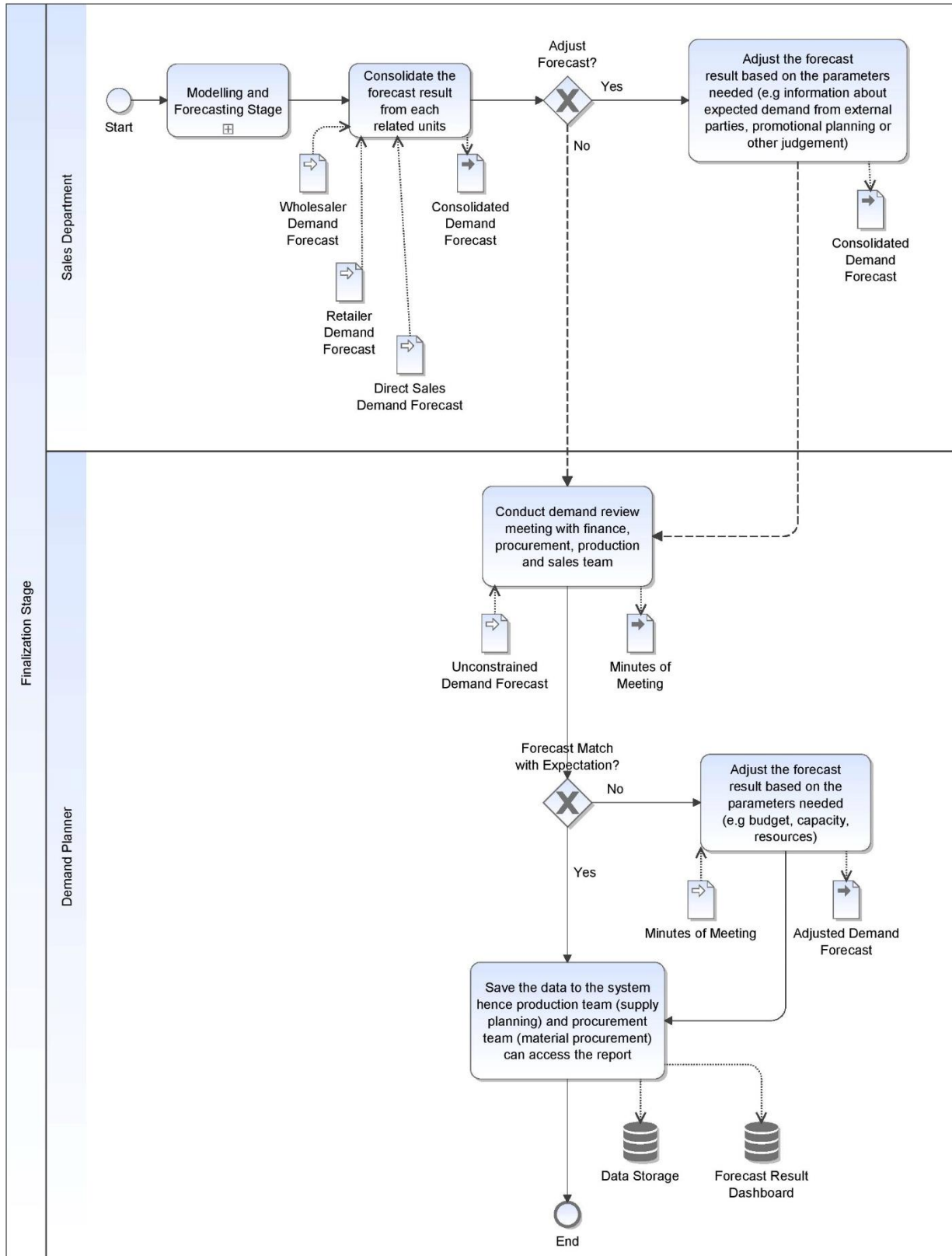Figure E.4. Modelling and Forecasting Stage of Direct Sales

Figure E.5. Finalization Stage

Appendix F: Project Team & Schedule Plan for Scrum Methodology

In this section, we describe the project team and the project schedule plan of the business process improvement.

Scrum Team

Scrum Master
Alifia Dheya Anggraeni

Business Owner
Chatarina Petra Salim

Stakeholder
Tinezhia Novitasari

Product Owner
Devano Yehezkiel Adipradhana

Scrum Team
Yusuf Hafidzun Alim

Project Schedule Plan

| W1	W2	W3	W4	W5	W6	W7
13 Feb	20 Feb	27 Feb	6 Mar	13 Mar	20 Mar	27 Mar
Kick-off	Sprint 1: Analysis	Mid-Term Presentation	Sprint 2: Improvement		Sprint 3: Realization	Conclusion

Final Presentation (29 Mar) & Report (1 Apr)
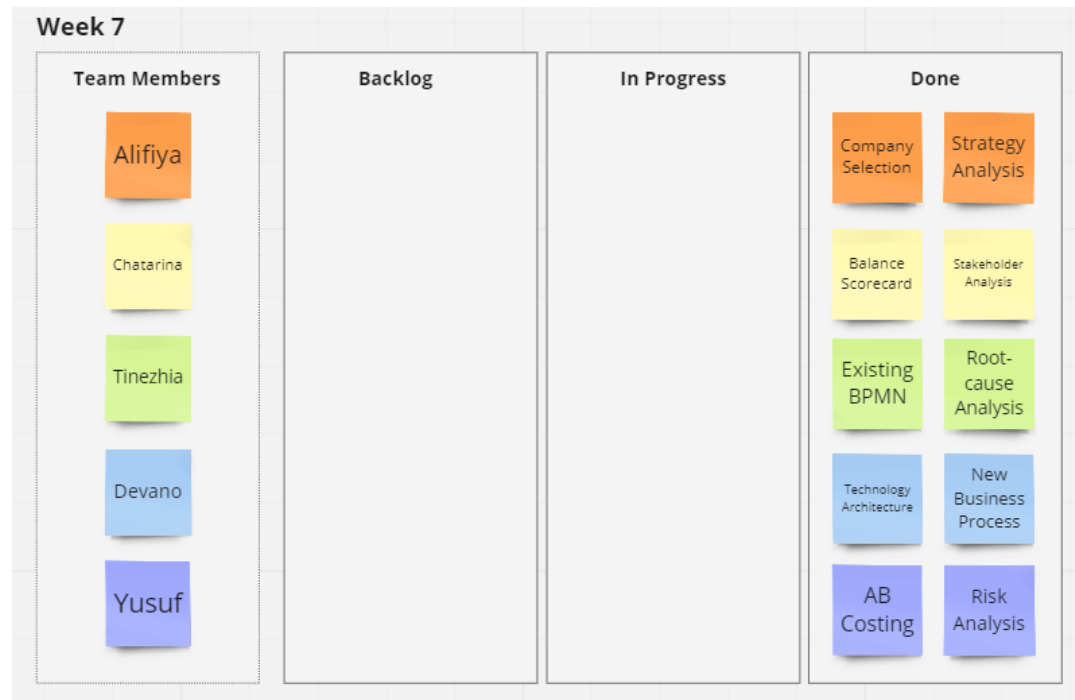
Appendix G: Kanban Chart

Week 1 - 13 February 2023 – In the kick-off week, the tasks that should be done are listed and are divided between team members.
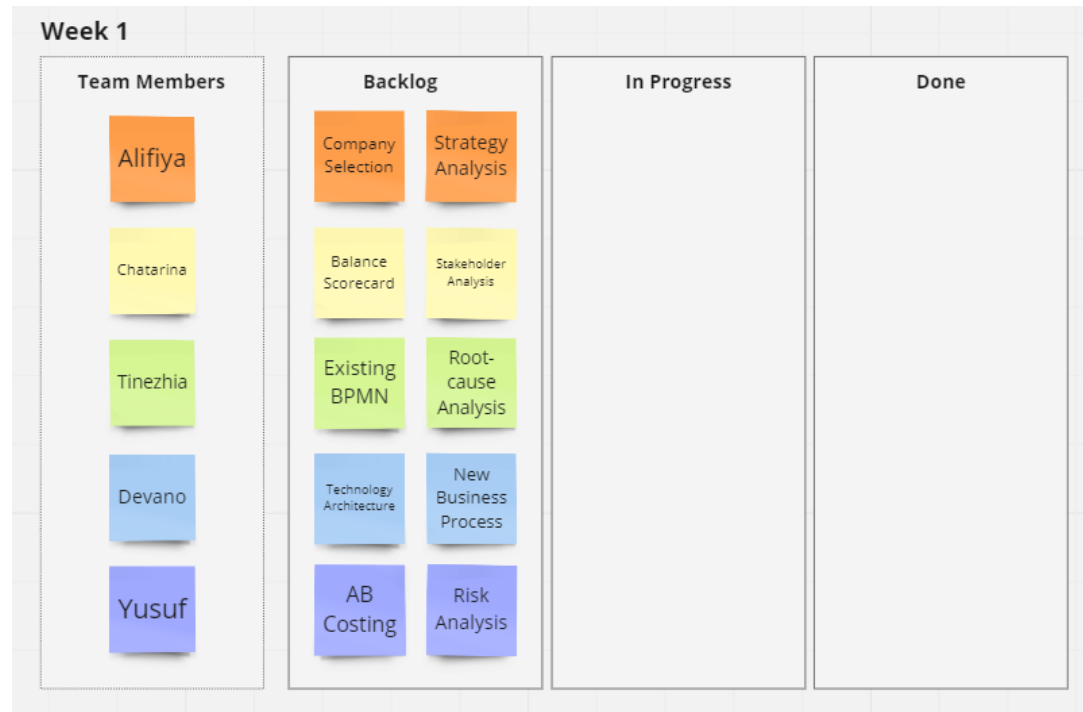
Week 3 – 27 February 2023 – Some tasks are moved into "In Progress" and "Done" sections based on the progress of the tasks.
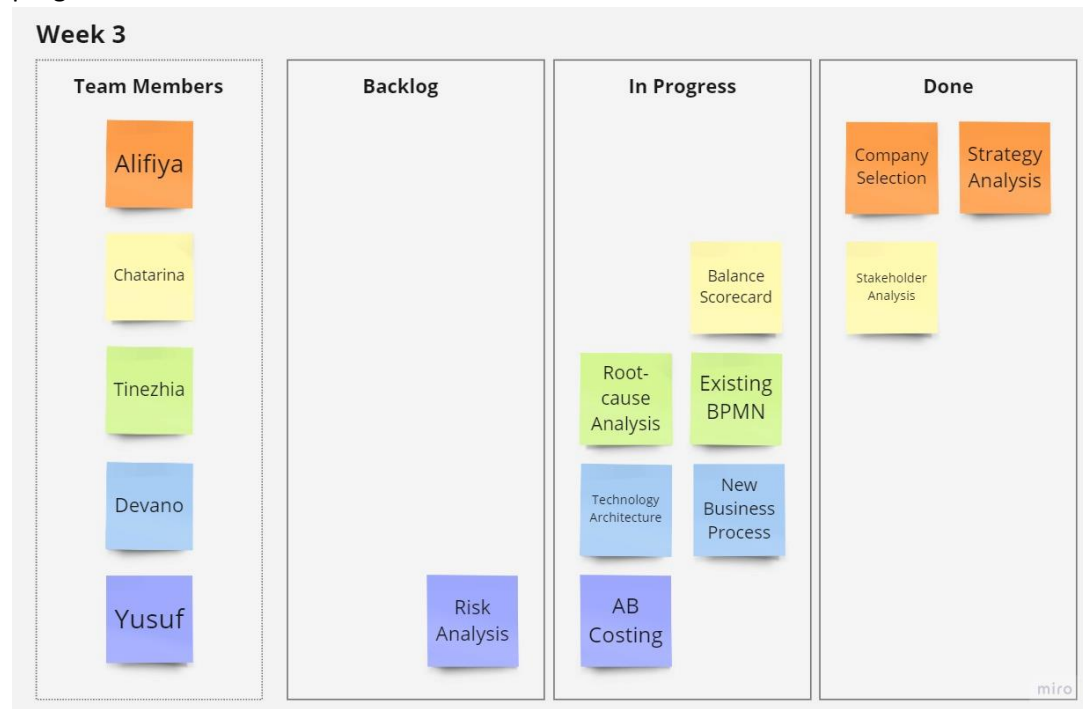
Week 7 – 27 March 2023 – All tasks are done.

Appendix H: Individual Reflection

H.1. Alifia Dheya Anggraeni - 5509831

Group Reflection

As a group, we worked effectively together. We understood each of our strengths and made sure they were used, so each of us held responsibility towards the group. Owing to the mutual understanding between teammates, we got to share and consider each other's thoughts as well as made important decisions together. We regularly conducted meetings every week. We discussed what things to do for the next week and divided the work, had a brainstorming session by sharing our difficulties with others and started to help each other, and did stand up meeting to share our progress with the work.

It was a great experience working with the group. All members were cooperative, proactive, and also supportive. The working environment within the group was good, everyone could express their opinions and gave feedback to each other. The group members had different backgrounds, which made us think differently while thinking about solving problems, but we could combine our diversity and made clear solution for our business process.

Personal Contribution and Reflection

We divided individual tasks equally among all the members of our group. We worked on some specific parts allocated to us individually, but we also discussed, worked collectively as a team, and reviewed each other's work to make a good result. The tasks assigned to me were doing the company's background analysis and explaining our business process selection, defining customers' wish, explaining the evaluation of as-is process as well as describing future process, and doing root cause analysis using fishbone and 5-whys. There were difficulties I faced, but brainstorming with other members were very important for finishing these tasks. These activities were all new to me, but with the provided readers and other materials, feedback from the professor and TAs, and also help from my team, I am convinced that the tasks that were assigned to me had been executed well.

As a Scrum Master, I worked on schedule plan from kick off to conclusion including sprint meetings and daily stand-up meetings. I have responsibility for identifying and allocation of tasks with members, follow up progress status on stand-up meetings, and manage issues during the execution of the work plan. Sprint meetings are executed weekly, and meeting minutes are maintained using Kanban methodology.

Points of Learning

Together with the team, I learned a lot of new knowledge and skill about business process. At first, I was not familiar with all of the methods and tools, so this project helped me in understanding them towards hands-on experience. And now, I understand about how to use a certain method for a business process project and when it is useful. I also learned about how to manage project in a group, how to do discussion with people from different background, how to solve issues, and how to do decision making.

H.2. Chatarina Petra Salim - 5706602

Group Reflection

I experienced a fun and enjoyable environment working in this group. This group has made a lot of development progress, with a business process recommendation that I am satisfied with the results. Although our group experienced some major revisions for the whole business process a few times, we managed to come up with the solutions and the results turned out to be great.

Everyone in the group is cooperative and fun to work with, from finding the company, analyzing the problem, constructing the business process, until building the recommendations. It is easy to give feedback to others as everyone is open to opinions and feedback on their work. If someone has difficulty in doing their tasks, other members will immediately help by giving ideas and suggestions to progress in the work.

Moreover, every week, we gather to discuss the progress of our work and what to do next. Overall, I think this is a great team where everyone cooperates well in collaboration. As a result, we managed to finish all our tasks well without any major problems.

Personal Contribution and Reflection

My responsibilities in this project are mainly in developing the business process with Tinezhia. I constructed the existing and new business model with suggestions and help from all team members. The advice, guidance, and feedback from the lecturers and teaching assistants are very helpful for me and the team to develop the business model. At first, I was confused in constructing the model correctly and had to revise the model a few times. However, with the support and help of my team members, the business model was managed to be constructed well.

Moreover, as a business owner, I am responsible for managing the backlog of the process and making strategic decisions. With the help of a to-do list and kanban, I analyzed the blockers of the scheduled tasks and what tasks that should be done with the targeted time.

Points of Learning

I learned a lot from this project, not only I got some knowledge regarding the digital business process management as well as the tools to identify the problems, but also some experience regarding managing a project in a team, analyzing the blockers in the project continuity, solving the difficulties, and cooperating with other people from different backgrounds. Additionally, I also learned how to make decisions and do problem solving in a limited time.

H.3. Devano Yehezkiel Adipradhana - 5664586

Group Reflection

The work ethic in this group is amazing, all members of this group have a strong determination on working on this project. We are a very diverse member, with variety of background and expertise, where I can learn about working in diverse environments. We do brainstorm a lot, where we trying to solve the problem with each of our uniqueness and background knowledge. We learn together through revision and feedback from the professor and TA. The scope of our work can be considered as complex business process, but we managed to help each other and understand the business improvement together through the process.

Every member of this group is very cooperative, they have a sense of responsibility towards the project. They are willing to work not only to their assigned task but work for the project as a whole. The members also have a strong learning mindset, which enable them to learn new knowledge from every feedback and revision.

The work schedule and distribution are neat, means we distribute the work evenly for each week. Therefore, we don't do much of sprinting near the deadline day. We are trying to implement the pareto method (80%-20%) in our work, in order to be prepared and have spare time for revision and evaluation.

Personal Contribution and Reflection

My responsibility in this project is developed the stake holder analysis, designing the machine learning architecture, calculate AB Costing and do the calculation and trade-off of the future process. Everybody have their main assigned task, but we work as a team that not only focused on our individual tasks. During the process, I got several feedbacks from professor which help me a lot during the writing of this report. I could understand how to make an even better analysis especially for the stakeholder of the company. I also learned various new thing from the paper and journal regarding the machine learning process, which hard at the beginning.

As a product owner, I have responsibility to manage to develop the product's development, such as ensuring that the improvement will meet the company vision, manage the development stages of the product and processes, and determining the customer needs.

Points of Learning

During this project, I learn a lot regarding the business process, especially on its implementation in demand planning and forecast cases. I learn a lot from the lecture and from the experienced member in my team, so I understand not only the theory but also the practical way of thinking to work on this project. I also learn a lot of tools for business process, especially on BPMN which is a new knowledge for me. I believe that I will gain more understanding by learning the business process from project or real cases.

Besides the business process knowledge, I also experienced how to manage a teamwork, especially how to work effectively by having a niche planning and scheduling. We implemented sprint method and Kanban during the process, which resulted into a more effective way of work.

H.4. Tinezhia Novitasari - 5631009

Group Reflection

I am grateful that I got to collaborate and team up with these astonishing teammates. I acknowledged that we are all have our own strength and weaknesses, yet we were able to manage it and intensify each of our strength better. We started the project early by sharing our previous experience about analyzing and improving the business process. We conducted that to ensure that we are all the same page about the definition of business process and what to expect when executing this group project before defining our selection of business process and company.

Throughout the project, we regularly conducted a meeting weekly which consist of some activities such as dividing tasks and to-do list as well as discussing each of our difficulties during the process of performing our task. Since our chosen business process is not a typical business process that one can understand easily, we managed to complete and established an astounding argument on our proposition as well as the BPMN due to insightful feedback from professor and TA.

Over the project, we encounter some major revisions, still manage to correct it expeditiously and completed all of our task without major issue. All the team members have strong sense of responsibility and cooperation, with which we could create constructive report.

Personal Contribution and Reflection

I am responsible in developing the As-is and To-be BPMN along with Chatarina. In addition, I also contributed on analyzing and determining the company's background (which consist of company profile and strategy), the ideation of business process selection (reasoning on the selected business process), key performance indicator and requirement on the process. We distributed the tasks, but in fact all of us were contributed on giving feedback and solution to each of our work.

During the project, I encountered some challenges on how to limit our scope of project and make reasonable assumptions on our model, since the first feedback we got from our process that it was to broad and high level. By the feedback from professor and TA, as well as intense discussion with all the team members, we managed to define a feasible assumptions and scoping.

Furthermore, as the stakeholder, I was responsible to ensure all the required process and people are modelled completely and assessed how the recommended improvement affect all parties. I must make sure that all the related stakeholders could satisfied through the proposed To-Be process by focusing on the how to fulfill customer's wishes.

Points of Learning

This project aids me to boost my understanding further on business process especially related to the Demand Planning and Forecasting not only theoretically but how it works in practice. Through the lecture, I also learned the step to step required when we want to propose a solution by performing the analysis, improvement, and realization approach.

Moreover, I learned on how to manage teamwork, how to appreciate my teammates on their hard work, expressing opinions, and receiving feedback. Lastly, the project helped me on determining a fair and logic decision making in a limited amount of time.

H.5. Yusuf Hafidzun Alim - 4752430

Group Reflection

The team has done an outstanding job in terms of cooperation and communication – everything is done in an effective and efficient manner. Given the diversity of backgrounds, it really provides us with plenty of information, knowledge and perspective which helps us to develop this project further. Apart from the abovementioned, everyone is willing to learn and adapt to the challenges and changing circumstances, which demonstrates strong determination.

There is a weekly standup meeting where we discuss and follow up our progress. During the standup there will be many important topics to discuss which we could solve and provide resolution afterwards. It is a helpful approach not only for individuals but also as a group as it gives us enough resources and information to deliver the project on time.

Despite the struggles along the way, either internally or externally (by feedback from professors), we were able to manage it successfully without any major issues. Communications are done clearly; tasks are distributed evenly with colleagues voluntarily willing to help each other. It is a great environment for all of us to learn not only about the subject but also about understanding each other as human beings.

Personal Contribution and Reflection

Being the one in charge on developing business scorecards, KPI definition, Activity-Based Costing, risk analysis, as well as involved in defining the advantages and the trade-offs of the proposed solutions; it has really helped me to have a deeper understanding of how a business process is developed. The process of developing the Activity-Based Costing is really quite challenging due to the limited resources available to define which activities are needed in implementing the future process. Also, finding the cost of each activity pool is also another challenge to overcome. However, it needs creativity and some cooperation as a team to solve the issue.

As a part of the scrum team with the role of a scrum team member, I am responsible for delivering the task on time. This requires not only individual work but also cooperation with other parties in order to have every task delivered smoothly and on time. I also provided feedback within each progress during scrum meetings. This is important as any delays could slow the progress of the project itself. The role that I played has helped me learn about time management and doing things effectively.

Points of Learning

There are three important aspects that I learned during this project: teamwork, knowledge and time management. Working on a project obviously requires teamwork: trusting each other, understanding, cooperating, as well as delivering the job nicely. Knowledge wise, this gives me a broader understanding of what a business process looks like. Initially, I only had a general knowledge about the business process. As it turned out, there was more than just the business process itself. Understanding the business scorecards, KPIs, and BPMN helped broaden my horizon in business process management; and it's all done through practice via project. Having a hands-on experience helped me gain knowledge better than just theory. In terms of time management, I learned about priorities and executing the job in an effective manner. With the implementation of the sprint method as well as using kanban as the medium, it helped me to manage my time and prioritize things better.