Business understanding

Fruit juices are produced by Juicy Fruit Company in Eindhoven, Netherlands. It offers a limited selection of tastes. There are just a few flavors that are produced in various pack sizes. They are provided to a small number of clients, all of whom are retail businesses. Direct shipments are made to clients by Juicy Fruit Company.

The goods that Juicy Fruit Company sells are ones that they produce. The company's unique mixer is used to combine the fruit juices. The fruit juice is immediately put into bottles using the bottling line after it has been mixed. The packaging supplies are purchased from Wales United Kingdom and Dresden Germany and the juice is purchased from international fruit dealers or growers. Each supplier offers unique qualities, such as pricing, lead time, and dependability. Two parts make up each final product: the bottle and the liquid. A thorough bill of materials specifies how much of each item is utilized to create a final product.

The company has 4 departments respectively Purchasing, Operations, Sales, and Supply Chain Management, each department in the company plays a critical role in ensuring the success and profitability of the business. The Purchasing department ensures that the company has reliable suppliers and favorable prices for raw materials, while the Operations department ensures efficient and cost-effective manufacturing and storage processes. The Sales department plays a key role in negotiating favorable terms with customers and maximizing sales revenue. Finally, the Supply Chain Management department ensures that the company has a reliable and efficient supply chain strategy in place to cover any potential disruptions or issues that may arise.

Effective communication and collaboration between these departments are also crucial to ensure that the company's overall goals are met. For example, the Purchasing department needs to communicate effectively with the Operations department to ensure that they are aware of any changes in supply and demand for raw materials. Similarly, the Sales department needs to work closely with the Operations department to ensure that they can meet customer demands and provide high-quality products on time. Therefore the successful functioning of each department is essential for the overall success of the company, and effective collaboration and communication between them are crucial to achieving this.

Data understanding

The Juicy Fruit Corporation data excel sheet consists of 7 different sheets that are managed by the company departments.

Purchasing&SCM

The Purchasing and SCM Excel sheet is a valuable tool for managing the company's supply chain and optimizing production processes. By providing a centralized platform for tracking inventory, managing purchase orders, and analyzing costs, this sheet helps the company improve efficiency, reduce waste, and ultimately increase profitability. This sheet contains the following main factors:

Supplier name	name of the company or organization that provides the raw materials, packaging materials, or other supplies needed for the production of juice.
Location	The location where the component is being sourced from.
Component	The name or code of the component being purchased.

Year/Months	The period for which data is being recorded.
Delivery reliability (%)	The percentage of deliveries that were made on time.
Rejection (%)	The percentage of components that were rejected due to quality issues.
Purchase value	The total value of purchases made during the period.
Transport costs	The cost of transporting the components from the source location to the company's facility.
Stock (weeks)	The number of weeks of demand that can be met with the current stock.
Amount purchased (piece or liters)	The total quantity of the component purchased during the period.

Table 1

Production

The sheet can be used to monitor key performance indicators (KPIs) such as production yield, downtime, and cleaning time. This helps the company to track the machine's performance and status and identify areas where production can be optimized and improve overall efficiency. The sheet contains the following key metrics:

Mixer	The piece of equipment used to mix the ingredients of the juice before bottling
Bottling line	The bottling line refers to the machinery used to fill and package the juice into bottles.
Run time (%), Changeover time (%), Breakdown time (%), Unused capacity (%), Overtime (%)	These are the percentages of each of the above indicators about the total available production time for the week. They help to give a more detailed picture of how time is being used in production.
Changeover time (%)	The average time per week used for changing over the bottling line as a percentage of the total capacity (i.e. capacity based on the number of shifts).
Breakdown time (%)	The average time per week the machine is broken down as a percentage of the total capacity (i.e. capacity based on the number of shifts).
Overtime (%)	Average time per week that the line is not operated by one of the permanent shifts as a percentage of the total capacity (i.e. capacity based on the number of shifts).
Production plan adherence (%)	This is the percentage of the production plan that is actually achieved during the week. It indicates how well the company is able to meet its production targets and how closely it is able to follow its production plan.

Table 2

Sales(Customer)

The Sales (customer) Excel sheet is a valuable tool for monitoring and analyzing the company's sales and distribution efforts, helping to identify areas for improvement and optimizing performance. It helps to track sales performance (through service level order lines), assess profitability (through revenue per week and gross margin per week), and analyze sustainability (through carbon footprint). Below is a brief explanation of the main columns:

Customer	This column likely lists the names or identifiers of the customers who have purchased the company's products.

Attained contract index	This column could represent an index or score that measures how well the company is meeting the terms of its contracts with customers.
Service level (order lines)	This column likely refers to the percentage of customer orders that were fulfilled without any errors or mistakes.
Revenue per week	This column likely shows the amount of money that the company earned from juice sales in a given week.
Gross margin per week	This column likely shows the amount of profit that the company earned from juice sales in a given week, after accounting for the costs of production and distribution.
Carbon footprint	This column likely shows the number of carbon emissions that were generated by the company's production and distribution activities in a given week.

Table 3

Sales (Customer – Product)

The columns in the Sales (customer - product) Excel sheet may be similar to those in the Sales (customer) Excel sheet, but with additional information related to the specific products that are being sold. Here is a brief explanation of the main columns in the Sales (customer - product) Excel sheet:

Customer	The name or ID of the customer who ordered the juice product.
Product	The name or ID of the juice product that was ordered by the customer
Demand per week (value)	The amount of the juice product that the customer ordered per week, measured in units or monetary value. This column provides information about the customer's demand for the product.
Gross margin per week	The profit margin earned by the company on the sale of the juice product to the customer per week. This column provides information about the profitability of the product.
Service level (order lines)	The percentage of customer orders that were fulfilled by the company within the expected time frame. This column provides information about the company's ability to meet customer demand.
Additional sales as a result of promotions (%)	The percentage increase in sales that was achieved as a result of promotional activities, such as discounts or special offers. This column provides information about the effectiveness of the company's marketing efforts in increasing sales.

Table 4

Warehouse(Raw and fin. goods)

The Warehouse (Raw and fin. goods) Excel sheet appears to contain information about the company's warehouse operations. It is used for inventory management, order tracking, and keeping track of the warehouse's capacity and usage. Below is a brief explanation of the terms mentioned in the sheet:

Warehouse	Refers to the location where the company stores its raw and finished goods inventory.
Cube utilization (%)	Refers to the percentage of the warehouse's total storage space that is currently being used.

Overflow (%)	Refers to the percentage of inventory that cannot be stored in the warehouse due to lack of space.

Table 5

Distributor

The Distributor excel sheet contains information related to the company's distributors, who are responsible for getting the products to retailers and other customers. Basically, by tracking this information, the company can monitor the performance of the distributor and ensure that the products are being distributed to the appropriate geographic regions and retailers. The sheet can also help the company identify any issues with product delivery or payment, and enable them to take corrective action where necessary.

SCM(Inventory)

The SCM (Inventory) Excel sheet is a vital tool for the company to manage inventory levels effectively and efficiently. It helps the company to ensure that it has the right products in stock, at the right time, and in the right quantities to meet customer demand while reducing waste and controlling costs. Some of the uses of the SCM (Inventory) Excel sheet are:

Product	Refers to the name or code of the product that the company produces or sells.
Demand per week (value)	Refers to the total value of the product that is demanded by customers in a week.
Gross margin per week	Refers to the total profit margin of the product in a week.
Obsoletes (%)	Refers to the percentage of inventory that is deemed obsolete or no longer in demand.
Stock (weeks)	Refers to the number of weeks of inventory that the company currently has.
Production plan adherence (%)	Refers to the percentage of adherence to the production plan.

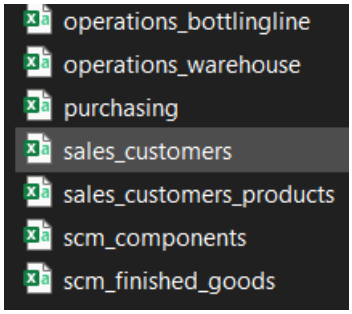
Table 6

Data preparation:

There are no missing values in the datasets. The only thing we need to clean is in the variable `Customer`. `AH supermarket` should be changed to `AHA supermarket`.

The original dataset doesn’t have the information on the bill of material which is the proportion of materials in each finished good. We will create a new table called `bill of material.

From 7 sheets, we split them up into 4 departments: operations, purchasing, sales, and supply chain management with corresponding values in 7 files like this:



Analysis

This part will be split into two main parts: KPI and Relationship. For each department, there are some different KPIs. We will first analyze the numbers and patterns from the visualization created by PowerBi. After that, we will conclude some main points retrieved from the analysis part. Recommendations will be followed by that based on the insights of the data. The relationship part shows the correlations between departments and how each department affects the other ones in the overall performance.

KPI

Purchasing

- Delivery reliability % of all suppliers
- Rejection %
- Transport cost % (Transport cost/Purchase value)
- COGS % (purchase value/revenue)

Analysis

Analyzing throughout the 5-year time, the **average delivery reliability percentage of all suppliers** increased unevenly, it rose sharply from 2017 to 2019 by approximately 4% and has a negligible increase from 2019 to 2021 and the digit reached its peak at 94.36% in 2021 but it still has room to improve. Generally comparing between suppliers, the annual average delivery reliability percentage is scattered:

- Orange Supplies BV has the highest digit which is 96.73% but it has been decreasing evenly from 98.04% to 95.28% during 5 years and is the only supplier to have its delivery reliability dropped.
- Meanwhile, Lemon concentrate and 3M bottles have a quite similar pattern and are the lowest digits. The lemon concentrate has the lowest digit which is 89.54% but it has the most remarkable rise from 81.77% to 93.48% which is approximately by over 11% from 2017 to 2019 and staying stable at over 93% till 2021. The reason behind this is that Lemon concentrate lies in New Delhi – India which is the farthest among all. Furthermore, 3M bottles also have a delivery reliability percentage that stayed at about 84% until the significant rise to 94.58% in 2019 and reached its peak in 2021 with 95.36% even though 3M bottles are in Germany, next to the Netherlands.
- Tetra Packaging BV has a slight increase from 92.46% in 2017 to 93.52% in 2021 and Star Hoku also shared the same trend when this company's delivery reliability shifted from 93.72% to 94.12% in the same period.

From 2017 to 2021, **the percentage of average rejection** dropped gradually from 2.43% to 1.59%. When this digit is analyzed through suppliers, 2 companies have a high annual average rejection percentage which is 3M bottles, Tetra Packaging BV and 3 companies have this digit below 1% which are Lemon concentrate, Orange Suppliers BV, Star Hoku:

- 3M bottle has the highest yearly average rejection percentage but this company has the strongest decrease by 3% from 2017 to 2021.
- Even though Lemon concentrate had the lowest delivery reliability %, it has the lowest yearly average rejection percentage and it managed to decrease to 0% in 2019 and stayed until 2021. Lemon has the best quality compared to other components.

- Orange Suppliers BV and Tetra Packaging BV have a slight decrease but this digit in Tetra Packaging BV fluctuates throughout 5 years.
- Even though only Star Hoku has a slight increase from 0.49% to 0.97%, it is the company that has the second lowest yearly average rejection percentage among all.

Transport costs % of all suppliers was very high 69.38%.

- Star Hoku and Tetra Packaging BV share the lowest 2 **transport costs percentage** respectively 4.29% and 4.26%.
- Orange Suppliers BV has a modest digit (8.22%) which nearly doubles the lowest figure.
- The lemon concentrate has the highest transport costs percentage which is 69.38% because of its furthest distance from the Netherlands and 3M bottles have the second highest digit which is 44.6%.
- Even though the % transport cost of 3M bottles was lower than Lemon concentrate, 3M bottles had a high purchase value of 11.8% compared to the total revenue of all periods. Meanwhile, we only spent 0.1% purchase value for component Lemon. This means that the total transport costs of Lemon were nothing compared to that of 3M bottles.

Conclusion

The average delivery reliability of all suppliers still has room to improve. The higher the better, because with high delivery reliability %, we make sure that we have high component availability and prepare them for production:

The percentage of rejection decreased which means that the quality of all components was getting better throughout the period.

Transport cost % was so high which needs to be concerned more.

Orange Suppliers BV had the highest percentage of **delivery reliability** but only it had a downward trend after 5 years among all.

3M Bottles has the second lowest **average delivery reliability percentage**, highest **rejection percentage,** and unfavorable **transport cost** because it is much higher than the Orange Suppliers BV, Star Hoku, and Tetra Packaging BV when these companies are in Europe.

Lemon concentrate lies in New Delhi – India which is the farthest among all and has the **highest % transport costs** and lowest **delivery reliability** but has the lowest **rejection rate**.

Recommendations

The purchasing department should be considering changing 2 suppliers which are 3M bottles and Lemon concentrate. Thereby changing supplier Lemon concentrate stills depend on the Juicy Fruit strategy whether they want to prioritize: low cost – low delivery reliability – high quality, high cost – high delivery reliability-high quality

The purchasing department should have a better deal with the supplier Orange Suppliers BV by changing the agreed delivery reliability or delivery window to prevent the downward trend of delivery reliability % in the upcoming periods because this is the main component of all finished goods.

Operations

- Cube utilization of raw material
- Cube utilization of finished goods

- Overflow %
- Production plan adherence

Analysis

Cube utilization % of raw materials warehouse decreased gradually throughout the period. On the other hand, the **cube utilization % of finished goods warehouses** increased dramatically from 71.8% in 2017 to 95.09% in 2019 and dropped down right away for the last 2 years.

Next, **overflow %** is also an important KPI. **Overflow % and cube utilization %** share the same pattern. Because a lower **cube utilization %** means we have more space in the warehouse so when there is a high demand for pallets in the warehouse, we still have room, and the **overflow %** will be lower.

Production Plan Adherence is a key KPI. It can depict how well the management of the supply chain and operations work through **Overtime** and how well purchasing and operations work through **Component Availability**. In addition to that, it can contribute to affecting the **service level**. **Overtime** itself doesn't say much**, % change of Overtime** will describe clearly how it affects **production plan adherence.** The same goes for **Component availability. % change of Overtime and component availability** is the % change between the current year and the previous year.

- **Production plan adherence** increased from 78.5% in 2017 to 96.2% in 2020. **% change of Overtime** kept decreasing from 2017 to 2020, even though there was not much change in 2020. During the same period, the **% change in component availability** also increased.
- **Production plan adherence** started to decrease from 96.2% in 2020 to 92.22% in 2021. **% change of Overtime** increased to 7.18% in 2021. On the opposite, the **% change of component availability** started to slow down from 2020 because the number in 2020 and 2021 were quite decent (99.75% and 99.78%) even though the % change was not impressive only 0.03%.

Conclusion

The **cube utilization % and overflow %** are generally good and in control.

Production plan adherence is an important KPI and is influenced by **overtime** and by the **availability of components**. The higher the production plan adherence, the better. **Production plan adherence** was affected mainly by **Overtime** in the latest period while the **component availability** performance showed a good sign.

Recommendations

overflow % can be improved if we have a better plan for safety stock and lotsize of components as well as finished goods.

The supply chain department and Operations should figure out how to minimize the **overtime** hours by having a better production plan that can fit with the capacity of the bottling line.

Supply chain

- Availability components %
- Stock components (weeks) - Order size
- Stock products (weeks)
- Production plan adherence %
- Rejects (finished goods) – Rejection % (components)

Analysis

2 upper graphs are for components, and 2 lower graphs are for finished products.

The average stock of components was still high after 5 years. This KPI is affected by two factors: lot size and safety stock. Because we don't have the internal data of the company so we don't know the exact lot size but order size is also a good alternative to consider**. Order size** decreased throughout the period, which means that the safety stock of components was high.

The component availability % rose from 96.62% to 99.78% which was a good sign.

Now we will look closer to components.

- **Average stock** of Lemon throughout 5 years was the highest at 7.0 weeks (more outstanding than other components). However, the average **component availability** of Lemon was the lowest, which is not good. The **order size** of Lemon was also the lowest, which means that the company had a really high safety stock for this component. We will inspect the component Lemon a little further**. Stock (weeks)** of this component had a steep rise (4.3 in 2017 to 7.9 in 2020 and 9.9 in 2021). The reason behind this is that the **component availability** of this component was improved up to close to 100%.
- Other components except for lemon and tetrapack 1 liter had **order size** significantly decrease more than twice after 5 years. Lemon kept the same **order size** and Tetrapack had the **order size** decrease just a little bit. This factor partly explains why in 2020 and 2021, Lemon and TetraPack had the highest **Stock (weeks).**
- All of the components except Mango had an upward trend of **component availability**. Mango decreased gradually even though it was still under good control.

Stock (weeks) of finished products fell to 2.22 in 2021. **Production plan adherence %** of JO-L 1l and JO-L300ML are the lowest ones. These two products all have the component Lemon. And the **component availability** of Lemon was the lowest as described above.

In the top 3 **rejects**, two of them are 300mL bottle. Looking back to the **rejection % of components**, the 300mL bottle also had the highest rejection % and that of Mango also rose after 5 years. This proves that the Quality of 300ml and Mango were not up to standard.

Conclusion

Safety stock of components was still high while **Order size** decreased double from 2017 to 2021.
Component availability % was close to 100%.
Lemon had the highest **stock (weeks)** so its **component availability** got improved up to 100%. But it goes with cost and space in the raw materials warehouse.
TetraPack's **order size** didn't have much change compared to other components and it also had the second highest **Stock (weeks)** after Lemon.
Mango's **component availability** decreased gradually.
JO-L1L and JO-L300mL finished goods had the lowest **average production plan adherence** because of the component Lemon.
300mL bottle's quality wasn't up to standard and the mango's **rejection rate** increased gradually.

Recommendations

The supply chain department should minimize the safety stock of components.

The problem with Lemon can be minimized by the purchasing department. Or if we still keep the same supplier, we have to deal with other costs.

The **order size** of Tetrapack can be optimized more by decreasing the lot size to save more space and cost in the raw materials warehouse without lowering its **component availability %.**

The quality of the 300mL bottle should be inspected more carefully as well as Mango before production.

Sales

- Gross margin of customers/ gross margin of each product compared with unit price/production cost/purchase value (make as a stacked column)
- Service level outbound order lines
- Carbon footprint

Analysis

The average **gross margin per week per product per customer** fluctuated throughout 5 years, it rose from 2747 in 2017 to 3090 in 2021 and reached its peak in 2019 with 3187.

When comparing this figure among customers:

- Mobil station had the highest gross margin per week per product with about 4300
- The second highest digit belongs to AHA supermarket with about 3600 and doubled the number of Texo which make this customer have the lowest gross margin with about 1600.

However, when adding up the average **gross margin per week by customer**,

- AHA supermarket occupied the most area despite their gross margin per week per product is not the highest because they bought more products.
- Unlike Mobil – placed after AHA supermarket in average gross margin per week by customer because they bought only 3 products.

When comparing this figure among the products:

- The JO1L has the highest gross margin per week with about 6700
- Both JO300ML and JO-M1L had the modest digit respectively about 3900 and 4100
- The last 3 products consisting of JO-L1L, JO-L300ML, JO-M300ML had their digit lower than 2000 respectively about 1500, 1000, and 1900 which make the JO-L300ML have the lowest digit.

The **service level percentage** increased sharply from 91.03% in 2017 to 96.72% in 2019 which made this the highest digit during the 5-year period, then the figure dropped by more than 3% in 2021. The service level percentage is significant among the 3 customers when all the digit is larger than 94% and the gap between the customer with the highest digit (Texo – 94.68%) and the customer with the lowest digit (AHA supermarket – 94.05%) is under 1%.

Among the products:

- JO300ML and JO-M1L had the highest service level respectively 96.77% and 96.54%
- Even though JOL1L had the largest gross margin per week but its average service level was only 94.75%
- Despite JO-M300ML having a low gross margin, its service level was higher than the JO1L which was 95.98%. Moreover, the 2 products that had remarkably low service levels were JO-L1L and JO-L300ML respectively about 1500 and 1000.

The **carbon footprint** decreased gradually from 1.43 to 1.26 over 5 years.

- Mobil station had the highest carbon footprint number per product which was 1.54
- While AHA supermarkets and Texo shared the same low carbon footprint digit (1.29 and 1.28 respectively).
- 1-liter products namely JO1L, JO-M1L and JO-L1L had the lowest carbon footprint digit among all with 0.97, 0.99 and 1.18 respectively despite they have higher gross margins per week than 300ml products.
- The last 3 products consist of JO300ML, JO-M300ML and JO-L300ML have the highest carbon footprint respectively 1.35, 1.45 and 1.79.

According to the **Revenue per piece break down by product**:

- Lemon products such as JO-L3000ML and JO-L1L had the highest gross margin per piece respectively 55.51% and 50.46%.
- 1-litter products have higher production cost than 300ml products
- 300ml products have higher purchase prices than 1-litter products

Conclusion

AHA supermarket is our main customer by **gross margin per week** followed by Mobil station and Texo.

Mobil station only bought 3 products even though it had the highest gross margin per week per product among all customers.

JO-L300ML and JO-L1L have the lowest gross margin per week even though they have the highest gross margin per piece. In addition to that, they have the lowest service level %. This can be explained by low adherence (Supply chain department) and low delivery reliability from suppliers – Lemon concentrate (Purchasing department).

JO1L has the highest gross margin per week, this can be explained by the demand which made JO1L is the highest-demand product. JO1L was the most preferred product among all which made Juicy Fruit has to establish a large number of shipping trips to customers which made it have a higher risk of not delivering on time and thereby JO1L's service level was lower than other products (JO300ML and JO-M1L)

JO300ML and JO-M1L has the highest service level %.

Service level throughout 5 years had a small increase but the amplitude was quite large. Texo had the least gross margin per week per product but had a higher service level than other customers.

Lemon products had a high value (high gross margin per piece) but they brought low income due to low demand which caused low margin per week.

Recommendations

Specifically, JO1L should be earned more attention from the Sales department.

Juicy Fruit can consider changing farther suppliers to closer ones because this can reduce the carbon footprint

Juicy Fruit can focus on promotional campaigns for customers Mobil station and AHA supermarket for specific products that gain the highest gross margin for the company.

Sales department should walk through the agreed service levels and other related information of customers (promotional campaigns…) with the Supply chain department to optimize the service level

of the main customers because these figures still have more room to develop and should be prioritized evenly among all.

Relationship

Purchasing – Supply chain - operation

Smaller order size (scm) -> Higher number of deliveries (purchasing) -> Less pallets (operation)

When the supply chain department has smaller **order size** plans for components, there are a higher **number of deliveries** for those components. In addition to that, smaller **order size** plans can help minimize the space of **raw materials warehouse** and save more money for operations.

Supply chain – Operation- sales

Shorter production interval (scm) -> bigger production batches (scm) -> changeover time of bottling line (operation) -> higher start-up productivity loss (operation) and lower obsolete percentage (sales)

When the supply chain department plans a shorter **production interval** for finished goods, it leads to bigger **production batches**. This decision makes the **changeover time of the bottling line** in operation increase. Consequently, there is a higher **start-up productivity loss** for operation and a decrease in **obsoletes %**.

Purchasing – Supply chain

lower delivery reliability (purchasing) -> low component availability (scm)

Component availability was mainly affected by the supplier's delivery reliability. Other factor like handling by employee staff also affected the component availability which explains whether there was the right number of employee capacity to handle goods into the warehouse or take in the delivered pallets and make the components available in good time for production.

Supply chain – Operation (Available in Operations - KPI)

Production plan adherence (operation): The production plan adherence is influenced by **overtime** and by the **availability of components** (supply chain)

Supply chain – sales

Production plan adherenceper product (scm) -> service level per piece low (sales)

Service level per piece was mainly affected by the production plan adherence. However, each trade unit agreed with customers (for example: box, pallet or pallet layer) has different demand for employee capacity which is also a factor that could affect the service level per piece.

Recommendations

After walking through all the analyses for each department, we sum up the most important recommendations for the CEO and management of the company.

Suppliers

The purchasing department should be considering changing 2 suppliers which are 3M bottles and Lemon concentrate. Thereby changing supplier Lemon concentrate stills depend on the Juicy Fruit strategy whether they want to prioritize: low cost – low delivery reliability – high quality, high cost – high delivery reliability-high quality. In addition to that, it also depends on the overall production performance of finished goods that have Lemon as one of their components. Because those products don't have much demand and bring back a very low gross margin. Therefore, even though Lemon

might stock higher than other components to improve its component availability, the cost of space it occupies in the warehouse is a very small number.

The purchasing department should make sure the delivery reliability of Orange Supplies BV higher for the upcoming periods.

Operation

Safety stock and lot size of components should be minimized.

Inspection of 300ml bottle and Mango

Customers

Specifically, JO1L should be earned more attention from the Sales department.

Even though carbon footprint is one of the main concerns nowadays for all businesses in all fields, it still depends on the business strategy if it is a significant goal that the company wants to integrate that into their business plans.

Mobil Station and AHA supermarket needs more promotional campaign.

Communication between departments

There should be more efficient communication between supply chain department and operations to match the production plan with the capacity of the bottling line and warehouse. The same goes for sales department and the supply chain department to have a better picture of how finished goods are delivered to customers.