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Cadena de Suministro, Transporte y Movilidad

Process improvement for inventory management in a Fast Moving Consumer Goods company

MEMÒRIA

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1. Glossary

App - Application

CL - Ordering costs

CS - Holding costs. CS = i* CA, i is possession rate by u.t

CA - Purchasing costs

D - Annual demand

EOQ - Economic Order Quantity

FMCG - Fast Moving Consumer Goods

ITR - Inventory turnover rate

KPI - Key Performance Indicator

PRS - Periodic Review System

Salesman - Employed by one or more suppliers, mainly responsible for selling goods to
Company A; and personally going to Company A's warehouse in a certain period to accept
orders then transfer orders to the corresponding suppliers.

SS - Safety stock

VC - Coefficient of the variability of demand

2. Introduction

Fast Moving Consumer Goods(FMCG) usually refers to those goods that are used for a short period of time, have low value, are easy to consume, have a wide distribution of consumers, have a high frequency of purchase, and have a long purchase duration.

Company A is a distributor of FMCG and has a large warehouse in Badalona that has more than 20000 types of inventory such as smoking accessories, stationery, toys, hardware, light bulbs, toiletries, candles, kitchen utensils, tableware, etc. The customers of company A are those Bazar (Shop that sells FMCG) located in Barcelona.

In company A, the inventory is mainly managing by 10 ordinary storekeepers, each storekeeper is responsible for managing inventory in different areas, i.e. to buy and keep stock to be able to serve all customers. Each storekeeper uses different criteria to manage the inventory of his products, i.e. which is the stock level, when and how much to buy. In terms of placing order to suppliers, there isn't any forecasting method. All storekeepers place orders based on their own experience, so there are some items with inventory overstock and others with stock shortage. In terms of checking the inventory, some storekeepers check once a day, and some storekeepers check once a week, but not everyone remembers to notify the information staff to update the inventory information in the company's system, therefore, physical inventory and inventory data do not match.

Moreover, storekeepers do not record in the system the orders placed to suppliers and the information staff only can enter inventory into the system according to the delivery note or the invoice. Moreover, the company does not have other option than believe that the products and the amount delivered are what the storekeeper ordered. When products arrive, but the delivery note is lost, the information staff cannot enter the product information into the system. Hence, the physical inventory and the data in the system does not match. Therefore, the aim of this master thesis is to analyze and improve the processes related to the inventory management and control in Company A.

2.1. Objectives of the project

The main objective of this project is to improve inventory management of company A. To attain this objective, the following specific objectives will be considered:

- An analysis of all processed related to inventory management is analyzed in order to detect the main problems to address.

- The ABC analysis of plastic goods to be focused on the most important goods.

- A demand forecast model for the goods families categorized as A.

- Measures to improve inventory processes.

2.2. Scope of the project

Analyze and improve the processes related to stock management of plastic goods classified as A. Does not include goods B or C.

3. Introduction of company A

Company A is an FMCG distributor in Badalona, founded in 2011. It mainly distributes with more than 20000 kinds of goods such as hardware, light bulbs, toiletries, candles, kitchen utensils, tableware, etc. Fast Moving Consumer Goods (hereinafter referred to as FMCG), usually refers to those goods with short aging, fast turnover, low value, easy consumption, wide distribution of consumers, high frequency of purchase, long duration of purchase, and most are the daily necessities of consumers. It involves many industries such as food, drinks, and daily chemical products that are highly competitive in the market, but company A's inventory does not include food and drinks. In general, the inherent characteristics of FMCG can be summarized in the following:

(1) The total demand is large.

FMCG are, mainly, necessary products for people's lives. An FMCG company earns profits by relying on the market consumption generated by users' repeated use and continuous purchase. Therefore, all aspects of the FMCG supply chain, especially upstream companies, tend to expand production, bulk transportation and other measures to reduce operating costs.

(2) Convenience.

Consumers who purchase such products are subject to high speed and convenience and are characterized by multi-frequency and small-volume purchases. In order to facilitate consumer purchases, in general, FMCG retail terminals have a large amount of distribution and wide distribution. In order to meet the needs of each retail terminal, FMCG companies tend to distribute a large number of goods in the distribution channels.

(3) Low brand loyalty.

The difference of related products is small so it's very easy to find an alternative, it means that customers are easy to convert brands when they are affected by advertising promotions and prices. Therefore, for FMCG manufacturers and agents, the shortage of goods often leads to the loss of customers, but for the distribution companies that operate multi-brand products at the same time, the negative impact of out-of-stocks is not significant.

(4) High demand uncertainty.

There are many factors affecting the demand for FMCG. The convenience of demand, high price sensitivity, fierce competition among the same industry and the increase in related products all increase the uncertainty of goods demand. Manufacturers of FMCG, which are lagging behind in inventory management simply press the bulk of the goods downstream to avoid the impact of uncertainty.

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(5) Too much SKUs.

Due to the low technical content of FMCG, there is little difference between similar products. In order to enhance product competitiveness, enterprises design and locate different products according to different consumer groups to meet market demand. Enterprises often classify the same large categories of products into several single product varieties (SKUs) according to the criteria of taste, size, weight, etc. A large number of SKUs increases the difficulty of inventory management.

Company A is located in the Badalona, with a building area of approximately 50000 square meters, in there are offices, warehouse areas, canteens for employees and toilets. At present, there are 25 employees, including 3 management personnel and 22 ordinary employees.

3.1. Organizational structure of company A

Company A is a familial enterprise, so its high-level are intimate relatives. There are only 3 people in the high-level, the Boss, the Human Resource(HR) Manager, and the Warehouse Manager.

The Boss. Nowadays, he is not involved in any activity of the company because he is focused on other companies.

The Human Resource(HR) Manager. Responsible for the company's personnel changes, daily inspections of employees, and payroll.

The Warehouse Manager. Determine the company's business scope (purchase new goods or stop selling some goods), place order for season goods, and receive feedback from all departments.

- For the Warehouse Manager Department, the 10 storekeepers who manage the inventory, they can know sales based on inventory situation (inventory overstock or stock shortage), so they need notify the manager that which goods are not selling well, then the manager decided to stop selling it or no. For storekeeper 3rd and 4th, they need notify the manager the stock shortage information of the seasonal goods, so that the manager can place order to the supplier.

- For other departments, only need to communicate with the manager if there is a problem with the work they are responsible for.

Under the high-level, Company A has 6 different functions department, responsible for all activities in the warehouse, the organizational structure has shown in below Fig. 3.1:
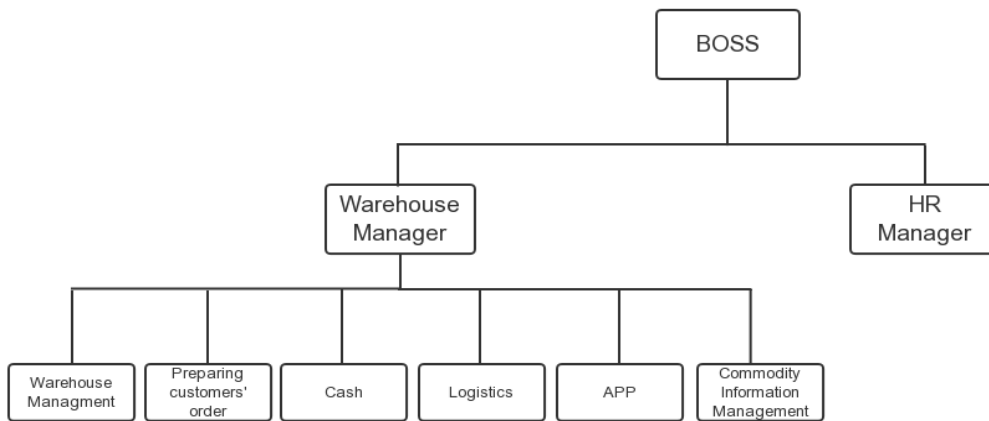
Fig. 3.1   Organizational structure of company A

Warehouse Management Department. This department has 10 storekeepers, they responsible for managing the goods in their respective lanes, checking the quantity of inventory and place order to the salesman.

Picking Department. This department has 2 employees(Pickers), they responsible for picking up the target goods on the warehouse racks according to the customer orders in the APP, and placing them in the waiting to delivery area.

Cash Department. This department has 4 cashiers, they responsible for the settlement of customer orders and collect money from the customer.

Logistics Department. In this department has 3 drivers fixed who responsible for making the route decision and transporting goods to the customer's location. When there is something need to be delivered, except the driver, also need a follower to help the driver carry the goods.

APP Department. This department has 3 employees, they responsible for updating the information of all goods in the app, such as picture, size, color, unit price, goods status, discount activities, etc.

Goods Information Management Department. There just one person in this department, who responsible for entering goods information to the company's system based on the delivery note or the invoice of the goods.

3.2. The layout of the warehouse

According to different goods types, Company A's warehouse is divided into different areas. In Fig. 3.2, we can see the layout of the warehouse. There are 12 lanes, each side of a lane

has a long storage rack, named with 26 Latin scripts in uppercase, like A, B, C… These racks have 4 floors, named 1, 2, 3, 4 in order from bottom to top; each floor of the rack is divided into different areas for placing different goods, named 001, 002, 003…from the left to right. With this naming method, goods can be found very easily, for instance, A1-001 is the position that storage the Needlework box; B1-001 is the position that storage the Small wooden boxes for 18*18*9.5 cm. With this naming scheme, the location of goods can be determined. There are also some other areas that are irregular, like Front zone, Back zone, Everyday Chemical zone.

All these racks and zones are managed by 10 storekeepers. Each storekeeper is responsible for the daily management of his own racks and places order for the goods in their racks to the supplier.

Right now, not all inventory is storage base on their category, it says, there are different goods on the same rack, and goods in the same category may be placed on different rack. It can be seen from Tab. 3.3, on the rack A have needlework, candles, bandage, etc.; and there are candles on the rack A and rack B. This leads to a storekeeper managing multiple goods memorize inventory information for different goods and communicating with multiple salesman, which greatly increases the difficulty of the storekeeper's work.
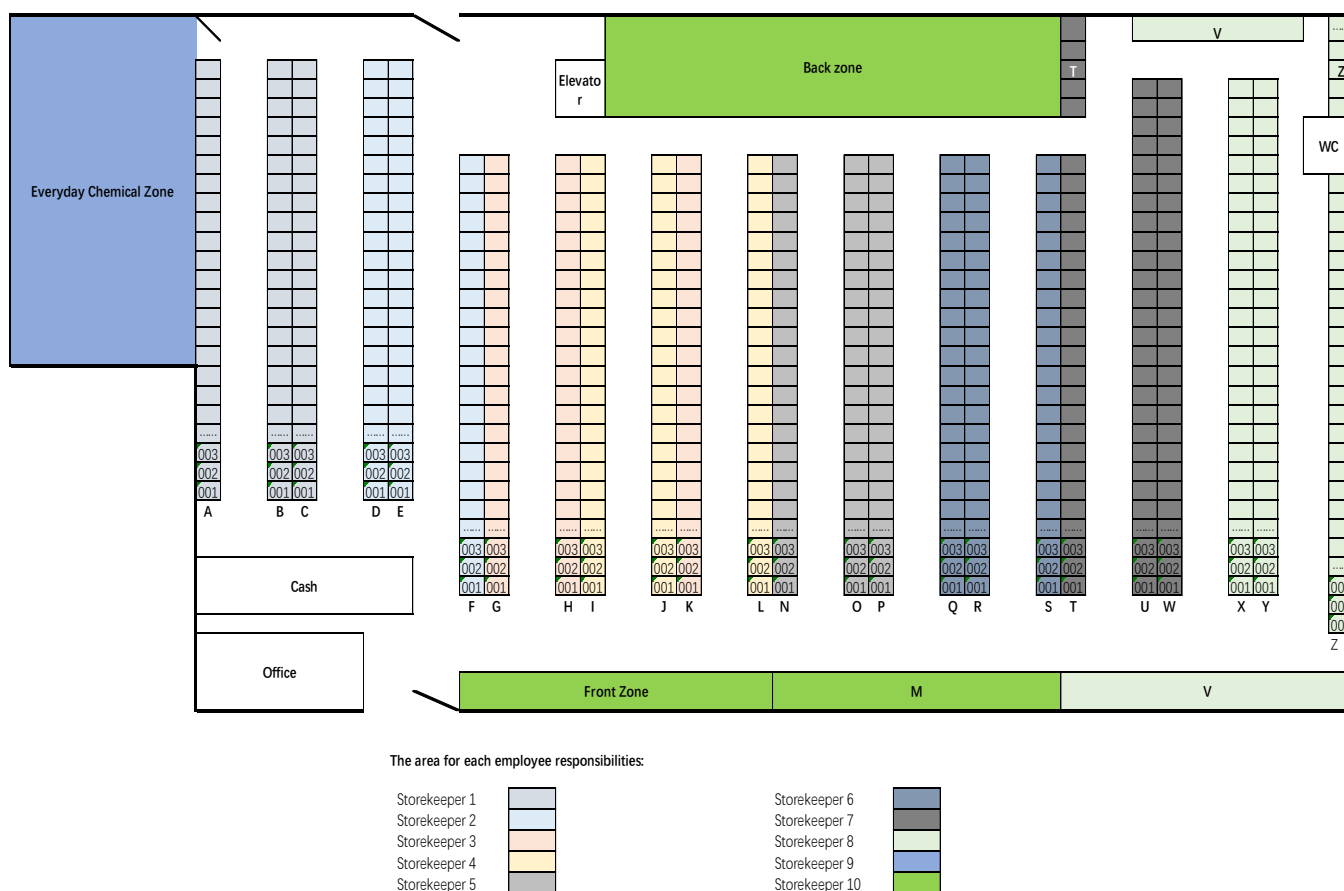
Fig. 3.2   Warehouse layout plan

Rack name	Goods name
A	Needlework, candles, bandages, etc.
B	Small wooden boxes, candles, shoe polish, plastic bags, etc.
C	Vases, fish tanks, carpets, gift bags, toothpaste, toothbrushes, etc.
D	Aromatherapy, gift bags, carpets, candles, tarpaulins, hairdryer, knee pads, wrister etc.
E	Bedding, tablecloths, mats, etc.
F	Socks, dishwashing cotton, dishwashing gloves, shower curtains, etc.
G, H	Toy
I, J, L	Seasonal Goods
K	Paint, decoration supplies.
N	Kitchen supplies (plastic), cling film, tin foil, Kitchen pot
O	Kitchen cutlery (plates, knives, forks, chopping boards, colander), kitchen scales, etc.
P	Various cups (ceramic cups, teapots, kettles, thermos cup)
Q	Glass cups, plate for paella, etc.
R, S	Hardware
T	Kitchen appliances(Juicing machine, toaster, etc.)
U	Household appliances(Hairdryer, coffee machine, etc..), pet supplies, matches, alcohol, lighter
V	Gift paper, cardboard, etc.
W	Photo frames, photo albums, blackboards, etc.
X	Notebook, book, wallpaper, big gift box, etc.
Y,Z	Stationery: pens, pencils, ballpoint pens, erasers, folders, etc.
M, Front &Back	Plastic products: trash cans, plastic cups, storage boxes, watering cans, bowls, basin, etc.

Tab. 3.3 Goods stored on different racks

Next, the assignment of racks to each storekeeper is provided.

1) Storekeeper 1 is responsible for racks A, B, C;
2) Storekeeper 2 is responsible for racks D, E, F;
3) Storekeeper 3 is responsible for racks G, H, K;
4) Storekeeper 4 is responsible for racks I, J, L;
5) Storekeeper 5 is responsible for racks N, O, P;
6) Storekeeper 6 is responsible for racks Q, R, S;
7) Storekeeper 7 is responsible for racks T, U, W;
8) Storekeeper 8 is responsible for racks X, Y, Z, V;
9) Storekeeper 9 is responsible for Everyday Chemical zone;
10) Storekeeper 10 is responsible for rack M, Front Zone, and Back Zone.

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4. Analysis of the inventory management Process

Because there are many competitors in the Badalona, once company A is out of stock, customers generally go to other FMCG companies, so Company A usually increases the inventory reserve to do not lose customers order. However, increasing the inventory has led to an increase in the inventory cost of Company A, and more liquidity is being occupied.

In order to get more information about the inventory management process of company A, I did a personal interview survey with the 10 storekeepers who are responsible for the daily management of inventory. The purpose of this survey is grasp the current operation situation of the warehouse, to know how each storekeeper do the job, to analyze whether there is a connection between the stock shortage and inventory overstock and the operation of the warehouse staff, thereby finding a way to improve the problem of stock shortage and inventory overstock.

Next, this chapter is devoted to analyze all the processes related to inventory management and identify the main problems based on the result of the survey.

Inventory management is a complex dynamic process, in company A except for the HR, all departments are involved.

4.1. Process of placing order to suppliers

According to the survey, we know that the inventory in Company A is classified by characteristics, they classified into seasonal and non-seasonal goods.

Seasonal goods are items that are only sold at a specific time. Such as goods for the beach in the summer and Christmas items in the winter. These goods normally need to take large-volume orders and only the warehouse manager can place the orders. The manager always takes the decision based on his own experience, he takes the sales volume of the previous sales season and adding or subtracting a quantity on it.

Non-seasonal goods are divided into three categories, high-selling-volume goods, general goods, and long sales cycles goods. For some high-selling-volume goods, such as household paper, plastic goods, the corresponding suppliers will send salesman to the warehouse to receive orders every week; for general goods, such as kitchen utensils, salesman may come once every 2 weeks; for goods with long sales cycles, such as hardware and small appliances, salesman may come once every month.

Orders of non-seasonal goods are the responsibility of the 10 storekeepers who manage the racks, it has been mentioned in 3.2. To give an example: when Storekeeper 1 feels that there are some goods does not have enough inventory in the lanes A, B, C, he records the stock shortage information in his mind. Then, when the salesman comes, Storekeeper 1

decides the quantity of order based on his own experience. Others 9 storekeepers do the same order process like Storekeeper 1, the only different thing is they take a different approach to record stock shortage information, someone records it on paper, someone records it on phone.

Based on the above situation, we realize that company A has the following problems in the process of making orders to suppliers:

1. All orders are determined by ordinary storekeepers (non-seasonal products), or the manager (seasonal products). Everyone determines the quantity according to their own experience and feelings, so the subjectivity is too strong. When there are personnel changes, it is easy to produce quantitative deviations, resulting in inventory overstock or stock shortage.

2. Does not exist a uniform document for orders, neither a record for orders. All orders are completed by oral communication between Company A's employees and salesman. Sometimes goods delivered with a wrong quantity or miss some items.

4.2. Receiving process

When the supplier delivers the goods to the warehouse, the employee R of the company A will be responsible for receiving the goods. R is not a fixed employee, but whoever is the one who is available at that moment. As mentioned in 4.1, because all the orders that company A places to the supplier do not record in anywhere, the employee can only use the delivery note or the invoice of the goods to check whether the quantity, color, and others information of the arrived goods are consistent with the information written on the invoice. When the information on the delivery note or the invoice is consistent with the actual goods, the employee R confirms the receipt; when the information is not consistent with the goods, the storekeeper in charge of this order needs to contact the salesman to solve the problem. When the goods are received, they are placed in the receiving zone, waiting for the storekeeper in charge of this order to put the goods into the racks.

Problems in this process:

Because all the orders that company A places to the supplier do not record in anywhere, the correctness of the supplier's delivery information cannot be confirmed. This leads to the fact that when the supplier delivers more goods than they should have, most times the company A can only accept this quantity, which causes the inventory overstock. Or instead, the supplier delivers fewer goods than they should have, which causes the inventory with stock shortage.

4.3. Process of update information into the system

The process of goods information management is mainly to input goods information to the company system, set and update goods status, change the data, and query the information. This process mainly consists of the following parts:

(1) Input goods information: After the purchase, the goods information provided by the supplier, like, goods code, specification, cargo unit, and unit price, etc. is taken as the basic information and is input by the information staff to the corresponding goods management module of the system.

(2) Set the status of the goods. The goods status is one of the basic information about the goods, mainly refers to the three states of the goods: available, obsolete, and out of stock. When the status of the item changes, it is set by the information staff.

(3) Change goods information. The information of the goods is not static, when employees see there is out of stock or received some goods, they should inform the person that responsible for changing the system information. When the unit price of the goods changes, the unit price in the system also needs to be modified. In general, only the coded of the goods is fixed.

(4) Consult goods information. According to the authorization of the administrator, the user of the system can use the username and password log in to the system to check information or to do other operations.

This process normally finished in 1-2 days, the flow chart of this process has in Fig. 4.1.
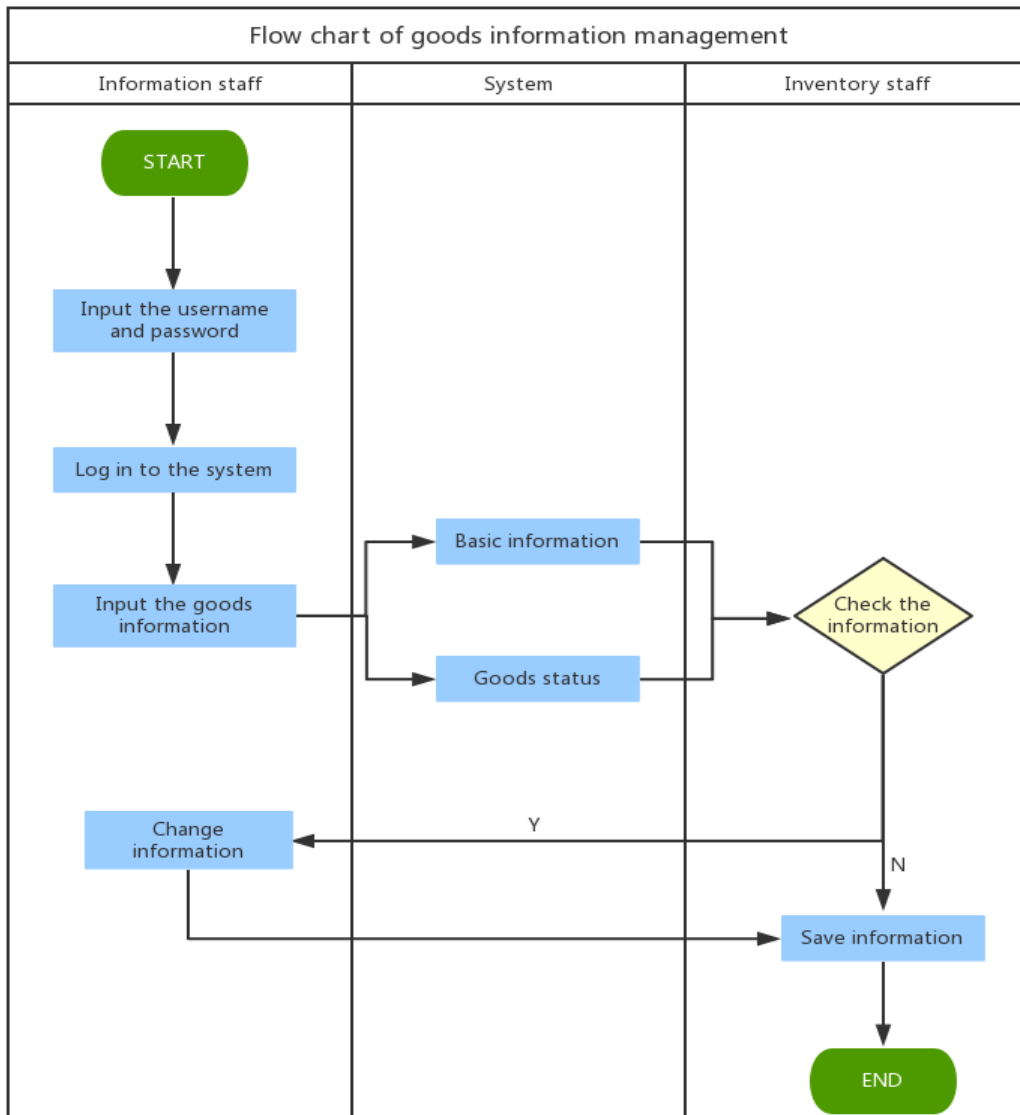
Fig. 4.1   Flow Chart of Goods Information Management

Problems in this process:

When the invoice/ delivery note is lost in transit and no one noticed the information staff that such an order has arrived, the information staff cannot input this receiving information into the system. If there are no new items in this order, then the problem will only be that the physical inventory and the data in the system do not match. If there are new items in this order, due to the information staff doesn't input the information of the new items into the system, there will be no such new items in the company A's APP, which means there are new items in the warehouse but the customer cannot see them on the APP, this results company A loses the order of the APP customer.

4.4. Process of customers' orders

Normally, there are two ways that customers place an order to Company A, one is through the online APP, the another is going warehouse entity to purchase. The two ways will be explained below in detail.

4.4.1. Online purchase - APP

Customers make orders through APP- YOUGOU, which has a minimum consumption amount 200€. Orders with a consumption amount between 200 - 500€ will be prepared by the Pickers, then the customers need to go to the warehouse to collect the goods. Orders with a consumption amount above 500€, the Picker will prepare the order, then the logistics team of Company A will deliver the goods to the customer.

When the customers use the YOUGOU, the home page and the order page of this APP have been shown in Fig 4.2.
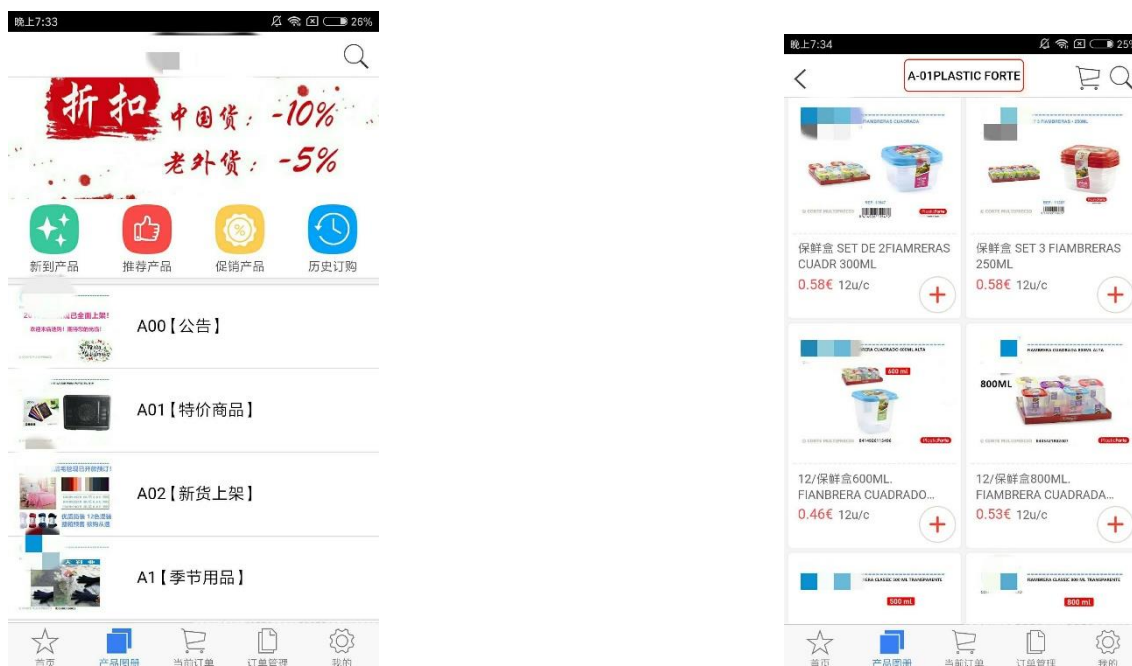
Fig. 4.2 Home page and Order page of APP - YOUGOU

Through the background of the APP, all details of order can be seen, like customers' name, address, telephone, goods name, and the quantity. The Information Worker will print the daily orders and hand it to the Picker. Then the Picker picks up the goods required on the order list from the rack. After all goods have been picked up, the Picker need to send the products to the goods issue area. At the end, the logistics department will analyze the customers' addresses, and plan the route to deliver the goods to the customers' location. This process typically takes 1-2 days.

If the out-of-stock situation is encountered during this process, the Picker needs to contact the customer to ask if he/she accepts the same kind of goods from other brands. If the customer accepts the alternative, the Picker continues the distribution process; if the customer does not accept the alternative, he/she needs to decide if he/she wants to wait until there is the product in stock or close the order.

A company has about 40 stable customers, and about 95% of them will use the APP to make orders.

The flow chart of customer makes an order on the APP has been shown in Fig. 4.3.

Process of customers make order on the APP

Customer	APP system	Information staff	Preparing the order	Logistic

START

View product

Add to Shopping Cart

Shopping cart settlement

Pending to pay order

Print order

Customer's order

Pick up the target goods

Out of stock

Accept alternatives

Y

N

Waiting for new inventory

Picking completed

Go to WH for rceipting

Put into the waiting delivery area

Make logistic plan

Order > 500 €

Y

N

Confirm receipt

Pay

Finished order

Delivery

END

Fig. 4.3   Process of customers make an order to Company A

4.4.2. Purchase at the warehouse

Customers come to the warehouse for on-site procurement. There is also a minimum consumption amount - 200€.

The whole process is very easy, just like shopping in the supermarket. Customers go to the racks to see the goods, select the quantity they want, and then go to the cashier to pay. Customers who choose the second method generally drive to the warehouse, so company A is not responsible for transporting the goods to the customer's location.

Problems in this process:

As mentioned in 3.1, the employees who manage the APP need to update the goods states in the background, and their information source is the goods states in Company A's internal systems.

When the actual inventory does not match the inventory data in the company's system, the goods information in the APP is not incorrect. So, there come 2 situations, one is the goods state in the APP is "Available", the customer can place an order through the APP, but there is not enough inventory in the warehouse, the customer cannot get what he/she already ordered, then the customer satisfaction decline. Another one is the goods state in the APP is "Out of stock", no one could place an order, but there was enough inventory in the warehouse, Company A lost order.

4.5. Problems and analysis of a company's inventory management process

After the introduction and analysis of the current status of A company's inventory management, this chapter will summarize and analyze some of the main problems found.

4.5.1. Main problems in the inventory management process

1)   The purchase process is not standardized

All orders are determined by ordinary storekeepers (non-seasonal products), or the manager (seasonal products). Everyone determines the quantity according to their own experience and feelings, so the subjectivity is too strong. More important when there are personnel changes, it is easy to produce quantitative deviations, resulting in inventory overstock or stock shortage.

2)   The order for suppliers hasn't been recorded.

All orders are completed by oral communication between Company A's storekeepers and

salesman. Sometimes goods delivered with the wrong quantity or miss some items.

3) Unable to verify the accuracy of the arrival information

Because all the orders that company A places to the supplier do not record in anywhere, the correctness of the supplier's delivery information cannot be confirmed. This leads to the fact that when the supplier delivers more goods than they should have, most times the company A can only accept this quantity, which causes the inventory overstock. Or instead, the supplier delivers fewer goods than they should have, which causes the inventory with stock shortage.

4) The physical inventory and the data in the system does not match

As what is wrote in 4.2, when there is an employee does not remember to notify the information staff of the correct inventory data, or the invoice/ delivery note is lost in transit, the physical inventory and the data in the system do not match. This leads to slow feedback of inventory data, poor timeliness, and accuracy, and therefore cannot meet the demand for customer orders.

5) Products are not allocated logically

Because Company A also accepts customers purchase goods in the warehouse, the display of goods in the warehouse is very important for sales. Due to the management personnel have less knowledge of the professional knowledge of cargo palletizing, and the arbitrariness of the work attitude is strong, the palletizing of goods is often in a disorderly state, lacking obvious classification. Which make the goods in the warehouse cannot be updated in time, and the maintenance of goods require a lot of manpower and material resources, resulting in low work efficiency, increased cost investment, and effect economic benefits. At the same time, the customer needs to go through every rack to find what they need. But in the reality, not everyone has this patient, the customer normally asks the employee where is the goods they need, which increase the employees' work; or just simply don't buy it.

4.5.2. Cause analysis

1) Insufficient understanding of inventory control

Because the benefits of Company A are relatively good, the boss and the managers did not consider the issue of inventory turnover. Unless there are inventory didn't been sold for weeks, the manager will focus on the inventory issue, and the conclusions are often very simple, either have bought too much, or the sales activity is not doing well.

2) Uncompleted information in the ERP system

Although Company A has its own ERP system, it has not been fully utilized. For example, the data in each department or each process of inventory management is relatively independent, and is not entered into the corresponding section of the ERP system, moreover, there is no paper record, so the information history cannot be check. In addition, in the ERP system, the inventory is simply categorized according to the supplier's name, instead of further classified by product type. This classification has led to the inability of Company A to manage in a targeted manner. It says there is no simple way to check total sales for goods except add the number from each invoice. Therefore, the actual sales of goods cannot be effectively analyzed, thus affecting the accuracy of procurement. It happened that some unimportant goods have accumulated inventories, while important goods have been out of stock.

3)   Lack of coordination between department

The communication between the various departments of Company A is not very good. The employees only care about their job, any job relative other departments will be considered as an extra job. If there is any problem, they will shirk their responsibility.

4)   No one is responsible for the result of the workers

Because there isn't a censorship system in company A, the initiative of employees is very low. Some employees only spent a little time on their work, which reduces the efficiency of the entire warehouse; some employees don't serious about work, which leads to errors in the work, such as input wrong inventory quantity is into the system. All these are not conducive to the timely adjustment of the inventory goods and increased the risk of inventory overstock, stock shortage, and losing customer's order.

5. Process improvement for the inventory management in the company A

The goal of A company's inventory management is to reduce the inventory cost and reduce the capital occupation as much as possible, so as to ensure the economic benefits of the company. In view of the inventory management problem analyzed, the inventory management policy should be improved. Firstly, by standardizing all processes of the inventory management system to reduce the inefficiencies. Secondly, the ERP information management system currently being used by Company A is sufficient to meet the needs of Company A in the process of procurement, storage and sales, but the main problem is that the system is not fully utilized and many data are not saved. Therefore, it is necessary to strength employees' understanding of the system and increasing the utilization rate of ERP software to improve the informationization level of inventory management. Finally, the uneven ability of employees directly restricts the overall work efficiency, so it is necessary to train employees to do their job better. Strengthen communication and collaboration between departments.

5.1. Improvement of the purchasing process

As the analysis before, there are 2 main problems in the purchasing process. One is the purchase process is not standardized, every storekeeper uses his own way to purchase and determines the quantity according to his own experience and feelings. So it causes that some goods are in stock before the salesman come, others don't.

Another one is there isn't a standardized purchase document, so most of the order information is not registered. Again, this process depends on the way the employee work. Right now, some storekeepers write the order information they need on the paper, some others records on their phone or they just remember in their mind, but no matter which way they chose to record the order information before the salesman come, they will not have registered this information. It means, those who record them with paper will throw away the paper; those who record with their phones will delete the records; those who remember them in their will naturally forget them after a while.

For solving these problems, first, the job responsibilities of storekeepers are redesign and then, the purchasing process is improved and standardized.

5.1.1. Warehouse storekeeper's job responsibilities

1) Responsible for managing and storing the goods they are assigned to.

2) Responsible for the purchasing and receiving process of their goods.

3) Responsible for regular (for instance, every Sunday) inventory count.

4) Responsible for the management of returns and/or bad goods (only for their goods) and return them to suppliers.

5) Responsible for the recording and delivery of documents such as goods input lists, inventory count lists, etc.

6) Responsible for the normal using, maintenance, and return of equipment and tools used in the work;

7) Complete other tasks arranged by the manager.

5.1.2. New purchasing process

Because the purchase of non-seasonal goods is the responsibility of the 10 storekeepers and the purchase of seasonal goods is the responsibility of the manager, the process of purchasing is divided into 2 different ways:

a)   Non-seasonal goods purchasing process

Assuming that the information in the ERP system is correct, the storekeeper can check the inventory into the system. Therefore, 1 day before the salesman come, storekeepers need to login to the ERP system to check the inventory. Meanwhile, the information into the system is not correct, the storekeeper should count the product to know the quantity in stock before deciding the amount to buy. Next, she/he has to fill, in a purchase order document the products to buy and the quantity. When the salesman comes, the storekeeper prints the order for the salesman. If the salesman accept the order, the storekeeper sends this purchase order to the information department for saving. If there is some modification in this order, such as to reduce the order quantity due to insufficient inventory in the supplier warehouse, the storekeeper needs to fill in a new purchase order with the correct information, and send this new order to the information department for saving. Fig 5.1. shows the flow chart of the process.

Non-seasonal goods purchasing process

Storekeeper	Info. Dept.

START

Check the inventory in ERP system or manuallly

Fill in the purchase order list

Determine the meeting time with salesman

Arrive the salesman

Change the order information

No

Purchase order list

YES

Fill in a new purchase order list

Save purchase order list

END
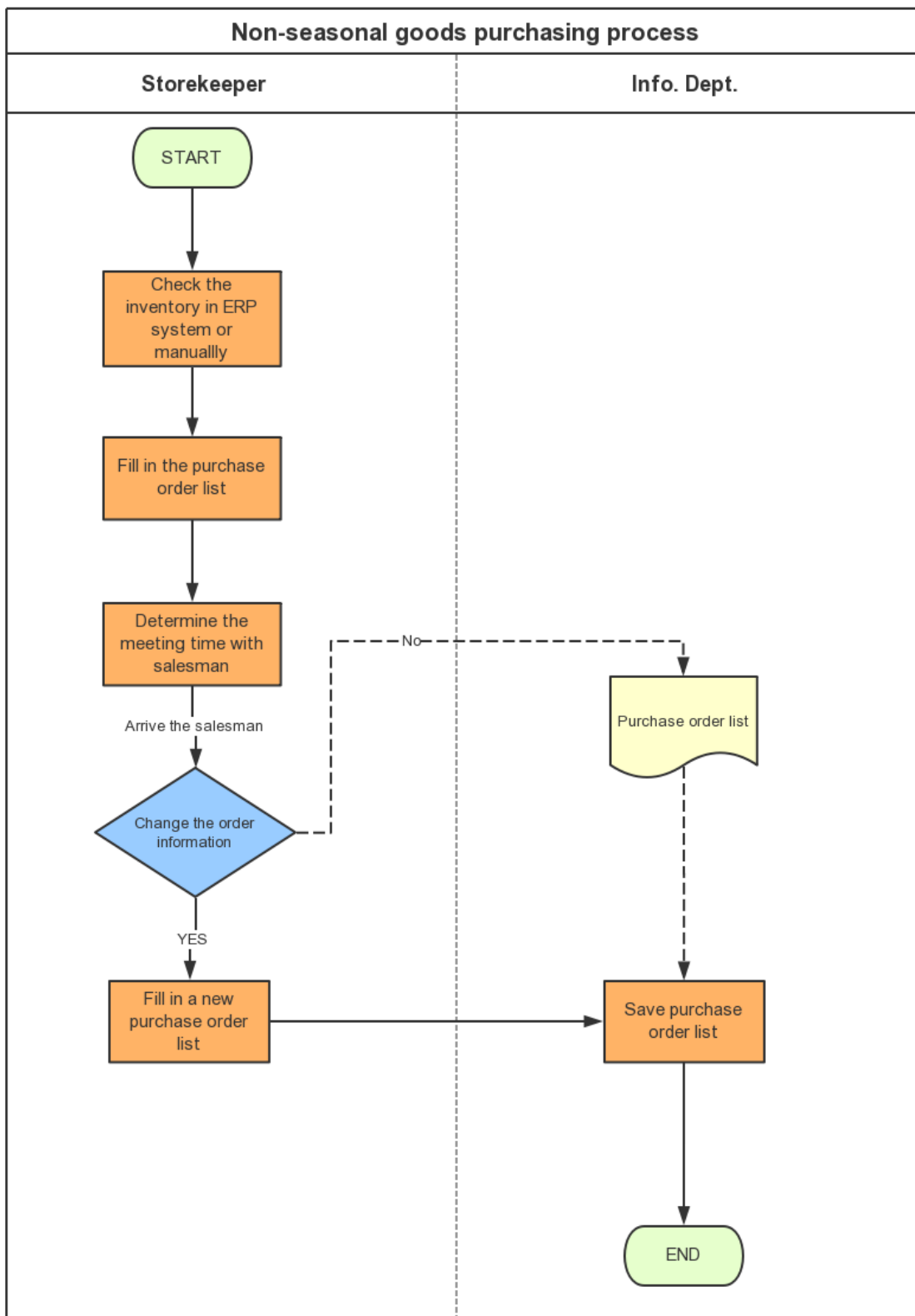
Fig. 5.1   Flow Chart of Non-seasonal goods purchasing process

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b)   Seasonal goods purchasing process

For the season goods, it is the responsibility to the manager. Because of the high season demand, the manager needs to do a demand forecasting for seasonal goods to order a suitable quantity to cover the season demand. Then he needs to contact the appropriate salesman to determine a meeting time for asking the price and the delivery time. After he got the information he needs, he needs to analyze the information and determine to place an order or not. If the manager determines to place an order, he need fill in the purchase order list in the ERP system. If the manager determines to not place an order, he needs contact other salesman to ask information until he found his satisfied supplier. Next, he need send the purchase order list to the appropriate salesman for ordering. And the last step is to send the purchase order list to the information department for saving. Fig 5.2 shows the flow chart of the process.
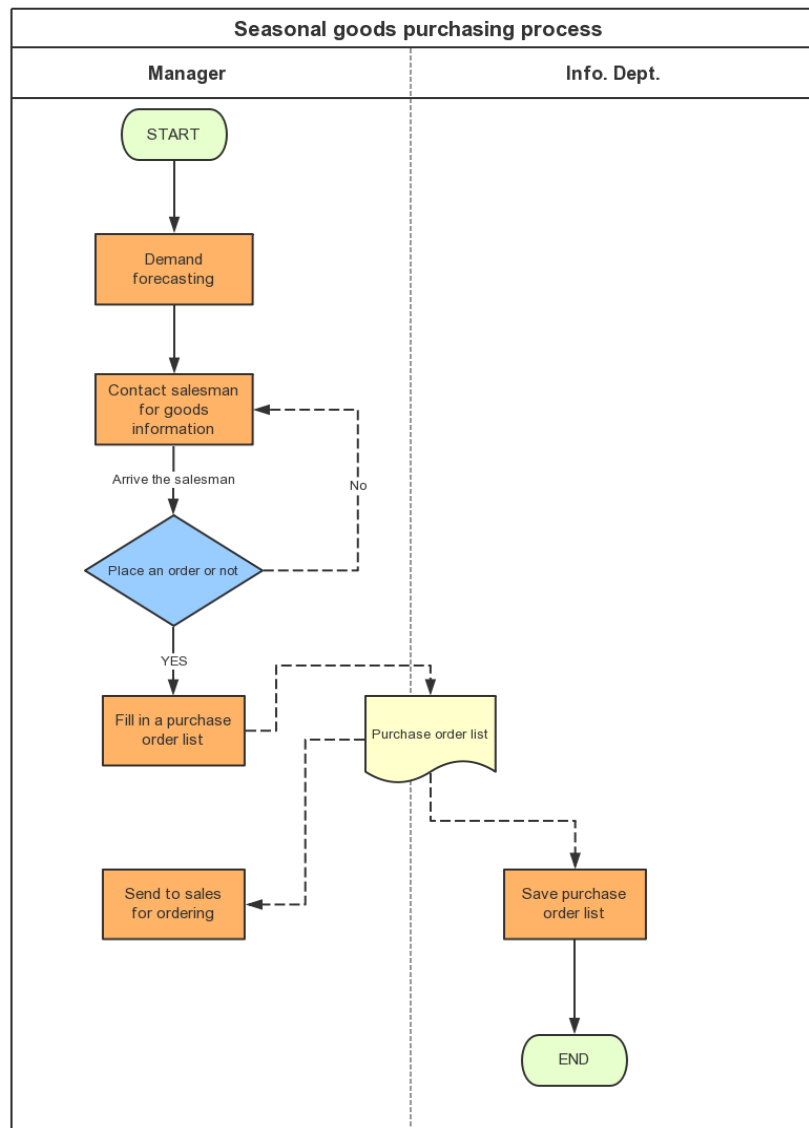
Fig. 5.2   Flow Chart of Seasonal goods purchasing process

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5.1.3. Indicators for verifying the effectivity of the purchase process

In order to monetarize the process some indicators are proposed:

1) Rate of purchase order registered

The first Key performance indicator (KPI) [1] is designed to check if the employees register the purchase order. Remember that one of the detected problems is the impossibility to check if the quantity bought and the quantity received from the supplier is the same.

Rate of Purchase Order Registered = Number of purchase orders registered / Number of orders

Target value: 100%

This indicator is calculated every month. The target value is 100%, which means the storekeeper must send the list to the information department every time and the information department must storage it well. Once this value is less than 100%, the cause must be found.

2) Punctual delivery rate

The second KPI is designed to check if the storekeeper finds a good supplier, by analyzing the delivery punctuality of the supplier. If the Punctual delivery rate is high, means the storekeeper has found a good supplier, vice versa.

Punctual Delivery Rate = Number of delivery punctuality / Number of orders

Target value: 95%

This indicator is calculated every month. The higher the ratio, the better delivery punctuality the supplier has; vice versa.

3) Delivery late rate

The third KPI is similar to the second one, but it's to measure the lateness of the supplier. Suppose Company A uses the advice given in this thesis, then each good has its own order cycle, the more the goods delivery delay, the worse the supplier is, the storekeeper responsible for managing these goods should consider informing this problem to the appropriate supplier to increase their on-time delivery rate. If the situation has not improved, the storekeeper should consider changing other suppliers.

Formula: Delivery Late Rate = Delay days / Order cycle

Target value: 28.5%

For example, if an item has an order cycle for 7 days, the delay is 3 days, then the delivery late rate is 42.9%.

This indicator is calculated every month. The higher the ratio, the worse delivery punctuality the supplier has; vice versa.

The warehouse manager responsible for calculating these 3 indicators and for improving the purchasing process.

5.1.4.   Template for purchase order list

This purchase order list template will register in the ERP system, the storekeeper and the manager need to fill in all information this list request, then imprint it and send to the information department.

The main information in this list: the goods name, the goods reference, the goods description, the price of goods, the quantity for purchasing, and the total cost of goods. Tab. 5.3 shows the template of the purchase order list.

Tab. 5.3   Template for purchase order list

5.2. Improvement of receiving process

Due to no one records the purchase order information after finished the purchase process, the correctness of the supplier's delivery information cannot be confirmed. When the supplier delivers more goods or fewer goods than the storekeeper orders, company A doesn't have evidence, so they can only receive the goods, and this a reason that causes some items with inventory overstock and others with stock shortage.

With the help of the new purchasing process above, the redesign of the receiving process could be done.

5.2.1. New receiving goods process

When the goods are delivered to the warehouse, the storekeeper must carefully check the name, parameters, quantity, and other information of the goods according to the purchase order of company A. In the meantime, he needs to check the outer packaging of the goods.

- For qualified goods, they should be put in the Receiving Zone, and wait for the storekeeper to transmit them to the designated location according to the characteristics of the goods;

- For unqualified goods, they should be put in the Returns/Bad Zone area and the details shall be recorded in the returns/bad goods list. Then wait for the storekeeper contact the salesman to communicate when and how to return these goods.

- If there are missed items or / overmuch items, the storekeeper should contact the salesman in time to communicate the reissue\return matters.

Then storekeepers need to fill in the goods input list and give the list to the warehouse manager to review, if every information is correct, it affixes the warehouse special seal and sends this list to information department be registered; if not, storekeepers need to find the reason of this mismatch and correct it. And a mistake report is required to writ has to be written by the storekeepers. Fig. 5.4 shows the flow chart of the new receiving process.

What have to be aware of is the input list has 2 copies, one is transferred to the Information Department as the basis for entering the ERP system, and the other is handed over to the warehouse manager for preservation. And the input list issued on the same day must be entered into the ERP system on the same day.

When there are goods with good quality but returned by the customer, it must be marked as "returns" on the input list.
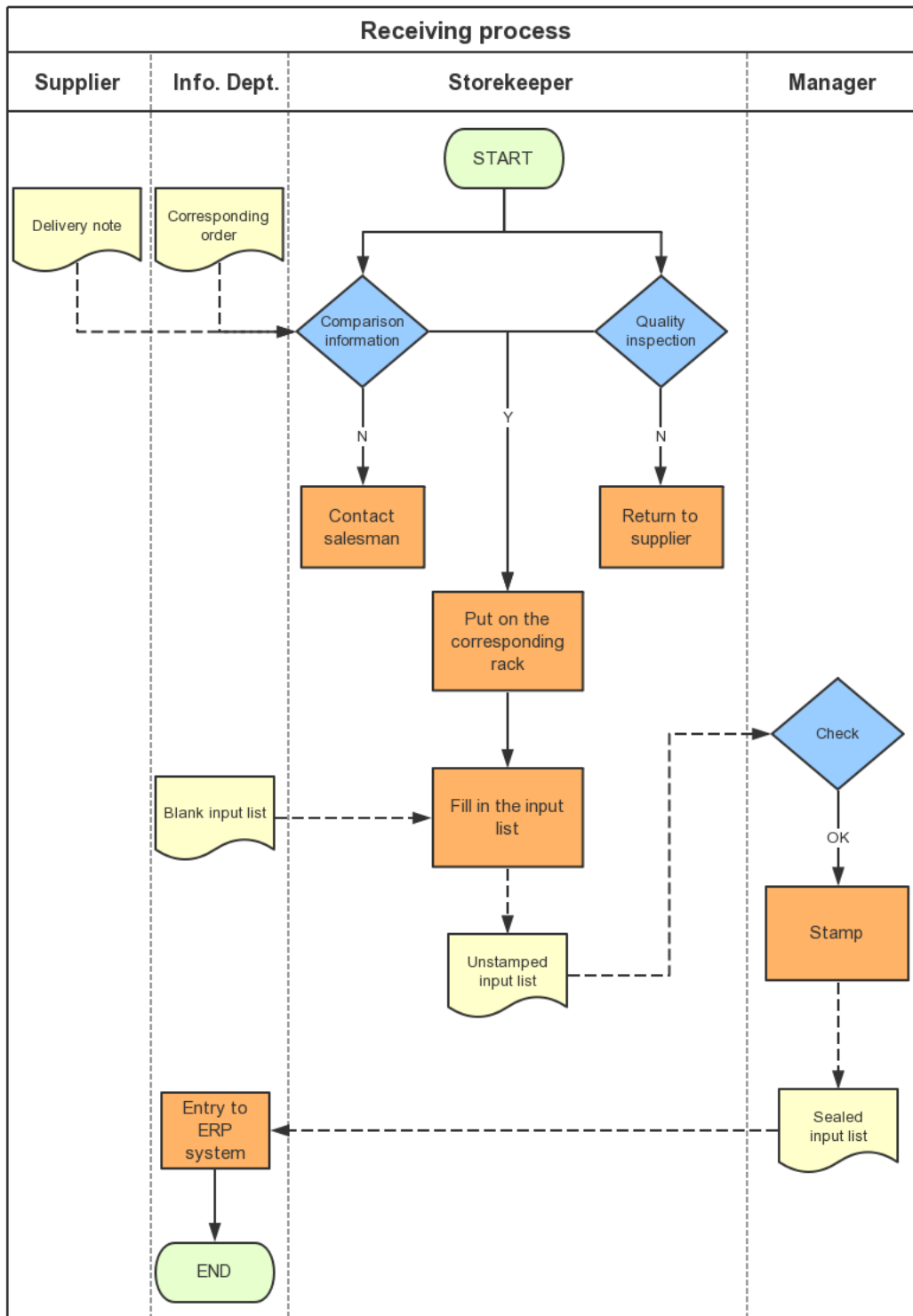
Fig. 5.4   Flow Chart of Receiving process

5.2.2.   Indicator for verifying the effectivity of the receiving process

1)   Accuracy of the placement of the goods

This KPI is designed to measure the accuracy of the placement of the goods. If the position of goods is wrong, pickers can't find what the customer wants.

Formula: Accuracy of the placement of the goods = Number of products placed in the wrong position / Total number of received goods

Target value: 5%

This indicator is calculated every month. The higher the ratio, the worse work efficiency the storekeeper has; vice versa.

The warehouse manager is responsible for calculating this indicator and for improving the receiving process.

5.2.3.   Template for the input list

The input list is a confirmation of the physical received quantity of purchased goods. The main information in this list: the goods name, the goods reference, the goods description, the order quantity in purchase order list, the quantity of receiving, and the difference between the purchasing quantity and the receiving quantity. Tab. 5.5 shows the template of the input list.

INPUT LIST

Receiving Date			Input by			Status		Normal ☐ Urgent	
Goods type		■ Non-seasonal goods		☐ Seasonal goods		Scheduled delivery time			
Supplier:									

No.	Goods name	Reference	Description	Quantity of order	Quantity of receiving	Difference	Bad goods	Entering to WH	Note
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
			Total:						

Note and signature	
	Signature: : _____ , BADALONA

Tab. 5.5   Template for the input list

5.3. Improvement of the inventory count process

The warehouse manager is responsible for coordinating the inventory count work, collecting and distributing the inventory count list. And each storekeeper is responsible for the inventory count in his area.

5.3.1.   New inventory count process

Before starting the process of inventory count, the whole warehouse needs to suspend all incoming, outgoing, and moving operations for inventory. The information department prepares the inventory count list in advance, then the manager receives the inventory count list from the information department and distributes the inventory count list to storekeepers. Next, the storekeepers implement the inventory count and fill in the inventory count list. After storekeepers fill in all inventory count list, the information department needs to collect them all, and compare the data of inventory count list and the data in the ERP system. If there is variance, the information department makes inventory variance adjustments based on the difference. The last one step is the storekeeper analyzes the reasons for the

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differences and makes a detailed written report for archival purposes. If there isn't variance, the information department just needs to save those lists.

Regarding the returns/bad goods inventory count, the returns/bad goods are sorted by suppliers, the name and quantity of each item should be recorded in the returns/bad goods list. Fig. 5.6 shows the flow chart of the new inventory count process.
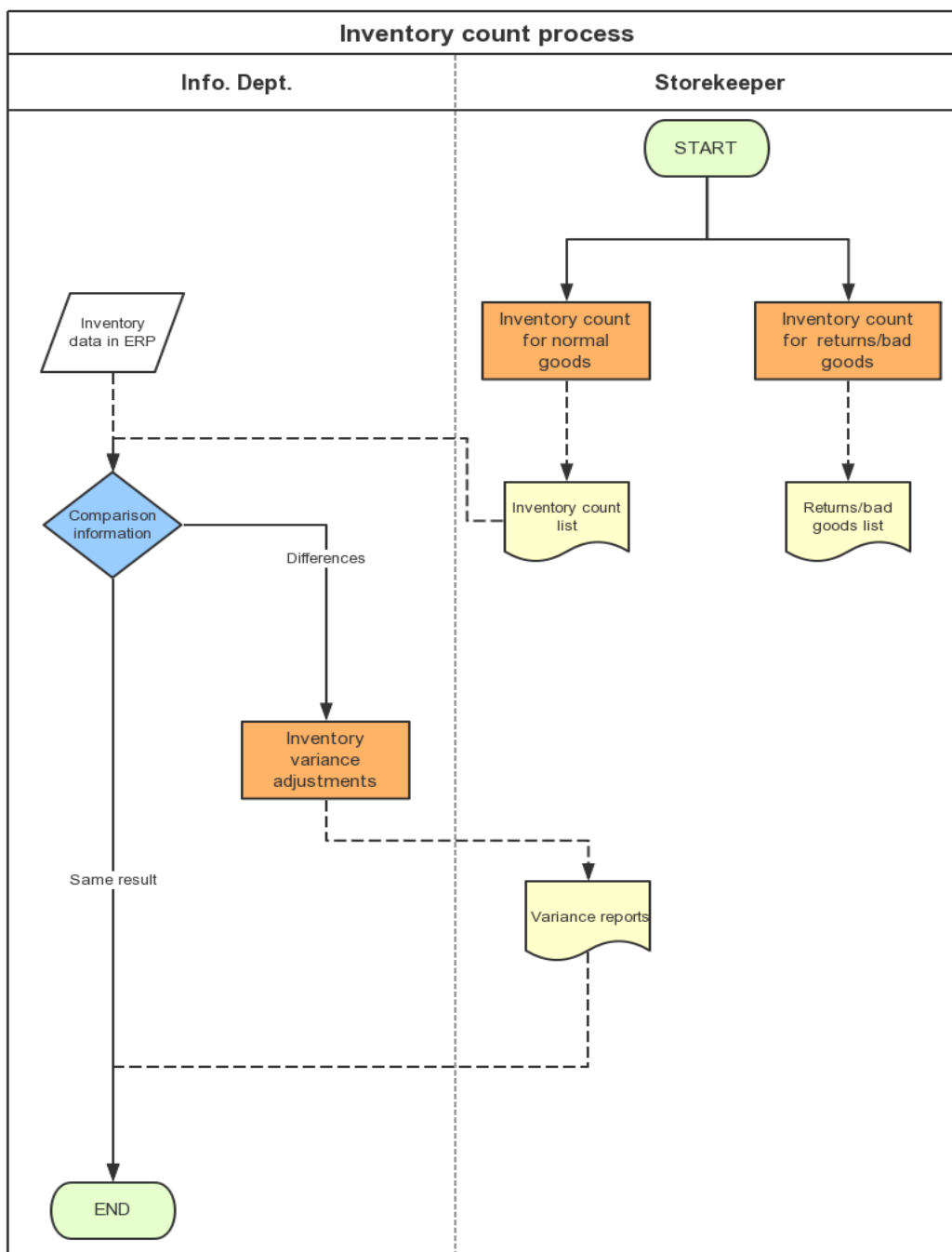
Fig. 5.6   Flow Chart of Inventory count process

5.3.2.   Indicators for verifying the effectivity of inventory counting process

1)   Rate of data mismatch

The first KPI is designed to check if the inventory counting process improves the mismatch between the inventory fiscal and the inventory data in the system. By recording the number of inconsistencies of the actual inventory and the inventory data in the system, as well as the number of discrepancies of each item. The fewer the discrepancies, the fewer inconsistencies, the more effective the improvements are; and vice versa.

Rate of Data Mismatch = Number of mismatch type of the goods / The amount of goods items

Target value: 0%

This indicator is calculated every month, and the manager is responsible for this. The target value is 0%, which means the storekeepers must communicate with information department about the correct inventory number in time, and the information department updates it correctly and timely. Once this value is bigger than 0%, the cause must be found.

5.3.3.   Template for documents used in the inventory count process

The main information in the inventory count list: the goods name, the goods reference, the goods description, the number of goods in the system, the number of goods in the inventory count process, and the variance between data in the system and the physical inventory. Only the quantity of fiscal inventory needs be filled in by storekeepers, others are filled in by ERP system automatically. Tab. 5.7 shows the template of the inventory count list.

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INVENTORY COUNT LIST

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Goods Name	Reference	Model	Inventory data in system			Quantity in inventory count			Variance
			Q	P	TC	Q	P	TC	

Tab. 5.7 Template for inventory count list

Inventory monthly report is very useful for analyzing the inventory, it records the on-hand inventory of last month, the input and the output of current month, by analyzing these three data, the inventory flow could be shown clearly. Tab. 5.8 shows the template of the inventory monthly report.

INVENTORY MONTHLY REPORT

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Goods Name	Reference	Model	On-hand stock of last month			Entering stock of this month			Output of this month			On-hand stock of this month			Note
			Q	P	TC	Q	P	TC	Q	P	TC	Q	P	TC	

Tab. 5.8 Template for inventory monthly report

There are 3 items in the inventory count variance report that need to be explained:

1) The summary of the inventory count mainly indicates the quantity of the goods with variance and the total amount of variance for them;

2) The inventory count variance analysis mainly indicates the name and reference of goods with variance. If there are too many types of goods, pages can be attached;

3) The possible reason mainly explains the reasons for the discrepancies (such as input list record errors, data entry errors, and unrecorded picking, etc.);

Fig. 5.9 shows the template of the inventory monthly report.

INVENTORY COUNT VARIANCE REPORT

DATE		Operator	
Summary of the inventory coun			
Inventory count variance analysis			
Processible reason			
Improvement measures and recommendations			
Operator: Sign: Date:		Manager: Sign: Date:	

Fig. 5.9   Template for Inventory Count Variance Report

5.4. Improvement of the picking process

5.4.1. Picker's job responsibilities and work processes

1) Complete daily picking tasks as required;

2) Picking goods according to the principle of order first in, first out;

3) Responsible for handling and feedback of upstream and downstream anomalies in the picking work;

4) Responsible for the normal using, maintenance, and return of equipment and tools used in the work;

5) Complete other tasks arranged by the manager.

5.4.2. New picking process:

After the picker receives the customer order provided by the APP department, he needs preparing the orders based on the order time. Then according to the principle of one roll container for an order, write the consignee on the outer packaging of the roll container. Generally, the goods are picked up on the shelves in the order of racks from A-Z, then placed in the roll container. Next, inspect the product packaging, signs, and review the goods name, quantity, model, etc. Moreover, the roll container will be sent to the checkout counter for the financial settlement. After the financial settlement, the printed invoice and delivery form will be placed in the roll container. The last step is reinforcing the packaged of roll container and put it in the Shipping Zone for transportation. Fig. 5.10 shows the flow chart of the picking process.

Picking process

Info. Dept.	Picker	Checkout counter	Logistic Dept.

START

Print customer order

Customer order

Write customer's name on the roll container

Pick goods

Review

Settlement

Invoice and Delivery form

Reinforce the packaged of roll container

Reinforce the packaged of roll container

END
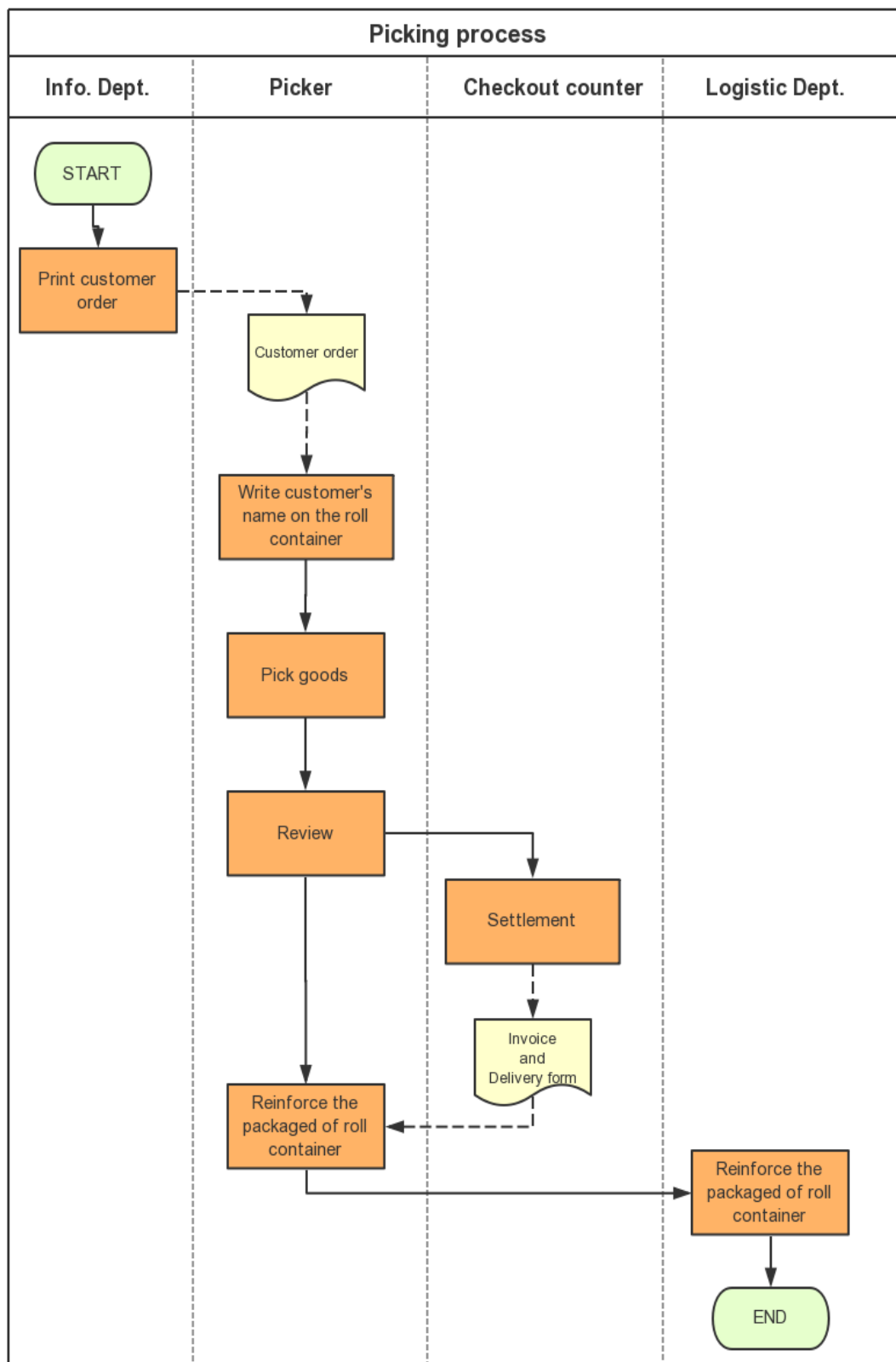
Fig. 5.10 Flow Chart of the Picking process

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5.4.3. Indicators for verifying the effectivity of picking process

1)   On-time delivery rate

The first KPI is to test the efficiency of the entire warehouse and to assess the coordination ability between the picking departments, finance department, and the logistic department.

On-time delivery rate = Number of on-time delivery / Number of order

Target value: 100%

This indicator is calculated every week by the manager, the target value is 100%, which means the picker must pick up all goods correctly, the finance department must do the settlement quickly and the logistic department must make a good transportation plan and avoid the roads that are prone to traffic jams. Once this value is less than 100%, the cause must be found, and write a delay report.

5.4.4. Template for delivery form

The delivery form records the information about those goods leaving the warehouse, like the price, the quantity and the total cost of goods.

In the picking process, there are three copies of the delivery form, one is transferred to the Information Department as the basis for entering the ERP system; one is handed over to the warehouse manager for preservation; the another will be recovered after the customer signed. Tab. 5.11 shows the template of delivery form.

DELIVERY FORM

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Customer Order Date			Pick by:		Status	■ Normal □ Urgent
Goods type					Delivery date:	
Customer：						
Goods Name	Reference	Model	Quantity	Price	Total price	Note
				Total Cost		

Tab. 5.11 Template for delivery from

5.5. Improvement of the placement of goods

One of the problems of A company's inventory management is that the products are not allocated logically. The goods displayed on the rack lacking obvious classification. Which make the maintenance of goods require a lot of manpower and material resources, resulting in low work efficiency, increased cost operation. At the same time, the customers need to go through every rack to find what they need. But in the reality, not everyone has this patient, if the customer doesn't like ask the employee where is the goods they need, they will Give up buying it, it caused the loss of customer orders.

In order to improve this problem, this section first reorganizes and reclassifies all the items in the warehouse, and then makes a new placement of goods based on the new classification.

5.5.1. Reclassifies of the goods in company A

In this reclassifies, those goods in company A are probably divided into 8 main categories, and there are some sub-categories and third level classification in each main category. Tab 5.12 shows the reclassifies of the goods.

	Main categories	Sub-categories	Third level categories
1	Beauty care	Shampoo and hair care	shampoo, Hair care, Hair dye,Stereotype, etc
		Toiletries	Bath products, Shower Gel, Soap, etc
		Oral care	Toothpaste, Toothbrush, Oral care accessories, Children's
		Beauty makeup	beauty tools, perfume, etc
		Medical supplies	alcohol, bandage.Bandage, etc
2	Household appliances	Kitchen Appliances	Rice cooker, Juicer, Coffee machine,Bread machine, etc
		Home devices	Lamp, charger, socket, etc
		Hard ware	
		Personal care	Shaver, hair dryer, Electronic scale, weighing scale, etc
3	Mobile digital	Computer product	Mouse, keyboard, stereo, computer accessories, etc.
		Mobile Communications	Telephone, mobile phone accessories, etc.
		Fashion digital	Radio, tape recorder, card reader, headphones, etc.
4	Household products	Bed linings	Pillows, pillows, blankets, four-piece beds, etc.
		Storage	Storage box, storage box, compressed storage bag,
		Washing	Clips, hangers, etc.
		Cleaning paper	Toilet paper, paper, handkerchief paper, wet tissue, kitchen
		cleaning supplies	Clothing cleaning, furniture cleaning, kitchen cleaning,
		Kitchen utensils	Pots, crispers, small kitchen utensils, cutlery, tea sets,
		Toiletries	Towels, bath towels, bathroom tools, etc.
		Auto Accessories	Motor oil, perfume, auto parts, etc.
		Dog food supplies	Dog food, cat food, repeating toys
5	Office Supplies	Office paper	Copy paper, printing paper, fax paper
		Office stationery	Ballpoint pens, folders, books, envelopes, etc.
		Daily supplies	Briefcase, photo album, gift pen, etc.
6	Sporting goods ball		Balls, outdoor products, bicycles and accessories, etc.
7	Toy		
8	Seasonal goods		

Tab. 5.12 Reclassifies of the goods

5.5.2. New placement of the goods in the storage zone

In this improvement, it is not necessary to change the whole layout of the storage zone, because the problem only is the placement of the goods. So the same layout plan as before will be used, and just need to redistribute the position of the goods on the rack. The seasonal goods are very important for the company, so it needs to be placed close to the entrance, that is rack C, D, E. Tab 5.13 and Fig. 5.14 are the result of the new placement of the goods.

	Main categories	Sub-categories	Rack name
1	Beauty care	Shampoo and hair care	A
		Toiletries	
		Oral care	B
		Beauty makeup	
		Medical supplies	
2	Seasonal Goods		C, D, E
3	Household appliances	Kitchen Appliances	F
		Home devices	G
		Hardware	H, I
		Personal care	J
4	Mobile digital	Computer product	K
		Mobile Communications	
		Fashion digital	L
5	Household products	Bed linings	M
		Storage	Front and back Zone
		Washing	N
		Cleaning paper	
		Cleaning supplies	Everyday Chemical Zone
		Kitchen utensils	O, P, Q
		Toiletries	R
		Auto Accessories	S
		Dog food supplies	
6	Office Supplies	Office paper	T, U
		Office stationery	V
		Daily supplies	W
7	Sporting		X
8	Toy		Y, Z

Tab. 5.13   List of the new placement of the goods

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Everyday Chemical Zone

Elevator

Back zone

T

V

Z

WC

Cash

Office

003 003 003 003 003
002 002 002 002 002
001 001 001 001 001

A   B C   D E

F G   H I   J K   L N   O P   Q R   S T   U W   X Y

003 003
002 002
001 001

Z

Front Zone   M   V

Goods' categories and the color of the corresponding storage area:

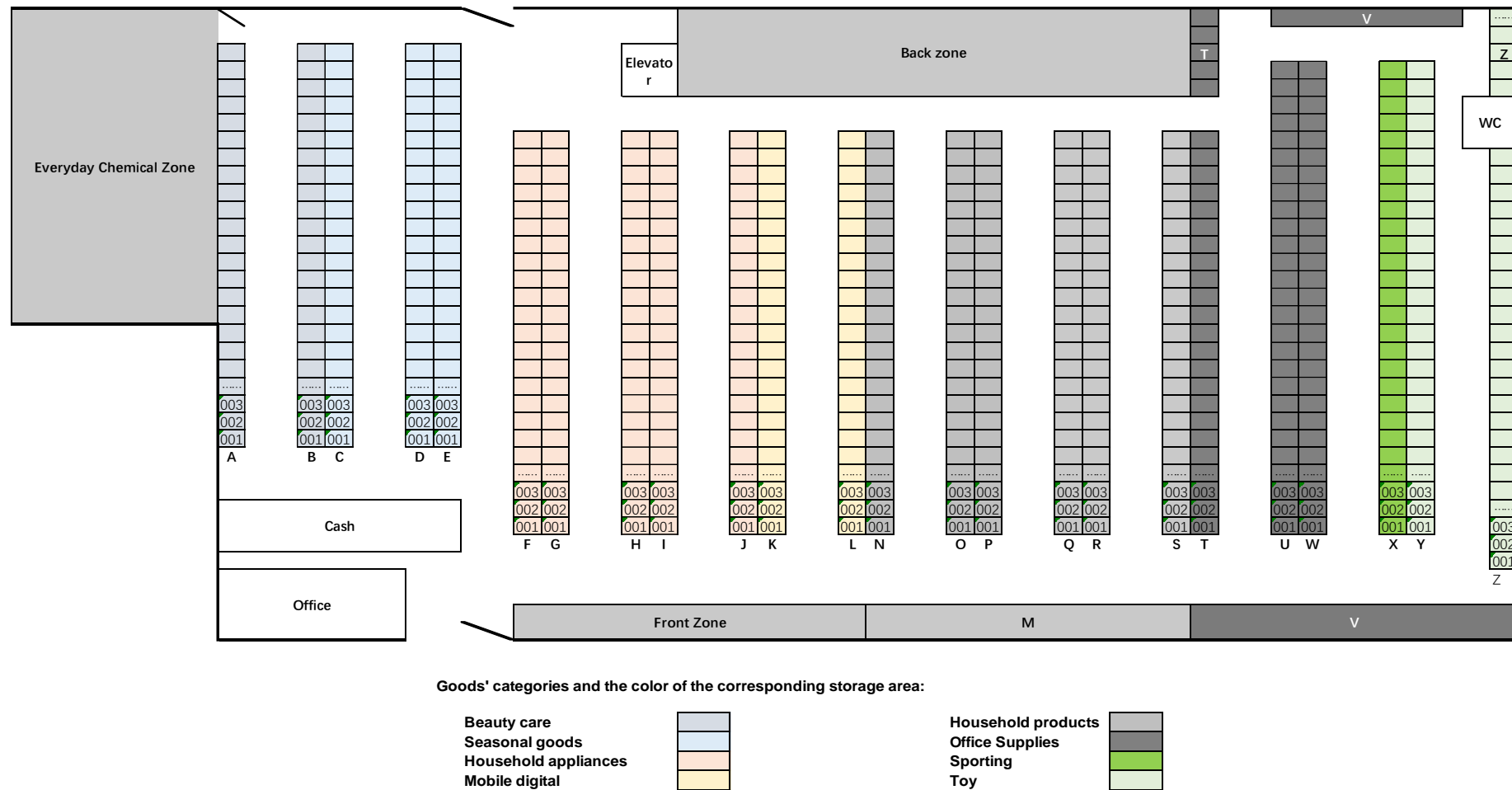|			
Beauty care		**Household products**	
Seasonal goods		**Office Supplies**	
Household appliances		**Sporting**	
Mobile digital		**Toy**	

Fig. 5.14 The new placement of the goods

5.6. Improvement of inventory management policy

Because Company A does not currently have a standardized ordering policy, even those storekeepers place order according to a certain period, once a week, once a month or twice a month, which is depended on the period of salesman comes, but the order – up – to – level is not optimized, actually they order any amount they want, don't follow a policy.

For resolving this problem, the Periodic Review System will be used to calculate the order cycle and the Order – Up – to – Level. The first step is doing the ABC analysis, then analyze the composition of inventory costs, and determine the type of demand.

5.6.1. ABC analysis

Since there are more than 20,000 kinds of stocks in Company A, only the processes relate to plastic trash cans have been chosen to be improved. Because the cost of the trash can be relatively high compared to other goods in Company A, and the volume is large, the improvement can significantly improve the utilization rate of the company A warehouse. At the same time, inventory overstock and stock shortage happened in this product line, it's a very representative example.

The first step to improving the inventory management is to perform ABC analysis on 36 trash cans sold by Company A.

The ABC inventory classification management method [2] refers to the classification of inventory items into three levels: particularly important inventory (category A), generally important inventory (category B), and unimportant inventory (category C) according to the variety and amount of funds occupied.

Category A products generally account for 15% of the total number of products, but account for about 75 - 80% of the total value of products; Category B products generally account for 25% of the total number of products, but about 15% of the total value of the remaining products; Category C products generally account for products 60% of the total, accounting for about 5% of the total value of the remaining products. Then we need to manage and control separately for different grades. Such classification management methods can achieve the following functions: compressing inventory, releasing pressure on capital, rationalizing inventory, and saving management input.

ABC Inventory Classification Management Procedure:
1) Calculate the total amount and total amount of various materials consumed by multiplying the average annual consumption of various types of inventory by their unit price.

2) Rearranging according to the order of the amount of money spent on each variety of materials, and calculating the proportion of total amount and total amount occupied by various materials.

3) Products with appropriate spending segments of 80% of the total amount are classified into Category A; products with 80%-95% of the total amount are classified into Category B; the remaining 5% of products are divided into Category C.

After the statistics and analysis, the basic information of crash can of the company A data, the two important data - unit prices and annual consumption (25/11/2017-27/10/2018) required for ABC analysis are listed in the Tab. 5.15.

Product name	Reference	Annual consumption	Unit Cost	Annual cost
P1	8414926114819	2250	2,33	5242,5
P2	8436552635315	420	2,46	1033,2
P3	8414926111542	2946	2,46	7247,16
P4	8414926111535	1710	1,49	2547,9
P5	8436552635445	738	1,49	1099,62
P6	8436552635438	228	1,49	339,72
P7	8414926299509	7	6,08	42,56
P8	8414926330066	23	9,5	218,5
P9	8414926299516	16	6,08	97,28
P10	8414926299523	23	6,08	139,84
P11	8414926299530	22	6,08	133,76
P12	8435421828353	216	9,21	1989,36
P13	8435421828346	639	4,91	3137,49
P14	8436552635599	75	9,21	690,75
P15	8414926329893	24	9,5	228
P16	8436552635377	148	4,91	726,68
P17	8436552635582	613	9,21	5645,73
P18	8414926330073	14	9,5	133
P19	8436552635360	1044	4,91	5126,04
P20	8414926115618	378	2,9	1096,2
P21	8414926115601	54	2,21	119,34
P22	8414926273264	128	1,8	230,4
P23	8414926201489	180	2,9	522
P24	8414926215592	228	2,21	503,88
P25	8414926284147	114	1,8	205,2
P26	8414926215653	708	2,9	2053,2
P27	8414926215561	372	2,21	822,12
P28	8414926307730	32	6,08	194,56
P29	8414926307549	69	6,08	419,52
P30	8414926307778	19	6,08	115,52
P31	8414926307723	24	6,08	145,92
P32	8414926307761	20	6,08	121,6
P33	8414926307563	137	6,08	832,96
P34	8414926284154	162	1,8	291,6
P35	8414926284178	66	2,17	143,22
P36	8414926307556	85	6,08	516,8

Table. 5.15   Basic information of the ABC analysis of the trash can

According to the ABC Inventory Classification Management Procedure, the final result has been shown in Tab. 5.16 and Fig. 5.17

Product name	Reference	Annual cost	Cost accumulate
P3	8414926111542	7247,16	16,41%
P17	8436552635582	5645,73	29,20%
P1	8414926114819	5242,5	41,07%
P19	8436552635360	5126,04	52,68%
P13	8435421828346	3137,49	59,79%
P4	8414926111535	2547,9	65,56%
P26	8414926215653	2053,2	70,21%
P12	8435421828353	1989,36	74,72%
P5	8436552635445	1099,62	77,21%
P20	8414926115618	1096,2	79,69%
P2	8436552635315	1033,2	82,03%
P33	8414926307563	832,96	83,92%
P27	8414926215561	822,12	85,78%
P16	8436552635377	726,68	87,42%
P14	8436552635599	690,75	88,99%
P23	8414926201489	522	90,17%
P36	8414926307556	516,8	91,34%
P24	8414926215592	503,88	92,48%
P29	8414926307549	419,52	93,43%
P6	8436552635438	339,72	94,20%
P34	8414926284154	291,6	94,86%
P22	8414926273264	230,4	95,38%
P15	8414926329893	228	95,90%
P8	8414926330066	218,5	96,39%
P25	8414926284147	205,2	96,86%
P28	8414926307730	194,56	97,30%
P31	8414926307723	145,92	97,63%
P35	8414926284178	143,22	97,96%
P10	8414926299523	139,84	98,27%
P11	8414926299530	133,76	98,57%
P18	8414926330073	133	98,88%
P32	8414926307761	121,6	99,15%
P21	8414926115601	119,34	99,42%
P30	8414926307778	115,52	99,68%
P9	8414926299516	97,28	99,90%
P7	8414926299509	42,56	100,00%
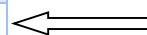
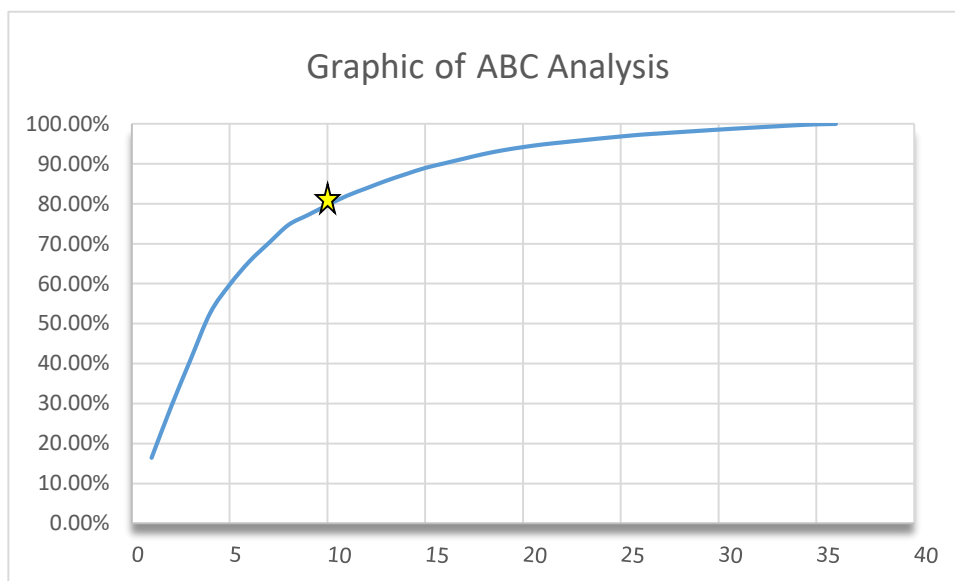Tab. 5.16   Cost accumulate for the trash can

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Fig. 5.17 Graphic of ABC Analysis

As the step (3) of ABC Inventory Classification Management Procedure, all the products
with appropriate spending segments less than 80% of the total amount are classified into
Category A. The resume of Category A has been shown in Tab. 5.18.

Class A	P3	P17	P1	P19	P13	P4	P26	P12	P5	P20

Tab. 5.18 Resume of Category A

For the Category A inventory, their inventory levels should be controlled by about 15%-20%;
for the Category B inventory, their inventory level should be controlled by about 20%; for
the Category C inventory, should be a large amount of inventory, control its inventory level
about 60%.

5.6.2. Inventory cost

Inventory is the number of reserves that a company has in a warehouse. As long as there
is inventory, the capital occupation will occur, so the inventory cost usually refers to the sum
of the costs incurred from the generation of the inventory to the end of the delivery. In
company A, the composition of inventory costs can be divided into the following three main
parts: inventory holding costs, purchase costs, and ordering costs. It can also be subdivided
under three levels of subjects, and Fig. 5.19clearly shows the relationship between
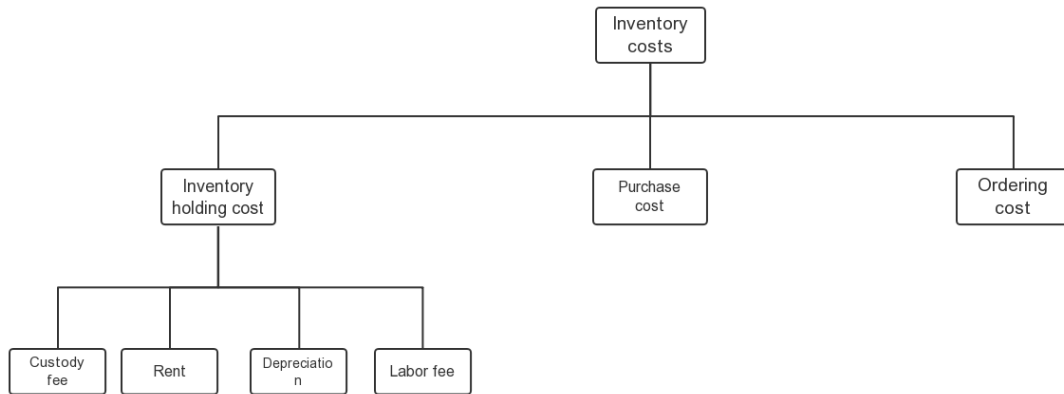inventory costs.

Fig. 5.19 Inventory cost composition

(1) Holding costs, which are the expenses necessary to maintain inventory. It usually includes the costs of capital costs, storage, insurance, damage, etc.

(2) Ordering costs. This part of the cost is related to the number of orders issued and increases with the number of orders, normally it's a fixed cost for per order.

(3) Purchasing costs, the unit cost of each product. Which is related to price and order quantity.

5.6.3. Determine the type of demand

The Standard deviation measures the absolute variability of customer demands, the coefficient of variation measures variability relative to average demand. According to the value of Coefficient of the variability of demand (VC), demand can be divided into two categories:

- Homogeneous (VC ≤ 0.25)
- Non-homogeneous (VC > 0.25)

And the formula is:

$$VC = \frac{T * \sum D_t^2}{(\sum D_t)^2} - 1 \qquad\qquad (Ec\ 5.1)$$

The demand of 10 products in Class A during the 10/2017 – 10/2018 has been shown in Tab. 5.20:

Pdt./Mth.	Nov	Dic	Ene(2018)	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct
P3	228	240	216	198	252	210	294	312	342	246	312	276
P17	45	34	43	20	47	42	69	84	130	30	64	70
P1	162	174	156	132	162	144	186	174	156	126	216	138
P19	85	60	51	81	46	111	95	120	165	56	70	104
P13	67	55	30	31	49	19	57	50	80	63	90	78
P4	90	100	120	80	70	120	100	160	90	120	140	160
P26	72	66	60	48	30	30	36	72	84	60	48	72
P12	11	9	7	9	18	26	35	29	30	17	11	14
P5	96	132	80	42	24	30	54	48	42	30	48	112
P20	30	30	24	18	18	12	36	60	42	36	30	42

Tab. 5.20   Annual sales (10/2017-10/2018) for products in Class A

Take P3 as an example, the calculation process of $VC_{(P3)}$ has been show below:

$$VC_{(P3)} = \frac{12*(228^2+240^2+216^2+198^2+252^2+210^2+294^2+312^2+342^2+246^2+312^2+276^2)}{(228+240+216+198+252+210+294+312+342+246+312+276)^2} - 1 \approx 0.029 \quad \text{(Ec 5. 2)}$$

The Tab. 5.21 is a resume of the result of VC for each product in Class A.

Product	P3	P17	P1	P19	P13	P4	P26	P12	P5	P20
VC	0.029	0.253	0.022	0.144	0.138	0.063	0.093	0.261	0.3	0.158

Tab. 5.21   Resume of the result of VC for each product in Class A

In the table 5.21 shows that only the VC value of P17, P12, P5 are bigger than 0.25, but due to there are not much different from their VC value to 0.25, these 3 products can be classified as demand Homogeneous as others 7 products.

5.6.4.   Periodic Review System

Periodic Review System (PRS) [4] is an inventory control method where the inventory is checked in fixed time periods and the orders are periodically placed in a period. But the quantity ordered is varied every time. The method has the following features:

1) An order is placed in fixed time periods
2) The quantity order is different every time
3) Could handle the relatively large demand fluctuations
4) Could adapt to demand seasonal
5) Reduced the inventory volume compared with the Fixed Period Ordering System
6) More suit for Class A items

The basic data are:

    CL - Ordering cost. The fixed cost associated with placing an order.

    CS - Holding costs. Cost of storing a unit of the product during the Horizon. CS = i* CA.

    d - Demand during a Period.

    h - Planning Horizon

It is intended to know:

T^*- Optimal Review Period.

$$T^* = \sqrt{\frac{2*CL*h}{CS*d}} \qquad\qquad\qquad \text{(Ec 5.3)}$$

The process of calculating:

Take P3 as an example, P3 is blue trash can with lid, the capacity is 21 L, at the price of 2.46€ per unit (each set has 6 units). Through the investigation, the storekeeper 10 who is responsible for plastic products has a weekly salary 300€. He normally needs place orders for 500 kinds of plastic products per week, and about half of his working hours are used to manage inventory, and the remaining half is for delivery. So the ordering costs (CL) is $CL = \frac{300}{500} \times 0.5 = 0.3€$. The Lead Time (L) of the P3 is 3 days, purchasing costs (CA) is 2.46€ per unit, possession rate by u.t (i) is 15%. Because the value of goods in company A is low, so we don't consider the inventory risk cost in this case. The employees work 8 hours per day and 6 days per week, consider I year has 288 days.

From above introduction of P3, the CA = 2.46€, CS = i * CA = 15% * 2.46 = 0.369€, CL = 0.3€, h = 1 year. Then through Tab. 5.2.2, the total demand of P3 is D = 3126 unit/year.

$$T^* = \sqrt{\frac{2*CL*h}{CS*d}} = \sqrt{\frac{2*0.3*1}{0.369*3126}} \approx 0.0228 years \approx 6.57\ days \quad \text{(Ec 5.4)}$$

Then rounded up $T^* = 7\ \text{days}$

Order–Up–to– Level

Order–Up–to–Level is an inventory level that could cover the anticipated demand before the next order is received, for each order in a fixed time the order quantity is same.

The basic data are:

        D - Expected demand during the review interval.

        R - Review interval.

        L - Lead-time

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M - Order–Up–to–Level

It is intended to know:

$$M = D(R + L) \qquad (Ec\ 5.5)$$

For the case of P3, D is daily demand, $R = T^* = 7$ days, L is 3 days.

So, $$M = \frac{3126}{6 \times 4 \times 12}(7 + 3) \approx 108.54\ unt. \approx 18.09\ sets \qquad (Ec\ 5.6)$$

Because each set has 6 units P3, so the final $M = 19$ sets. This means that whenever the P3 store reviews inventory, it should bring on-hand inventory plus on-order inventory up to 19 sets. For example, suppose that during the first inventory review, it is found that 30 units are in inventory, in that case, 14 sets P3 (114 – 30 = 84 units. = 14 sets) should be ordered.

The total cost $TC = CL * \frac{D}{Q} + CA * D + CS * \frac{Q}{2}$, while $Q = \frac{M}{2} = \frac{114}{2} = 57$ unts.

$$TC = 0.3 * \frac{3126}{57} + 2.46 * 3126 + 0.369 * \frac{57}{2} = 7716.93\ \frac{€}{year} \qquad (Ec\ 5.7)$$

The calculation process of the other 9 goods is the same as that of P3. The calculation process is omitted here, and only the calculation results are listed in Tab. 5.22.

Product	D	CA	PRS		
			T	M	TC
P3	3126	2.46	7	114	7716.93
P17	678	9.37	8	26	6377.64
P1	1926	2.37	9	81	4586.09
P19	1044	4.97	8	40	5211.80
P13	669	4.97	10	31	3343.66
P4	1350	1.5	13	75	2040.02
P26	678	2.95	13	38	2015.01
P12	216	9.37	13	12	2038.94
P5	738	1.5	18	54	1118.24
P20	378	2.95	18	28	1126.30

Tab. 5.22   Redistribute the position of the goods

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5.6.5. Harris-Wilson Model

Because company A has an aim which is reducing the total cost of inventory management, so the Harris – Wilson Model [4] will be used to calculating the total cost. But if the ERP system in company A isn't good, the Harris – Wilson Model cannot be used in reality.

Harris-Wilson Model was first proposed by F. W. Harris in 1913. In 1934, after further revision by R. H. Wilson., the well-known economic order quantity (EOQ) was formed. It refers to the calculation of the purchase order cost and the storage cost, so as to achieve the best order quantity with the sum of the purchase order cost and the storage cost. This method not only considers the problem of order but also considers the aspect of warehousing, it is a combination of these two aspects.

$$Q^* = \sqrt{\frac{2*CL*D}{CS}} \qquad \text{(Ec 5.8)}$$

$$K(Q) = CL * \frac{D}{Q} + CA * D + CS * \frac{Q}{2} \qquad \text{(Ec 5.9)}$$

In the formula:

CL: Ordering costs

CS: Holding costs. CS = i* CA, i is possession rate by u.t

CA: Purchasing costs

D: Annual demand

Assumption: the out of stock is not allowed, regardless of the volume discount, the ordering cost is independent of the order quantity, and through the investigation, the Lead Time (L) of the P3 is 3 days, CL=0.3€, CA = 2.46€, i = 15%.

So, CS = i * CA = 15% * 2.46 = 0.369€

Then through Tab. 5.20 we have D = 3126 unit.

$$Q^* = \sqrt{\frac{2 * CL * D}{CS}} = \sqrt{\frac{2 * 0.3 * 3126}{0.369}} \approx 71.29 \text{ units} \approx 11.88 \text{ sets} \qquad \text{(Ec 5.10)}$$

If Q= 11 sets = 66 units,

$$K(Q_1) = 0.3 * \frac{3126}{66} + 2.46 * 3126 + 0.369 * \frac{66}{2} \approx 7716.35 \text{ €} \qquad \text{(Ec 5.11)}$$

If Q= 12 sets = 72 units,

$$K(Q_2) = 0.3 * \frac{3126}{72} + 2.46 * 3126 + 0.369 * \frac{72}{2} \approx 7716.27 \text{ €} \qquad \text{(Ec 5.12)}$$

Due to $K(Q_1)$ is bigger than $K(Q_2)$, the $\mathbf{Q^* = 12\ sets}$, whie $\mathbf{K(Q) = 7716.27}$ €.

$$\text{Order point: } s = D * L = 3126 * \frac{3}{288} \approx 32.56\ units \approx 5.4\ set = \mathbf{6\ sets} \qquad \text{(Ec 5.13)}$$

$$\text{Order number: } N = \frac{D}{Q} = \frac{3126}{72} \approx 43.42\ times\ per\ period = \mathbf{44\ times} \qquad \text{(Ec 5.14)}$$

$$\text{Order cycle: } T = \frac{Q}{D} = \frac{72}{3126} \approx 0.023 \frac{year}{order} \approx 6.63 \frac{day}{order} = \mathbf{7\ day/order} \qquad \text{(Ec 5.15)}$$

In summary, for P3 company A should place an order to supplier every 7 days once and should place order 44 times per period (1 year), and the EOQ is 12 sets (72 units) with a minimal cost 7716.35 €.

5.6.6. Comparative results of Periodic Review System and Harris and Wilson Model for 10 goods of class A

Due to all these 10 goods are demand homogeneous, the process of calculating is the same, so the details of calculating have been omitted only shows the resume of the calculate result below in Tab. 5.23.

Product	D	CA	PRS			Harris–Wilson Model				
			T	M	TC	Q	K	Order point (s)	Order num. (N)	Order cycle (T)
P3	3126	2.46	7	114	7716.93	72	7716.27	36	44	7
P17	678	9.37	8	26	6377.64	18	6376.81	8	38	8
P1	1926	2.37	9	81	4586.09	58	4584.89	21	34	9
P19	1044	4.97	8	40	5211.80	29	5210.29	11	36	8
P13	669	4.97	10	31	3343.66	24	3342.24	7	28	11
P4	1350	1.5	13	75	2040.02	60	2038.50	14	23	13
P26	678	2.95	13	38	2015.01	31	2013.52	8	22	14
P12	216	9.37	13	12	2038.94	10	2037.43	3	22	14
P5	738	1.5	18	54	1118.24	45	1116.98	8	17	18
P20	378	2.95	18	28	1126.30	23	1125.12	4	17	18

Tab. 5.23   Resume of the result of PRS and Harris-Wilson Model for goods in Class A

Compare the total cost (TC) of PRS and the total cost (K) of Harris-Wilson Model, it's easy to see the total cost of Harris-Wilson Mode is smaller, which means Harris-Wilson Mode is more suitable for calculating the order quantity.

5.7. Improvement of the level of informatization

Right now, there is a big problem in company A - the physical inventory and the data in the system does not match. The 2 main reasons for this problem are: the employee does not remember to notify the information staff of the correct inventory data, and the invoice/ delivery note from the supplier is lost in transit, the information staff doesn't have a data source to update inventory in the system. For these 2 reasons, through the redesign of purchasing process and receiving process, all employees will remember to notify the information staff the correct inventory data, and the information staff will have all document and data their need to update the system data.

On the other hand, according to the results of the Tab. 5.23, it's easy to know that Harris-Wilson Model is more suitable for the company. But the implementation of this model in reality, has a necessary condition, which is the company must have an ERP system that could place order automatically when the inventory level drops to the order point. Therefore, the improvement of the level of informatization is necessary.

5.7.1.   Foundation of the level of informatization

By applying the ERP system to the business activities of Company A, by improving the accuracy and timeliness of data information, it can strengthen the core competitiveness of Company A under the market competition system and obtain the maximum economic benefits for Company A. For example, when the inventory data in the company A's APP can match the actual inventory in the warehouse, there will be no problem of missing customer orders; for example, when the ERP system can automatically place an order, Company A does not have to worry about the stock shortage.

According to the following logic diagrams [5], the most important things should be done by company A has shown below in Fig. 5.24.
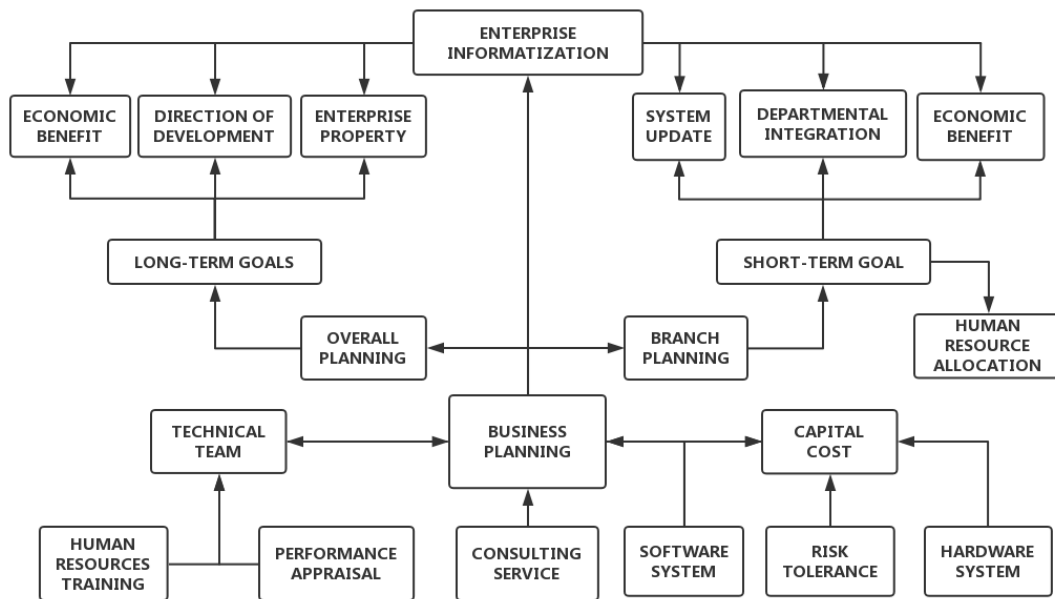
Fig. 5.24 Logic diagram of Goods enterprise informatization

1) Formulating a development strategy plan. Enterprise informatization planning should be based on the actual situation of the company A and the evaluation results of all aspects of the company, and analyze, summarize it, and formulate the stage objectives with the development of enterprise informatization.

2) Create a technical team. Informatization construction is a complex and long-term system engineering. Company A must have an information-based talent team that understands both information technology and management business. The flow chart of building an information technology team has been shown in Fig. 5.25.
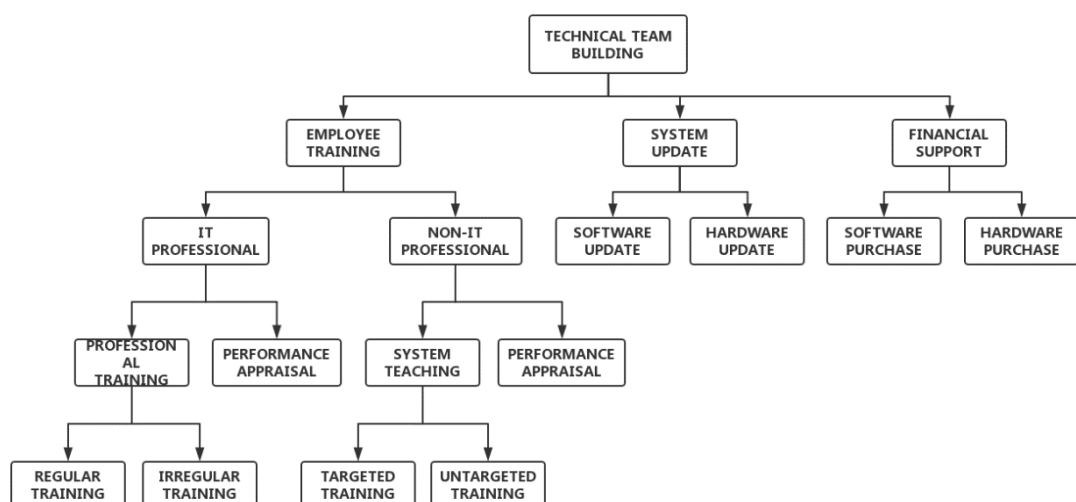

Fig. 5.25 Flow chart of the information technology team building process

Enterprise informatization is not a simple purchase of software and hardware systems. It is the real operation of informatization. The technical team is the most important choice for enterprise information construction. Company A already has an ERP system, now it just missing a technical team that can make enterprise information real operation, and seek economic benefits for the company.

3) Adjust the working mode. The foundation of enterprise informatization construction is the "digitalization" of internal information of company A, and on this basis, the workflow of business operations is fixed in the form of software programs, and this process is continuously extended to various areas of business operations.

5.7.2.   The job responsibilities of the information department

1) Manage and maintain various data in the ERP system;
2) Create and maintain templates for the various paper documents required for the daily work of the various departments in the warehouse;
3) Enter the data and information on various paper documents submitted by various departments into the ERP system;
4) Keep a variety of paper documents handed over by various departments;
5) Check the inventory data in the ERP system according to the inventory count list
6) Complete other tasks arranged by the manager.

6. The planning and the budget of the project

By reviewing the entire project's production process, the whole planning and the budget for this project have been shown in Fig. 6.2.

6.1. Gantt chart

There are 6 main tasks of this project, and these tasks are subdivided into a total of 28 tasks, the most important of them is the analysis of the problems in the inventory management process, the next is the improvement proposal. Fig. 6.1 shows the detail of these tasks.

Name	Begin date	End date	Completion
Investigate information of company A	9/17/18	10/2/18	100
Investigate the inventory management process	10/1/18	10/25/18	100
Worker survey	10/1/18	10/5/18	100
Introduce the inventory management process	10/1/18	10/19/18	100
Analyze problems in the process	10/1/18	10/25/18	100
Improvement proposal	10/24/18	1/17/19	100
ABC analysis	10/24/18	11/2/18	100
Inventory cost	11/5/18	11/6/18	100
Determine demand type	11/19/18	11/21/18	100
Organize historical demand	11/5/18	11/23/18	100
Annex of Workers' survey	11/21/18	11/26/18	100
Harri- Wilson Model	11/21/18	11/27/18	100
Periodic Review System	11/28/18	12/4/18	100
Compare calculation results	12/5/18	12/10/18	100
Improvement for the process of inventory management	12/14/18	1/7/19	100
Improvement of purchasing process	12/14/18	12/24/18	100
Improvement of receiving process	12/21/18	12/24/18	100
Improvement of inventory count process	12/26/18	12/27/18	100
Improvement of picking process	12/31/18	12/31/18	100
Improvement of the placement of goods	12/31/18	1/1/19	100
Improvement of the level of informatization	1/4/19	1/7/19	100
Conclusion	1/7/19	1/8/19	100
Inspection and improvement of the entire project	1/9/19	1/17/19	100

Fig. 6.1   Task list of this project

The Fig. 6.2 shows the Gantt chart of this project, through this figure it can be clearly seen when each task starts from when, whether there are dependencies between different tasks, which tasks are completed at the same time, and which tasks are completed in order.
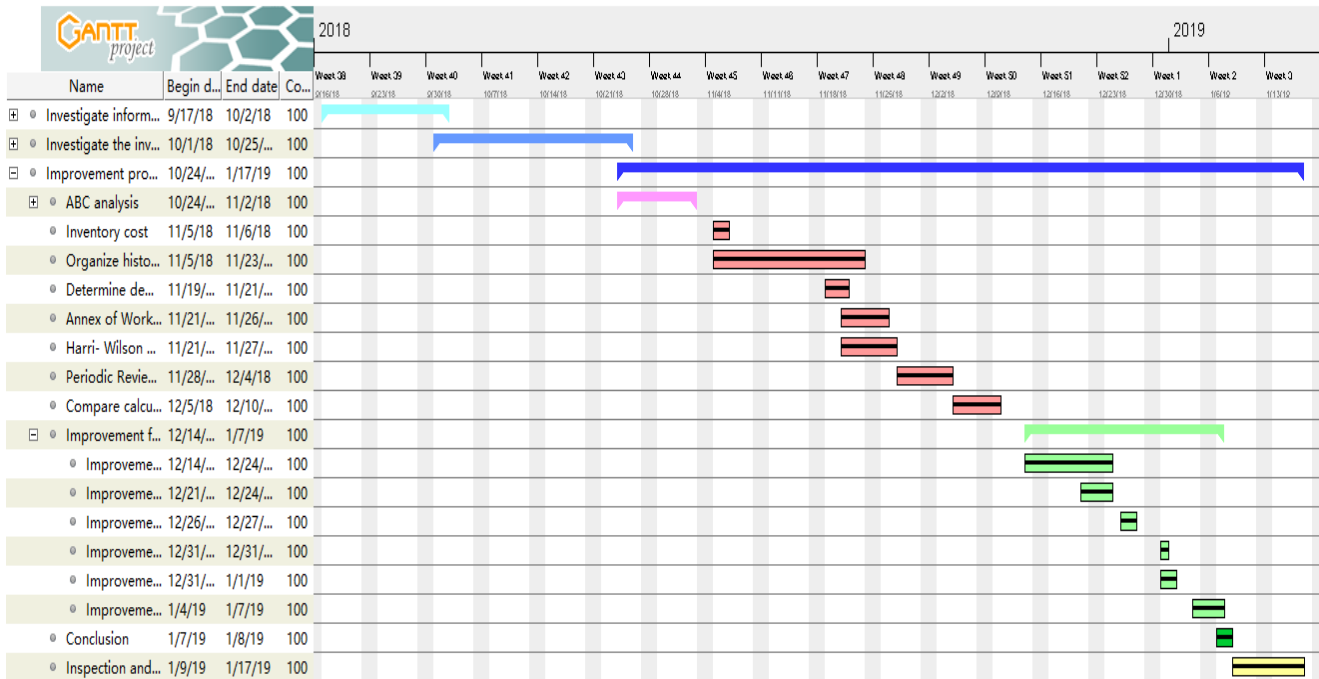
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Fig. 6.2   Gantt chart of this project

It's easy to see from the Gantt chart, I spent the most time in the section on proposing improvements, it cost 65 days. For the whole project, it spends 260 days.

6.2.   Budget of this project

According to the Gantt chart above, from the start date of this project until now, this project has cost 260 days, and I spend an average of 2 hours a day to study with this project. The time cost per hour is 8€, so the total time cost is 4160€.

The materials used in this project writing are pens, ballpoint pens, pencils, erasers, notebooks, folders, etc. The cost of materials used is 15€.

My laptop is priced at 400€, assuming it has a useful life of 4 years. This project used 17,8% of the useful life., it costs 71,2€.

So the total budget of this project is 4246,2€.

7. The environmental impact

In the process of completing this project, I paid great attention to the protection of the environment. The questionnaires given to workers of Company A were all based on online questionnaires and sound recording interviews, which reduced paper waste during the project.

On the other hand, if Company A implements the improvement suggestions I have proposed in this thesis, then Company A can effectively improve the efficiency of inventory management and reduce inventory costs. Then the adverse impact on the environment generated by Company A's old inventory management process will be reduced. For example, when certain goods have inventory overstock, Company A will return the goods to the supplier, which will generate unnecessary Energy (gasoline, electric energy, etc.) loss.

In summary, the project is an environmentally neutral project that does not have a very bad impact on the environment and does not greatly contribute to environmental improvement.

8. Conclusion

In recent years, with the development of Company A, various problems in its inventory management have gradually emerged. How to do a good job in inventory management and develop an inventory management strategy suitable for its own development is an urgent problem that Company A needs to solve.

In this context, this thesis introduces and analyzes the current situation of inventory management of Company A, and uses the ABC analysis principle, the Periodic Review System and the EOQ model as the theoretical basis, combined with the relevant data of Company A, the improvements for the problems in the company A's inventory management are proposed.

8.1. Main conclusions of this thesis

This thesis analyzes the current situation of A company's operation and inventory management, clarifies the research focus, conducts relevant analysis, and draws corresponding optimization measures in a targeted manner. The specific conclusions are as follows:

1) The main problems of A company's inventory management are:
- the purchase process is not standardized;
- the order for suppliers haven't been recorded;
- unable to verify the accuracy of the arrival information;
- the physical inventory and the data in the system does not match;
- the product order does not follow a logic.

2) Analyze the causes of the problem and summarize it as:
- insufficient understanding of inventory control;
- uncompleted information in the ERP system;
- lack of coordination between departments;
- no one is responsible for the result of the workers

3) Based on the above analysis, with the initial application of A company's ERP system, by using the ABC analysis theory, EOQ model and other theories, improved the company's inventory management process and inventory management policy.

4) In order to reduce the resistance and difficulty of the work, under the premise of not affect the original administrative organization structure, the inventory management related management mode was adjusted, the professional organization structure and functions were improved, formed an inventory management mechanism suitable for the actual work needs of Company A.

5) Designed a long-term plan for the improvement of the level of informatization of

Company A, and established an inventory inquiry form and method to meet the needs of differentiated management.

8.2. Limitations of this thesis

Although this thesis studies the inventory management of Company A and analyzes its existing problems, it proposes corresponding improvement measures, but it is limited by the geographical location, development status, consumer groups, and my personal experience and ability level, it has led to the insufficiency of the research on other related problems in company A's inventory management. The method of solving the problem is not comprehensive enough, and many aspects still need further research and improvement. Teachers, experts, and professors are welcome to criticize and correct.

Acknowledgments

First of all, I would like to sincerely thank my thesis supervisor Professor Immaculada Ribas Her meticulous academic attitude has benefited me a lot, and I have made great progress both in theoretical research and in practical work. In the whole process of opening the topic, structure, practice, writing, revision, and finalization, Imma gave me a lot of careful guidance and detailed revision opinions, which enabled me to successfully complete the graduation thesis. Thanks again to Professor Imma for his selflessness guidance and teaching.

Finally, I would like to express my heartfelt gratitude and respect to the experts who have patiently reviewed this thesis during the busy schedule and the teachers of the defense team!

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Annex

Daily Work Style Questionnaire (1)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   6 years

2. **Have you had worked at any warehouse before? If you have, how long?**

   No

3. **Which racks are you responsible for?**

   A, B, C

4. **Which products are you responsible for?**

   Needlework, candles, bandages, etc.

   Small wooden boxes, candles, shoe polish, plastic bags, etc.

   Vases, fish tanks, carpets, gift bags, toothpaste, toothbrushes, etc.

5. **Is there stock shortage in products that you are responsible for?**

   Carpets,

   toothpaste, toothbrushes, small wooden boxes.

6. **Is there inventory overstock in products that you are responsible for?**

   Vases, fish tanks.

7. **How often do you check the inventory?**
      1) **For the products that salesman comes once a week.**
      2) **For the products that salesman comes once a half month.**
      3) **For the products that salesman comes once a month.**

   The storekeepers check the inventory every day for all goods, because one of their work is to replenish the goods on the racks in a timely manner.

   Company A's racks have 4 floors, only first and second floors are sales areas, because third and 4th floors are too high, customers are not convenient to get goods. So when goods on the first and second floors are not enough, the storekeepers need to move goods on the third and 4th floors to the first and second floors.

8. **How do you judge the inventory of a product is overstock?**

   The storekeepers are judged based on experience, so they can't give a certain time period. I sorted out their answers and can be divided into the following two situations.

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1) **For the products that have long purchase duration.**

The number of inventory has not decreased, or reduced slowly for weeks.

2) **For the products that have short purchase duration.**

The number of inventory has not decreased, or reduced slowly for days.

9. Do you record stock shortage/inventory overstock information? If so, how?

No

10. After checked the inventory, do you remember to tell the APP department about the inventory shortage information?

Yes.

11. How do you decide the order quantity for goods?

According to my experience and the sales

12. Do you have a forecasting method?

No.

13. How do you remember the quantity of each product in an order?

I didn't remember. When salesman comes, I go through each rack and place the order based on the quantity of each product.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

According to the delivery note.

Daily Work Style Questionnaire (2)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

    4 years
2. **Have you had worked at any warehouse before? If you have, how long?**

    No
3. **Which racks are you responsible for?**

    D, E, F
4. **Which products are you responsible for?**

    Aromatherapy, gift bags, carpets, candles, tarpaulins, hairdryer, knee pads, wrister etc.

    Bedding, tablecloths, mats, etc.

    Socks, dishwashing cotton, dishwashing gloves, shower curtains, etc.
5. **Is there stock shortage in products that you are responsible for?**

    Aromatherapy, carpets
6. **Is there inventory overstock in products that you are responsible for?**

    tarpaulins, shower curtains
7. **How often do you check the inventory?**
    3) **For the products that salesman comes once a week.**
    4) **For the products that salesman comes once a half month.**
    5) **For the products that salesman comes once a month.**

    Same as above
8. **How do you judge the inventory of a product is overstock?**

    Same as above
9. **Do you record stock shortage/inventory overstock information? If so, how?**

    No.
10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.
11. **How do you decide the order quantity for goods?**

    According to my experience and the sales
12. **Do you have a forecasting method?**

    No.
13. **How do you remember the quantity of each product in an order?**

I didn't remember. When salesman comes, I go through each rack and place the order based on the quantity of each product.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

I don't check it.

Daily Work Style Questionnaire (3)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   1 year

2. **Have you had worked at any warehouse before? If you have, how long?**

   No

3. **Which racks are you responsible for?**

   G, H, K

4. **Which products are you responsible for?**

   Toy.

   Paint, decoration supplies.

5. **Is there stock shortage in products that you are responsible for?**

   Some toys

6. **Is there inventory overstock in products that you are responsible for?**

   Some toys, especially for the big toy.

7. **How often do you check the inventory?**
   1) **For the products that salesman comes once a week.**
   2) **For the products that salesman comes once a half month.**
   3) **For the products that salesman comes once a month.**

   Same as above

8. **How do you judge the inventory of a product is overstock?**

   Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

   Yes, written on the paper, and give it to the manager.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

    I don't place order, the manager is responsible for placing order.

12. **Do you have a forecasting method?**

    No.

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13. How do you remember the quantity of each product in an order?

I don't place order, the manager is responsible for placing order.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

I don't check it.

Daily Work Style Questionnaire (4)

Your feedback will be used to improve our inventory management. Thank you!

1. How long have you been working at Company A?

   6 years

2. Have you had worked at any warehouse before? If you have, how long?

   Yes, 4 years.

3. Which racks are you responsible for?

   I, J, L

4. Which products are you responsible for?

   Seasonal Goods

5. Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?

   Few.

6. Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?

   Most of them.

7. How often do you check the inventory?
   1) **For the products that salesman comes once a week.**
   2) **For the products that salesman comes once a half month.**
   3) **For the products that salesman comes once a month.**

   Same as above

8. How do you judge the inventory of a product is overstock?

   Same as above

9. Do you record stock shortage/inventory overstock information? If so, how?

   Yes, written on the paper, and give it to the manager.

10. After checked the inventory, do you remember telling the APP department about the inventory shortage information?

   No.

11. How do you decide the order quantity for goods?

   I don't place order, the manager is responsible for placing order.

12. Do you have a forecasting method?

   No.

ETSEIB

13. How do you remember the quantity of each product in an order?

I don't place order, the manager is responsible for placing order.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

I don't check it.

Daily Work Style Questionnaire (5)

Your feedback will be used to improve our inventory management. Thank you!

1. How long have you been working at Company A?

1 year

2. Have you had worked at any warehouse before? If you have, how long?

Yes, 1 year.

3. Which racks are you responsible for?

N, O, P

4. Which products are you responsible for?

Kitchen supplies (plastic), cling film, tin foil, Kitchen pot

Kitchen cutlery (plates, knives, forks, chopping boards, colander), kitchen scales, etc.

Various cups (ceramic cups, teapots, kettles, thermos cup)

5. Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?

ceramic cups, Kitchen supplies (plastic), Kitchen pot.

6. Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?

Kitchen cutlery (plates, knives, forks, chopping boards, colander).

7. How often do you check the inventory?
   1) **For the products that salesman comes once a week.**
   2) **For the products that salesman comes once a half month.**
   3) **For the products that salesman comes once a month.**

Same as above

8. How do you judge the inventory of a product is overstock?

Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

Yes, I record it on my phone.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

Yes.

11. **How do you decide the order quantity for goods?**

According to my experience and the sales.

12. **Do you have a forecasting method?**

No.

13. **How do you remember the quantity of each product in an order?**

Yes, I record it on my phone.

14. **After placing the order, will you save the order information? If so, which kind of information will you save?**

No.

15. **During the receiving, how do you check the receiving information?**

According to the delivery note.

ETSEIB

Daily Work Style Questionnaire (6)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   6 years

2. **Have you had worked at any warehouse before? If you have, how long?**

   No.

3. **Which racks are you responsible for?**

   Q, R, S

4. **Which products are you responsible for?**

   Glass cups, plate for paella, etc.

   Hardware

5. **Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?**

   Cheap glass cups.

6. **Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?**

   Expensive glass cups, some hardware.

7. **How often do you check the inventory?**
      1) **For the products that salesman comes once a week.**
      2) **For the products that salesman comes once a half month.**
      3) **For the products that salesman comes once a month.**

   Same as above

8. **How do you judge the inventory of a product is overstock?**

   Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

   Yes, written on the paper.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

    According to my experience and the sales.

12. **Do you have a forecasting method?**

No.

13. How do you remember the quantity of each product in an order?

I wrote them on the paper.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

According to the delivery note.

ETSEIB

Daily Work Style Questionnaire (7)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   3 years

2. **Have you had worked at any warehouse before? If you have, how long?**

   No.

3. **Which racks are you responsible for?**

   T, U, W

4. **Which products are you responsible for?**

   Kitchen appliances (Juicing machine, toaster, etc.)

   Household appliances (Hairdryer, coffee machine, etc..), pet supplies, matches, alcohol, lighter

   Photo frames, photo albums, blackboards, etc.

5. **Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?**

   Pet supplies, lighter

6. **Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?**

   Big photo frames, kitchen appliances.

7. **How often do you check the inventory?**
   1) **For the products that salesman comes once a week.**
   2) **For the products that salesman comes once a half month.**
   3) **For the products that salesman comes once a month.**

   Same as above

8. **How do you judge the inventory of a product is overstock?**

   Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

   No.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

According to my experience and the sales.

12. Do you have a forecasting method?

No.

13. How do you remember the quantity of each product in an order?

I didn't remember. When salesman comes, I go through each rack and place the order based on the quantity of each product.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

I don't check it.

ETSEIB

Daily Work Style Questionnaire (8)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   5 years

2. **Have you had worked at any warehouse before? If you have, how long?**

   Yes, 4 years.

3. **Which racks are you responsible for?**

   X, Y, Z, V

4. **Which products are you responsible for?**

   Notebook, book, wallpaper, big gift box, etc.

   Stationery: pens, pencils, ballpoint pens, erasers, folders, etc.

   Gift paper, cardboard, etc.

5. **Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?**

   Paints, glue

6. **Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?**

   Notebook (because there are too many types), folder.

7. **How often do you check the inventory?**
   1) **For the products that salesman comes once a week.**
   2) **For the products that salesman comes once a half month.**
   3) **For the products that salesman comes once a month.**

   Same as above

8. **How do you judge the inventory of a product is overstock?**

   Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

   Yes, written on the paper.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

    According to my experience and the sales.

ETSEIB

12. Do you have a forecasting method?

No.

13. How do you remember the quantity of each product in an order?

I wrote them on the paper.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

According to the delivery note.

Daily Work Style Questionnaire (9)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

   3 years

2. **Have you had worked at any warehouse before? If you have, how long?**

   Yes, 5 years.

3. **Which racks are you responsible for?**

   Everyday Chemical zone

4. **Which products are you responsible for?**

   Everyday Chemical.

5. **Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?**

   Garbage bag, toilet paper

6. **Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?**

   Shower gel and shampoo (because there are too many types), Aromatherapy

7. **How often do you check the inventory?**
      1) **For the products that salesman comes once a week.**
      2) **For the products that salesman comes once a half month.**
      3) **For the products that salesman comes once a month.**

   Same as above

8. **How do you judge the inventory of a product is overstock?**

   Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

   No.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

    According to my experience and the sales.

12. **Do you have a forecasting method?**

    No.

13. How do you remember the quantity of each product in an order?

I didn't remember. When salesman comes, I go through each rack and place the order based on the quantity of each product.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

According to the delivery note.

ETSEIB

Daily Work Style Questionnaire (10)

Your feedback will be used to improve our inventory management. Thank you!

1. **How long have you been working at Company A?**

    8 years

2. **Have you had worked at any warehouse before? If you have, how long?**

    Yes, 4 years.

3. **Which racks are you responsible for?**

    Rack M, Front Zone, and Back Zone.

4. **Which products are you responsible for?**

    Plastic products: trash cans, plastic cups, storage boxes, watering cans, bowls, basin, etc..

5. **Is there stock shortage in products that you are responsible for? If so, could you please tell me the product name and the frequency of stock shortage?**

    Trash can, storage box, watering cans, some spray bottle

6. **Is there inventory overstock in products that you are responsible for? If so, could you please tell me the product name and the frequency of inventory overstock?**

    Crisper, plastic drawer

7. **How often do you check the inventory?**
    1) **For the products that salesman comes once a week.**
    2) **For the products that salesman comes once a half month.**
    3) **For the products that salesman comes once a month.**

    Same as above

8. **How do you judge the inventory of a product is overstock?**

    Same as above

9. **Do you record stock shortage/inventory overstock information? If so, how?**

    Yes, written on the paper.

10. **After checked the inventory, do you remember telling the APP department about the inventory shortage information?**

    Yes.

11. **How do you decide the order quantity for goods?**

    According to my experience and the sales.

12. **Do you have a forecasting method?**

No.

13. How do you remember the quantity of each product in an order?

I wrote them on the paper.

14. After placing the order, will you save the order information? If so, which kind of information will you save?

No.

15. During the receiving, how do you check the receiving information?

No, the goods are stable, so the quantity of each order is almost the same.