2012

Final Thesis in Suofei

-Optimize internal logistics system to meet the demand of E-commerce

Fei Xia 21009112

Wuxi Suofei Socks Co. LTD

2013/01/05

Summary

Wuxi Suofei socks Co. LTD is a company mainly produce all kinds of socks for export to Japan and America, the company has done export for more than 10 years. But recent years export industry in China is no longer popular than before, profit is reducing year by year. In order to survive in such a serious environment, the management of Company Suofei decided to start E-commerce, mainly focus on domestic market.

Suofei has set up the E-commerce department in February 2012, although the time period is still short until now, but the order quantities is increasing fast, it must say Suofei really done good sales promotion. With the increasing of sales there began to reveal problems. The lag in internal logistics system cannot meet the demand of E-commerce. Good management of E-commerce cannot without the support from internal logistics system. Export is quite different with E-commerce; internal logistics situation for E-commerce is far more complex than export. So Suofei now has bottleneck: Too difficult to handle so many orders, mistakes and time wasting leads to customer dissatisfaction. So, one of the main projects for Suofei now, is to optimize the internal logistics system to meet the demand of E-commerce. This report is written for this purpose.

First of all, find the demand of E-commerce is important, and then it is possible to analysis how to optimize. Demand not only means the sales number, but also objectives such as delivery time, quality, return of goods, flexibility and etc.

According to the research, there are several main problems will influence the development of E-commerce. They are:

- The rapid increasing of order sizes beyond the affordable range of current logistics.
- Customers' satisfaction rate of delivery time is too low.
- Safety stock is too high, and not reasonable. Stock level in finished products warehouse is too high.
- The production of socks sell via E-commerce is not separate from export; products sales by E-commerce even do not have a specialized warehouse. Layout of the factory is not reasonable.
- The logistics facilities are out of date.
- The order picking flow wastes too much time.
- Information exchange system has problems.
- Employees are not skilled enough to use modern facilities.

After get such conclusion, I have given several recommendations in order to solve the problem:

- Set up new safety stock for finished products of E-commerce based on the forecast: silk short socks and silk stockings have the safety stock of 800; other types have the safety stock of 40. Also reduce the type of products from 240 to 200, in order to reduce the stock.
- Introduction new facilities both in hardware and software.
- Change the overall layout; change the layout of finishing workshop and finished warehouse. Give a separate warehouse to E-commerce.
- Shorter the delivery time by improving the order picking process. With the use of RFID system and order classified system, it is possible to deal orders within 1-2 hours. Greatly shorten the order picking process.
- Enhance internal communication: through meetings, oral and written communication, computer software and other method to enhance internal communication.
- Staff training: train the staff to use the new facilities and steady the skill to use ERP system.

The total investment is ¥ 116050, and payback period will be 5 months.

I wish this report can give company Suofei useful help, and finally the recommendations can be adopted in the company.

Table of contents

Chapter1. Introduction

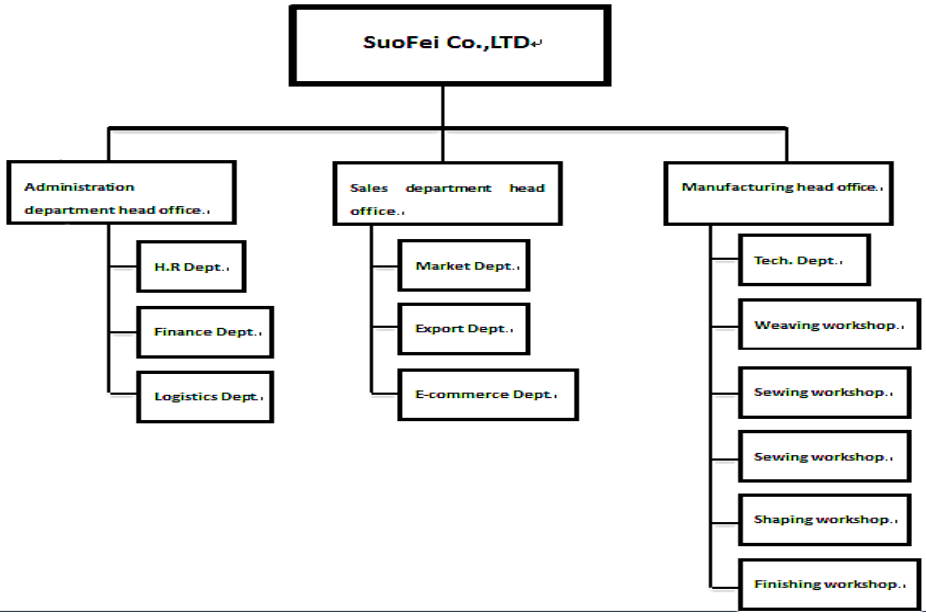
1.1 Background of Company Suofei

Wuxi Suofei socks Co. LTD is a company mainly produce all kinds of socks for export to Japan and America. The predecessor of the company is a state-owned enterprise. In 1986, the state-owned enterprise closed down, in 1988 one of the employee set up the Suofei socks company. Now the company has a history for more than 20 years, and already became one of the leaders in socks industry in Wuxi, also quite famous in Jiangsu province.

Suofei built a website and a web shop several years ago, and spent some money on it, but until 2011 there is no any profit at all. Because Suofei do not have fixed skilled employees to focus on E-commerce, and on the other hand, management does not pay enough attention to E-commerce.

But from February 2012, Suofei began to focus on E-commerce, and started to have profit on E-commerce. It was a new trying for Suofei, until June 2012, the sales could just equal to cost, because at the beginning a lot of promotion and discount activities has to be carried out. From July 2012, E-commerce started to earn profit, and the order size increased fast. While there comes the problems, one of the most serious problem is the original logistics management cannot keep up with the rapid growth of sales by E-commerce. So the management of Suofei really wants to do some change to meet the demand of E-commerce.

Organization Structure



Graph 1.1 organization structures in Suofei

Introduction of every department:

Administration head office: 1 employee. This department is responsible for the daily management of company.

H.R department: 2 employees. This department is responsible for managing the employees.

Finance Department: 2 employees. This department is responsible for dealing with financial problems.

Logistics Department: 3 employees. Logistics department mainly deals with transportation matters with Export, internal transportation and also responsible for contact with courier companies for delivery of products sold through E-commerce.

Sales head office: 1 employee. It is responsible for managing the operation of sales departments.

Market Department: 2 employees. It is responsible for researching the market and etc.

Export Department: 4 employees. It is responsible for contacting the business with foreign customers.

E-commerce Department: 5 employees. It is responsible for doing business through E-commerce.

Manufactory head office: 2 employees. It is responsible for arranging the production activities every day.

Technic Department: 3 employees. It is responsible for fixing and maintaining the machines and software.

Weaving Workshop[1]: 18 employees. It is responsible for producing the body of socks and managing the raw material warehouse.

Sewing Workshop: 10 employees. It is responsible for producing the head of socks.

Shaping Workshop: 5 employees. It is responsible for shaping the socks; make the socks into the same size.

Finishing workshop: 9 employees. It is responsible for finishing the socks with package and also managing the semi-finished products warehouse and finished products warehouse.

[1] See appendix 2

1.2 Context of the problem

China is famous for huge amount of export, but now doing export is more and more difficult. The increasing of material cost, the falling of US dollar, the increasing of labor cost, the competition from Vietnam and Indonesia, all make Chinese small and medium enterprises hard to survive. Suofei is one of those companies. The profit of Suofei in 2011 was

￥3,000,000, has reduced 10% than year 2010. According to the seasonal report of 2012, we can believe the profit of 2012 will continually goes down. The only method is to find new market and change style.

On the other hand, too many years of being "World's Factory", China bears too much pollution and poverty. Although the situation is not so good now, Chinese government continually encourages small and medium enterprises to change style, from labor-intensive to technology-intensive. While Suofei Socks company is a typical labor-intensive enterprise.

With the pressure from all aspects, Suofei decided to adapt to E-commerce industry to solve the dilemma. However, the current logistics system is rather fall behind; it cannot meet the fast increasing of E-commerce. The management focuses too much on the sales but ignores the logistics. It is also a common problem in the whole industry. In China, logistics has not been taken seriously.

In Suofei, the sales really do well, but in the internal logistics system, waste, delay, repeat can be seen anywhere. So, it is rather important to help Suofei to optimize the internal logistics management.

1.3 Motive of the research

For company Suofei, there are several motives:

1. Now a days, E-commerce is increasing fast in China, it is also a good chance for Suofei.
2. The whole Socks industry in Jiangsu is downturn these years, quite a lot factories had closed down. That's because the average salary in Jiangsu is higher than before, for a typical labor-intensive enterprise such as Suofei, the labor cost has increased 60%. If Suofei wants to survive, the best way is to do change, to adapt to the new market.
3. In previous years, Suofei just produce what the foreign companies asked for, Suofei is strongly depend on customers. Once the customers reduce the order, Suofei can do nothing. But now, Suofei can design new products and sale via E-commerce. The company no longer relies on several fixed customers. That's also why Chinese government encourages hand-intensive industries to do independent innovation. What Suofei did is also a good exemplary within Socks Industry in Wuxi.

1.4 Objectives

Company Suofei asks me to optimize the internal logistics system to meet the demand of E-commerce. So in this report, I will mainly describe what problems I have found among internal logistics for E-commerce and how could we solve them. According to the research I will give suitable advices to Suofei.

1.5 Definition of the problem

The sales of E-commerce in Suofei is increasing fast, at the end of 2012, it can be excepted to have a turnover of ￥760,000 with profit of ￥15,000 per month. In the end of 2013, the profit per month can reach ￥35,000. However, a suitable logistics system is indispensable for good E-commerce. If the logistics system cannot satisfy the rapid development of E-commerce, it will cause a lot of waste, mistake and costs.

In company Suofei, the logistics system is quite out of date; a lot of works are done by human. For example, although there is ERP system, but the information entry are by manual, so mistakes are always there. The layout of warehouse is disordered, I always see employees looking for something among a bunch of things. While logistics for E-commerce in Suofei is a new try, it is sure to have all kinds of problems at the very beginning of E-commerce. The best way to solve these problems is to optimize the internal logistics. To make everything in order and easy to operate by a logistics way with lowest cost is the main topic.

1.6 Research questions

As the objective is to optimize the internal logistics to meet the demand of E-commerce, so at the most beginning, it is important to know what the demand of E-commerce is. It is not only numbers, but also includes several aspects such as order sizes, quality and etc. After knowing the demand, we can do research on the current situation, and then find out the problems and logistics objectives of Company Suofei. Objectives can give a guide of future optimization. When knows the future demand and company objectives, the next step is to figure out what kind of logistics solutions can help to reach those objectives. Finally, use logistics methods to solve problems.

According to this research set up, I have divided the problems into several sub-questions.

1. **What is the demand of E-commerce?**

   - What are the current order sizes of E-commerce? What is the forecast of order sizes in next 2 years?
   - What is the current delivery time of products for customers?
   - How many products are currently returned? How long is the current return period?

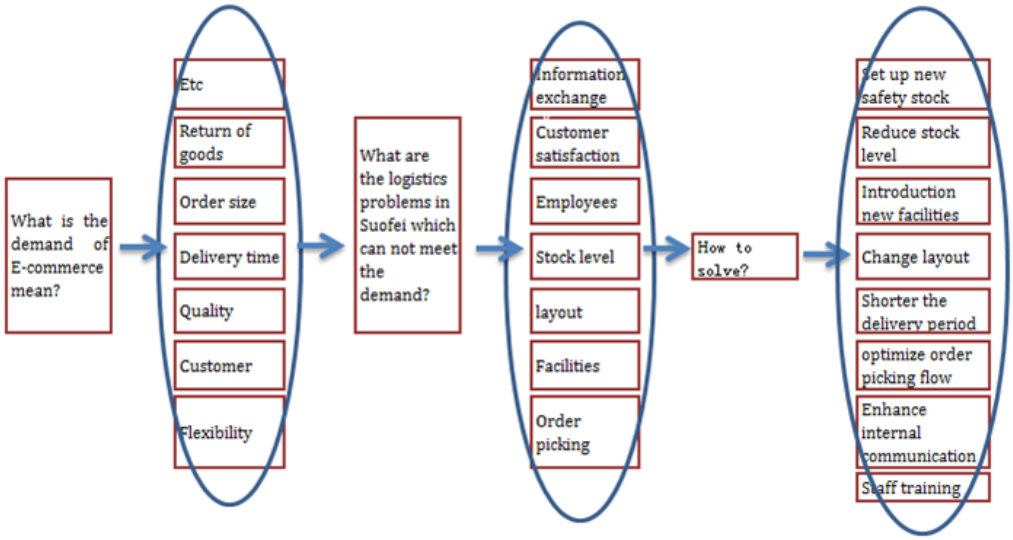
- What is the current quality of products which sell through E-commerce to satisfy customers?
- What is the current flexibility? Are there any possibilities to do change when meet unexpected situations?

2. **What is the current situation of internal logistics of E-commerce in Suofei?**
   - What is the current order picking process?
   - What is the internal transportation process?
   - What is the layout of warehouse and finishing workshop for E-commerce products?
   - What kind of logistics facilities are being used in Suofei now?
   - What are the structure, control system, information system, and personnel organization?
3. **What are the problems in the current situation of internal logistics of E-Commerce in Suofei?**
   - Order picking process [Are there any processes in internal logistics wasting cost or time, and if yes, how much wastes can be reduced?][2]
   - International transportation process [Are there any processes in internal transportation process wasting cost or time, and if yes, how much wastes can be reduced?]
   - Lay-out of warehouse and finishing workshop for E-commerce products [Are there any unreasonable areas within the layout, and if yes, where is the problem]
   - Logistics facilities [Are there any problems with logistics facilities, and if yes, how serious it is?]
   - Structure, control system, information system, and personnel organization [Is information exchanging smoothly and efficiency in organization? Do the employees have enough skill to handle their work and facilities? How to control quality in total?]
4. **What solutions are possible to reach these objectives and how should these solutions be implemented?"**

[2] http://www.mbaknol.com/logistics-management/business-objectives-of-logistics-systems/

- Safety stock and stock levels for finished products of E-commerce
- Facilities in aspects of stocking, order picking, transportation and management
- Layout of the whole organization and also inside several workshops and warehouses.
- Order picking process by using new software so that can advance the delivery time.
- Internal communication to improve work efficiency and the ability of control.
- Staff

1.7 Conceptual model



Graph 1.2 Conceptual model

Chapter2. Research method

2.1 Research participants

Tutor of final thesis: Mr. Dennis Vegter

Company supervisor/ logistics manager: Mr. Zhiwei Xia

Trainee: Miss. Fei Xia

Other colleagues in E-commerce department: Mr. Jianxiong Wu, Miss. Yueqin Mao. Thanks for those 2 colleagues; they have given me a lot of help during daily work.

Other helper: E-commerce manager: Mr. Zhensheng Yang.

2.2 Research design:

The whole of the researches can be divided into 2 methods: desk research and field research.

Desk Research:

Research questions	How to find information	Instruments
1. What are the order sizes of all kinds of products from February 2012 to June 2012?	Monthly sales report, statistics tool on web shop.	Report, computer
2. Forecast the order sizes of next 2 years	According to the data from Feb. 2012 to June 2012, and seasonal rhythm.	Report, computer
3. What is the characteristic of the order of E-commerce in Suofei	According to the delivery receipts from 3PL and the order time can know the period	Delivery receipts
4. What is the delivery time of products	According to the sales number on E-shop, and ask the colleagues	Computer
5. How many products are currently returned? How long is the current return period?	Read the sales report.	Computer, Report
6. What is the safety stock of every product?	Read the report to find the data	Report

Table 2.1: Desk research

Field research

Research questions	How to find information	Instruments
1. What is the current quality of products which sell through E-commerce to satisfy customers?	Discuss with colleagues, read the report, experience daily work	Interview
2. What is the current flexibility? Are there any possibilities to do change when meet unexpected situations?	Discuss with colleagues, experience daily work.	Interview
3. What is the lay-out of the whole organization?	Watch the floor plan, and go to every department to see if there is any different.	camera, band tape
4. What is the layout of warehouse and finishing workshop for E-commerce product?	Watch the floor plan, and go to the warehouse and workshop to see real situation	camera, band tape
5. What is the internal transportation process?	Follow the goods flow to see how they are moved. Interview employees.	Interview
6. What is the current order picking process?	Go to see the transportation flow and calculate time costs of all steps.	Calculator
7. What kind of logistics facilities are being used now	Go to the work shop and warehouse to see. Ask logistics manager.	Interview
8. What are the structure, control system, information system, and personnel organization?	Discuss with colleagues and read the company rule	Interview
9. What are the logistics objectives and the logistics performance	Go to the work shop and warehouse to see. Ask logistics manager.	Interview
10. Do the employees have enough skill to handle their work and facilities?	Ask every manager of different departments, and observe the employees	Interview

Chapter3. The demand of E-commerce

It is important to know what the demand of E-commerce is. Such as the order sizes, delivery time, quality and etc. After analyzing the demand, we can have clearly ideas about the current situation of the E-commerce.

3.1 Current orders sizes and forecast of E-Commerce

The order sizes of all kinds[3] of products from February 2012 to June 2012:

Product name	Number of types	February(in pair)	March(in pair)	April(in pair)	May(in pair)	June(in pair)	Total
Children's socks(0-2)	27	2156	2578	2956	3645	3740	15075
Children's socks(3-5)	25	2689	2871	3078	3144	3526	15308
Children's socks(6-8)	28	1896	2013	2148	2579	3078	11714
Children's socks(9-12)	28	1507	2079	2845	2978	2784	12193
Women's short sock	37	3580	3845	4507	4813	5019	21764
Women's stocking	28	2909	3548	4807	4756	4004	20024
Women's tights	17	2850	3956	4845	4224	3904	19779
Men's short sock	34	2144	2846	2947	3570	4407	15914
Men's stocking	8	1289	1309	1745	1578	1624	7545
Silk short sock	4	579	1507	3501	4897	5877	16361
Silk stocking	4	603	1453	3860	4897	6480	17293
Total	**240**	**22202**	**28005**	**37239**	**41081**	**44443**	**172970**

Table 3.1: Order sizes from February 2012 to June 2012.

Forecast of order sizes within 2 years[4], this calculation is based on the sales data from 2012/02 to 2012/06 from Company Suofei, the detailed process of forecast is in Appendix 1:

[3] There are in total 240 types of socks now sales on the web-shop, it is impossible and no sense to list separately here, so I list the main types by age group and size.

[4] The detailed calculation of forecasting for monthly is in appendix 1; here list the general data of every half year. The forecast is done by forecasting tool in EXCEL.

Product name	2012/07-2012/12 (in pair)	2013/01-2013/06 (in pair)	2013/07-2013/12(in pair)	2014/01-2014/06(in pair)
Children's socks(0-2)	27028	39479	51961	64445
Children's socks(3-5)	21260	27592	33901	40209
Children's socks(6-8)	21045	31457	41776	52087
Children's socks(9-12)	20373	27974	35799	43641
Women's short sock	32647	43767	54985	66207
Women's stocking	26688	31477	36725	42005
Women's tights	23145	24502	26219	27969
Men's short sock	31528	48680	65678	82668
Men's stocking	9893	12036	14281	16533
Silk short sock	55670	97775	14007	182378
Silk stocking	60464	107151	154034	200922
Total	**329741**	**491890**	**529366**	**819064**

Table 3.2: Forecast of order sizes within 2 years

After analysis this forecast, we can see that the order sizes will increasing fast. In next 2 years the order sizes will increase 4 times. So it is both chance and challenge for Company Suofei.

3.2 Current delivery time

In order to show it clearly, I will use a map to describe.

Graph 3.3: Delivery period of E-commerce

Comments of the map:

The launch point is where Company Suofei located.

Circle with green are the cities where delivery period is within 3 days

Arrows in blue are the cities where products can be arrived within 5 days

Red arrows are cities where products can be arrived within 9 days

Orange arrows are cities where products can be arrived within 15 days.

Suofei cooperates with 2 courier companies, one is for close and small amount delivery, orders in the green circle with small amount is usually delivered by Company A; others are delivered by Company B. So after get the order, the staff in E-commerce department should sort the orders.

3.3 Current return of products

Recently, the return rate is below 3%. Because socks are cheap, generally one order will not above ¥ 50. So even there are problems with products, most of the customers are not going to return the products. However, Suofei still have the rule of return of products:

First of all, socks are underclothes, unless there are obvious problems for example send the wrong products or the damage of package, otherwise we will not accept return of goods; because we cannot sell them again.

Then if there are such problems, products can be returned within 5 days after the products are arrived at customers.

Next, customers should show us what are the problems by pictures on Internet, and then Suofei can send new products. The period is about 3 days, which means within 3 days after getting the return orders; company will send the new products.

3.4 Current quality of products sold through E-Commerce

Quality of socks: The raw material and crafts used is the same as the products sell via Export. The return rate of socks is only 3% as mentioned above. So the quality of socks is good.

Quality of deal with orders: According to the feedback on Internet, 25% of customer think we are fast enough, others think we should improve.

Quality of web-shop: According to the feedback of customers, our web-shop has lots of types in good order; the only problem is difficult to find our shop.

Quality of return of products: our staff is kind enough, and the after sales service can satisfy the customers.

3.5 Current flexibility

Flexibility is important because it reflects the ability of Suofei; whether it can do changes when meet unexpected situations. E-commerce is a new try for Suofei, so there always have unexpected situations, for example:

Situation 1: Customer has made one order, but the stock for one type is not enough. When this situation happens, first of all change the stock information of the products or cancel the products on Web-shop, so that no customers will order again. Then we have several choices:

a) Contact with the customer as soon as possible, to ask whether we can change another type or cancel the order.
b) If the customer insists the original order, we will produce the socks as soon as possible.
c) But in case it is impossible to produce that product at the moment, we can ask other factories for help.
d) The worst choice is to compensate customers

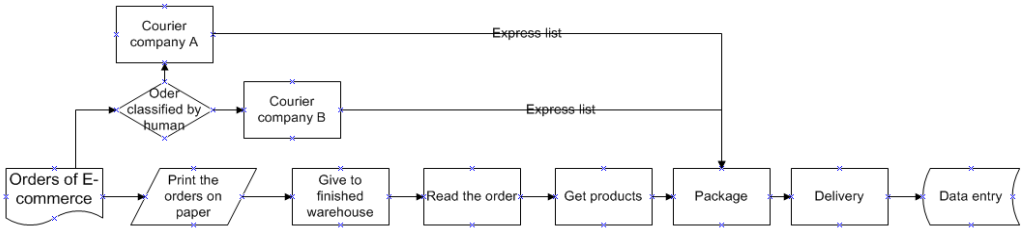
Situation 2: Suppose there are only one pair of sock left, Customer A orders these socks at 8:00am without payment. At 10:00 Customer B also wants to order these socks and he said he will pay immediately. What should we do?

For this situation, in Suofei, there is such a rule: If customer makes one order, there are two days for payment. So in this case, Suofei will keep the products for Customer A for 2 days. And for Customer B, we will ask him to order other types or wait for some days.

Chapter4. Current situation of internal logistics

After knowing the demand of E-commerce, we can do research on the current internal logistics of E-commerce, then we can find the problems.

4.1 Current order picking process

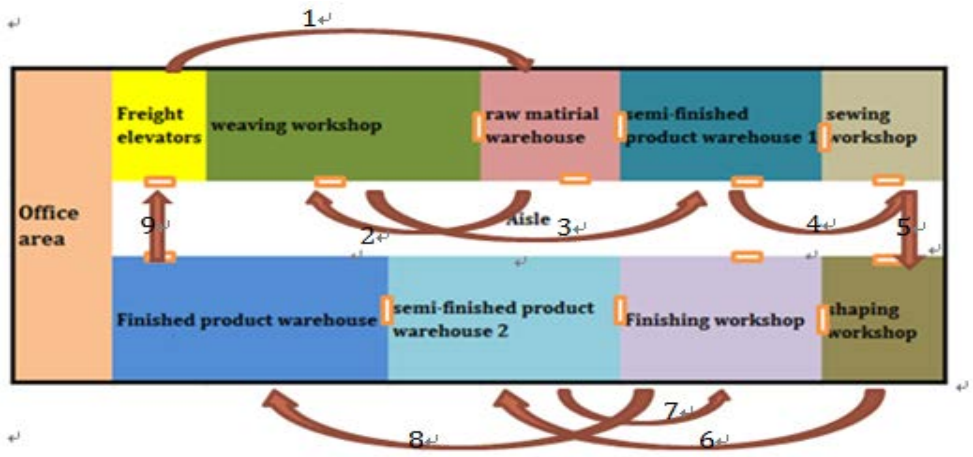


Graph 4.1: current order picking process

Explanation: When Suofei get the orders from E-shop, first of all is to choose Courier Company according to the order. Then the staff will print the information of the order on paper, give to finished warehouse. The staff in warehouse will pick the products and package materials according to the paper. Then package, and put the express list on the surface. Next is delivery by Courier Company. The last step is to enter the data.

When Suofei receive the order, usually it will spend 2 day to send the products out. Most of the time is spend on splitting orders, looking for products, check the requirements, and sometime solve mistakes.

4.2 Current internal transportation process



Graph 4.2: Current general layout and the goods flow in Suofei

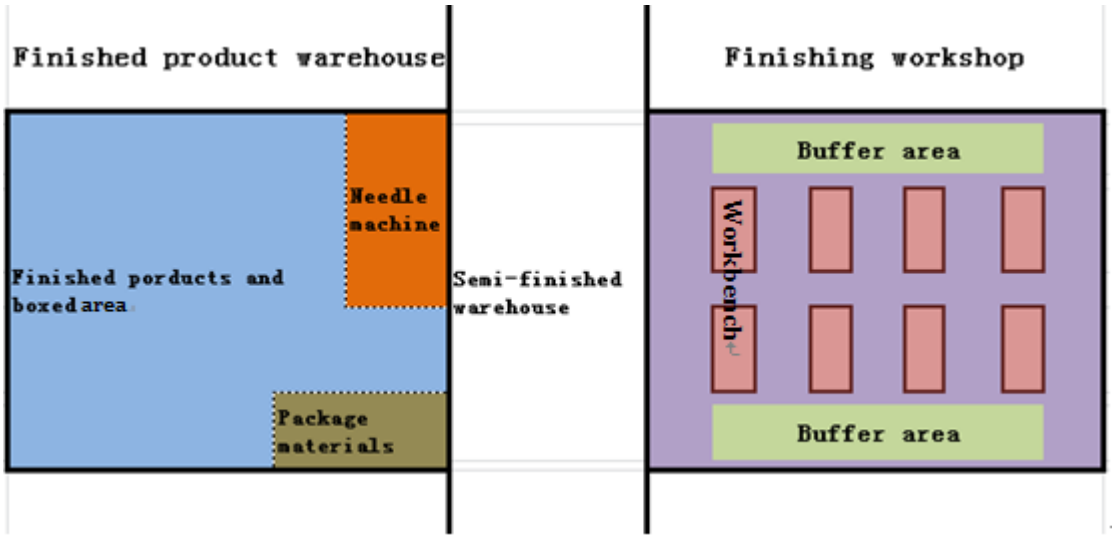
Comments of the graph:

The brown arrow is the goods flow,

The black number means the sequence.

In this graph we can see that in Suofei, E-commerce do not separate from the core business, even E-commerce do not have a specialized warehouse.

4.3 Current layout of warehouse and finishing workshop for E-commerce products



Graph 4.3: Current layout of finished product warehouse and finishing workshop

The layout of finished product warehouse is quite complex; it is difficult to divide the area with specialized functions.

The finishing workshop and finished product warehouse both contain the products sell by E-commerce and Export.

4.4 Current capacity and stock level in warehouse

The situation of the stock in warehouse is quite complex, they do not have an exact way of calculating the stock level. At the beginning of February 2012, Suofei produced about 300 pairs for every type (in total 240 types) of product, and stocked in warehouse by collection boxes. Once the product is less than 50 pairs, produce another 300 pairs, about 1 plastic box, 0.25 m^3.

Raw material warehouse: the size of this warehouse is 16*12m = 192m^2. The main material is cotton yarn, nylon and spandex. They are been put in nylon polybags, one bags is about 25kg. The maxim capacity of the raw material can support the production for 2 weeks.

Semi-finished products warehouse 1: the size of this warehouse is 16*5m = 80m^2. This warehouse is necessary, because waving workshop works 24 hours a day. But sewing

workshop works 8 hours a day. So this warehouse is used to store the semi-finished products produced with the other 16 hours. So the capacity is fixed, about 7000 pairs

Semi-finished products warehouse 2: the size of this warehouse is 16*10m = 160m^2. In this warehouse products are mainly put in the collection boxes as I described before. Shaping workshop can once shape 500 pair socks, the finishing work shop cannot deal with them at once, or the socks do not need to be packaged at the moment, then the socks will be stored here. The last but not least, in some special situation, Suofei will do some orders only with package, that means some semi-finished products which have already been shaped are come from other factories. This kind of socks will also be store in this warehouse. There is no any shelf in this warehouse, collection boxes cannot be superposed, so there are about 180 collection boxes, and maxim capacity is 81,000 pairs. The stock level is not stable, sometime it is empty, and sometime it is quite full.

Finished product warehouse: the size of this warehouse is 16*25m = 400m^2. In this warehouse products are mainly put in the collection boxes. According to the real situation, sometime, the socks also need to be put in the cartons as customers' requirements. So about 250 collection boxes are there, and other is for store cartons. There is also no shelf in this warehouse, collection boxes cannot be superposed, and cartons can be superposed maxim with 4. So the maxim capacity of finished product warehouse is about 200,000 pairs. Usually the storage can reach 85%, especially close to the delivery date of export orders, the storage can reach 110%, and even the cartons are stored on the aisle.

4.5 Current logistics facilities

ERP system: Mainly used to manage the orders from customers, including financial system, warehousing, delivering, raw material management and etc.

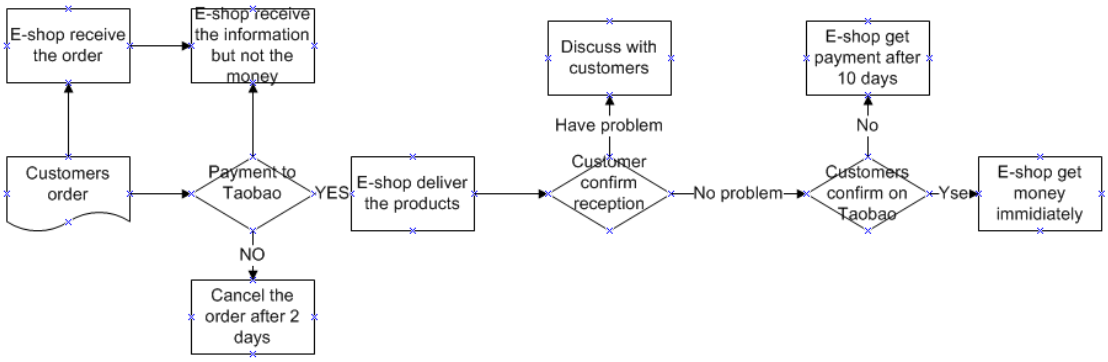
Flat plate carts: size 60*90 cm, used to transport the goods inside the factory.

Plastic box: Size 50*56*80 cm. Socks cannot just put on the pallets, will slip off. So such plastic box are been used in Suofei

Graph 4.4: Flat plate carts and plastic box

4.6 Current structure, control system and information system

Structure:



Graph 4.5: Structure of E-shop

Control system: What products are sold on E-shop? We should remember that the main business for Suofei is Export; when production, it is common to have all kinds of loss. So Suofei need to purchase 2% more material. And also produce more socks in case there is loss. So after finish the order, there always have 20-50 pairs left. At the very beginning Suofei sell those socks on E-shop. Then Suofei will check which socks are popular, and make mass production to sell on E-shop.

Information system: In Taobao, we use the communication software called "Aliwangwang"[5] to communicate with customers, customers can ask any questions through this software, our staff will answer as soon as possible. Besides this communication software, there are also one software used for manage the orders and products called "Assistant of Taobao"[6]

[5] http://wangwang.taobao.com/

[6] http://zhuli.taobao.com/

Chapter5. Problems in the current situation of internal logistics of E-Commerce in Suofei

5.1 Problems with order picking process

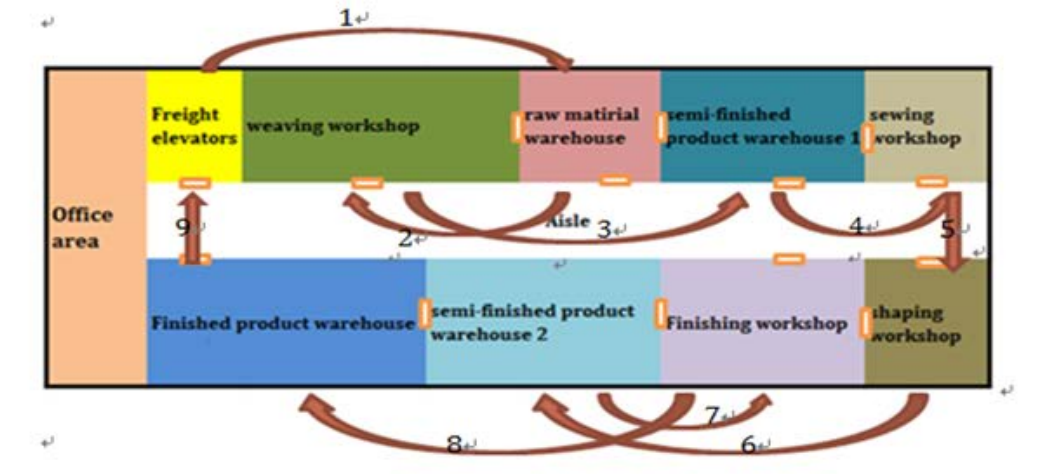
First of all, easy to make mistakes: current order picking process is done all by human, as E-commerce usually contains huge information, and the order picking process is complex with several steps, so it is quite often to make mistakes.

Second, low efficiency: as mentioned before, the whole process needs more than half an hour to finish. So Suofei could deal with 200 orders within one day. The bottleneck will appear in February of 2013, because the orders will be more than 200 per day.

Third, waste money: As the whole process are done by human with low efficiency, Suofei needs to hire more staffs to meet the demand.

So in total, we assume that we should make the whole order picking process less than 15 minutes and deal with double orders with the current amount of staffs.

5.2 Problems with Internal transportation process



Picture 5.1: current transportation flow

Take a look at this picture again; we can clearly see the problems:

Step 1 and step 2: There is a go back process for those 2 steps.

Step 6 and step 7: Also a go back process.

In this case the total time wasting for one movement is about 3 minutes, every day there will have about 200 movements. So total wasting for one day is 10 hours. So if we could improve this transportation process, we can reduce one more staff.

5.3 Problems with lay-out of warehouse and finishing workshop for E-commerce products

Problems with warehouse: In Suofei, there is no specialized warehouse for E-commerce, as we can see from the picture in Chapter 4. This way also makes difficulty of order picking and inventory checking. When finding products, it always depends on the memory of staff, so quite easy to make mistakes.

Problems with finishing workshop: The workbench occupied too much space; the buffer area is far away from workbench, the packaging of E-commerce is not separated from Export. This kind of situation will lead to low efficiency, and confuse the two products.

5.4 Problems with current capacity and stock level in warehouse

Capacity: Capacity for raw material warehouse and semi-finished warehouse 1,2 is OK. Capacity for finished product warehouse seems not enough; it depends on what kind of storage tools we use.

Stock level: Stock level is not reasonable, Suofei do not have exactly way of calculating safety stock and reorder point. The production plans for all products are all most the same, just different frequency. But as we know the sales for different products are quite different. The current way of making stock level will make huge stocks in warehouse.

According to the forecast, we can have average daily demand of every product for E-commerce. Until June 2014, the daily demand of products is showed below.

Main type	Children's 0-2	Children's 3-5	Children's 6-8	Children's 9-12	Women's short sock	Women's stocking
Number of types	27	25	28	28	37	28
Number of order (pair)	17	12	14	12	13	11

Main type	Women's tights	Men's short sock	Men's stocking	silk short sock	Silk stocking
Number of types(different colour)	17	34	8	4	4
Number of order(pair)	12	18	15	338	360

Table 6.1: Average daily demand of E-commerce in June 2014

As discussed at the beginning of Chapter 4.4, Suofei produced about 300 pairs for every type (in total 240 types) of product at beginning; once the product is less than 50 pairs, produce another 300 pairs, about 1 plastic box, 0.25 m^3. In this situation, there is no exactly way of calculating safe stock, and stock level. According to these two charts, we can see that the daily demand of first 8 main types are around 15 pairs, only the last two main types are high to around 350 pairs a day. But the production plans for those products are same. So we need to change it.

5.5 Problems with logistics facilities

Flat plate cars: do not have problems.

Plastic box: current size is large for store products for E-commerce. It occupies too much space.

5.6 Problems with structure, control system, information system, and personnel organization

Information exchange: Most of the information exchange is by writing and talking face to face; computer seems not popular in Suofei. It can understand like this, most of the managers are older, they cannot use computer. What's more, there are no courses in Suofei to help them to learn. For example, once there is an order, the general manager will send the order to production head office, and the production head office will print the order 4 times and give to every workshop. If the paper lost, there may have huge mistakes, the managers do not like to check the orders with computers. So the information exchange is not quite good.

Employees: As described above, most of the supervisors are older than 50; they have enough experience in traditional socks industry, but lack the skill of using modern technology. For the operatives, most of them are come from remote areas in China, with low education level, they can handle the duplication of work, if we need to invest new facilities, they need time to adapt.

Control the quality:

Control the quality of products:

- Suofei use the finest raw material to make the socks comfortable to wear.
- In waving shop, every sock will be checked after it is produced. To check the length, color and the hole.
- In sewing shop, every sock will be checked after it is sewed, to check whether it is firm.
- In finishing shop, every step has the chance to find whether there is any problem.
- After package, the socks should go through the needle machine, to check whether there are needles or scissors in the socks.

Control the quality of orders:

- Every department will have the order both on paper and in computer.
- After the package, there will have 2 employees to check the product and the package according to the orders.
- Every day before 16 o'clock the check must be finished, because the courier will arrive at 16 o'clock.

- After sells, the customers can give us feedback on Internet; this kind of feedback can be read by everyone who visits the web shop. So we have to do best and make our customers satisfied in order to attract more customers.

Chapter6. Solutions of reach these objectives and the implementation

After so many researches, we can summarize several points which we should focus on to improve the internal logistics.

6.1 Safety stock and stock levels for finished products of E-commerce

As we already know the safety stock and stock levels for finished products is unreasonable (See Chapter 5.4), so here I set up the new safety and stock levels. Only when we know the new safety stock we can know how to do the other changes, whether the warehouse enough to use? Whether we need to invest shelves or maybe we can even smaller the warehouse?

When taking care of the characteristic of E-commerce, products should be delivered as soon as possible, and in case the waving shop needs to rush job for other orders from export, I suggest making the safety stock as bellow:

To calculate the safety stock, we need to use such formula:

$$SS=Z * SQRT(STD*STD*L + STD2*STD2*D*D)$$ [7]

SS= Safety Stock, Z= service factor, STD = Standard deviation of demand, L= Average Lead time, STD2= Standard deviation of Lead time, D= Average Demand.

Assume the daily demand and lead time follow Normal distribution[8] , STD= 2 (because it is impossible to calculate the exactly daily demand now, I just assume STD= 2, when Suofei use this formula can calculate with the true number), STD2= 1.86, Service level is 98%, so Z= 2.05[9]

- The first 8 main types of products[10]: L= 3*85%+ 5*10%+ 9* 3.5% + 15* 1.5% = 3.59, in order to make the calculation easier, we make the D= 15

[7] http://baike.baidu.com/view/2091687.htm

[8] http://en.wikipedia.org/wiki/Normal_distribution

[9] http://tupian.baike.com/a4_66_26_01300000325866123179261546736_jpg.html?prd=zhengwenye_left_neirong_tupian

[10] The 8 main types include Children's 0-2, Children's 3-5, Children's 6-8, Children's 9-12, Women's short sock, Women's stocking, Women's tights, Men's short sock and Men's stocking.

SS= 2.05*SQRT(2*2*3.59+1.86*1.86*15*15)= 58 pairs

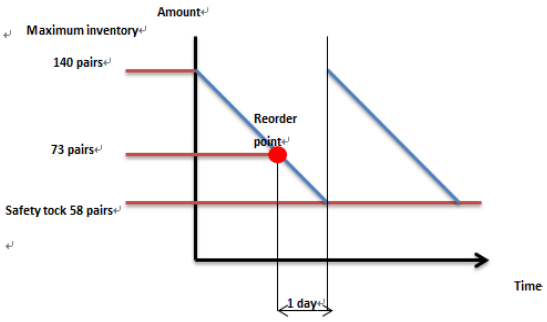
Reorder point= Lead Time Demand + Safety Stock= 15+58= 73 pairs

- The last 2 types[11] silk short socks and silk stockings: L=3.59, D=350

  SS= 2.05*SQRT(2*2*3.59+1.86*1.86*350*350)=1335 pairs

  Reorder point= 350+1335= 1685 pairs

The production machines in Suofei are automatically controlled by computers, when change the products just need to change the information in computer, so product small quantity is possible.



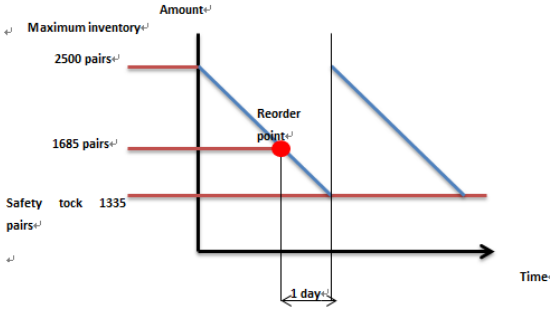


Chart 6.2: Safety stock for 8 main type products except silk socks.

Chart 6.3: Safety stock for silk socks.

What's more, 240 types are too much, such a huge amount of types will lead to complex and mistakes and high stock level as well. And we still need to introduce new stock facilities in Suofei. If we keep 240 types the space for warehouse will not enough, maybe we should enlarge warehouse or introduce shelves. But consider the real cost, the best way is to reduce the types. So I suggest reducing the total types to 200. This number is suitable for the size of warehouse. The way of reduce types is to do research of the sales number; the selling of products with less profit will be stopped.

6.2 Facilities in aspects of stocking, order picking, transportation and management

Smaller size of plastic box: 56*40*50 cm, this is special for stock products for E-commerce. This kind of collection box can contain 150 pairs of short socks. For stockings it can contain 70 pairs. For Children's socks it can contain 200 pairs. According to the stock level of products, we need to purchase about 235 new collection boxes, 225 used to stock, 10 used to transport.

Advantages:

[11] The 2 main types include silk short sock and Silk stocking

- The size is quite suit for the stock level in warehouse. 1-2 new plastic boxes can use to stock one type of product. It is easy and much clearer for sort out.
- Save place in the warehouse. The current collection boxes are too large to stock products with small amount.
- No need to introduce shelves any more. The warehouse can have enough space to stock products

Smaller Flat plate carts then original: 48*73 cm, which is used to assort the new plastic boxes.

Advantages:

- Match the size of new plastic boxes
- In the warehouse can make the aisle a little bit narrow, so that we can save space.
- Much more flexible.

Small finishing box: with the size of 22*20*15cm. It can contain maximum 30 pairs of stockings. It is used for store the products required in orders temporary. So staff can put the products and package material in the same finishing box for one order.

Advantages:

- Prevent the confusion in case there are several orders at the same time.
- 6 such kind of finishing boxes can be put on the flat plate cart at the same time, so 6 orders can be done at the same time.
- Tags of RFID can be put in the box, so the requirements of the order are easy to find.

Software used for classify the orders

This software is used in the E-commerce department. As said before, Suofei cooperate with 2 courier companies, but in E-commerce department the sort of orders is done by human. It takes too much time and has problems quite often. Here order classified software is used to classify the orders according to the customers' address and amount of products, because different orders may need different courier companies. This software can used to automatically match the orders with suitable courier company.

Advantages:

- Increase the communication efficiency with courier companies, so that can sort the orders as soon as possible
- Reduce mistakes taken by manual operation.
- Cheap then EDI, as the best software of communication with co-operators is EDI, but take the price into account, EDI is not suitable in Suofei. So we can first use order

classified software to classify the orders then communicate with courier companies by computer.

RFID system

RFID system will be mainly used in 3 parts:

In E-commerce department, when employees receive the orders, they should edit the tags with the information of amount, type and package.

In finished products warehouse, each collection box should have a tag, which shows the information of the products in the box.

Portable readers can be put on the flat plate carts or carried by the operator.

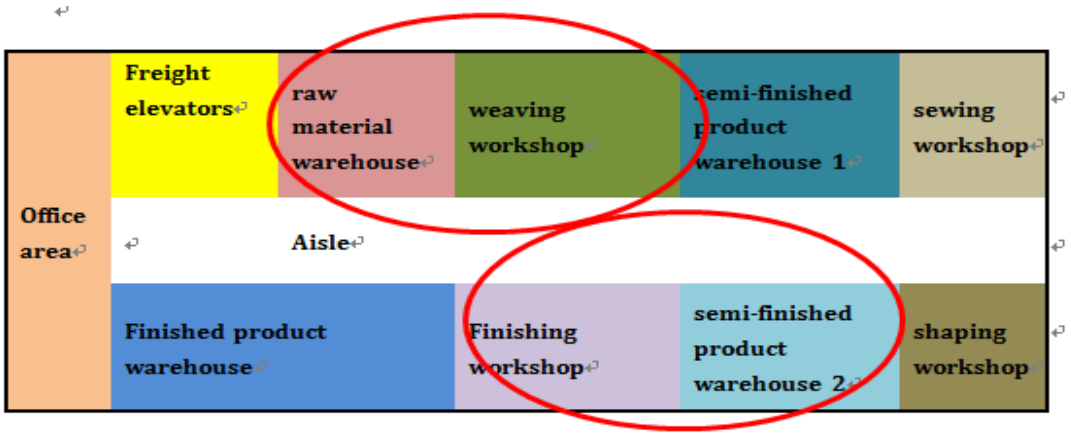
So the working process is like this: E-commerce department edit the tags contain the information of orders, then gives to the finished products warehouse. Staff in warehouse read the tag and put the tag in a bag on the surface of a finishing box, then find suitable products and package materials put in the same finishing box; after find all the things, package the products. At last, the tags need to be recycled and given back to E-commerce department.

Advantages:

- Reduce the time of exchange information
- Reduce labour cost
- Easier and faster to find the products.
- When there are several orders, it is possible to reduce mistakes.
- The tags can be read and write, so it can be used several times

6.3 Layout of the whole organization and several workshops

First of all change the overall layout.

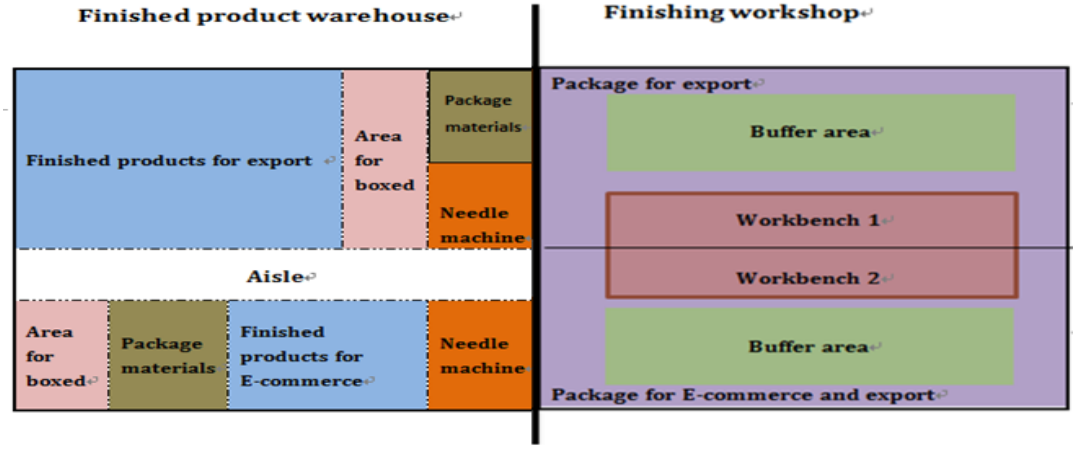


Graph 6.4: new layout of whole organization

Two main changes in this layout: raw material warehouse will move next to the freight elevators, so the materials do not have to move across weaving workshop. Then the semi-finished product warehouse 2 will move next to the shaping workshop. So the product flow will be smoothly.

Generally in the overall layout, the transport process will be like a circle. This way could save a lot of time and human resources.

Then I also suggest changing the internal layout of finishing workshop and finished product warehouse. Doing so has great significance. Suofei do not separate the production of socks sell via E-commerce from other orders. This may lead to complex situations, because every order of E-commerce can be different, but export is large quantity with same requirements. Although the produce process of socks for both sides are all the same, but the packaging is quite different. So here we just change the layout of finishing workshop and the finished product warehouse.



Graph 6.5: New layout of finishing workshop and finished product warehouse

Name of area [12]	Size	Function
1. Package for E-commerce and export	8*20 = 160m^2	The main task is to package orders for E-commerce, if there is no more order, package for export

[12] Here mainly describe the areas which E-commerce will use

2. Workbench 2	1*12 =12m^2	Where socks are packaged. Can contain 4 employees work at the same time.
3. Buffer area	5*20 = 100m^2	Packaging materials, socks which need to be packaged will store here.
4. Needle machine	1*3= 3m^2	Machine for check whether there is needle in socks
5. Finished products for E-commerce	8*17=136m^2	Used to stock the finished product
6. Package materials	8*4=32m^2	Used to stock the materials for packaging.
7. Area for boxed	8*5= 40m^2	Only after checking the needles, socks can be packaged in outer package, maybe cartons maybe plastic bags

Table 6.6: Functions of every area used for E-commerce

The size for stocking finished products for E-commerce needs 8*17=136m^2. Because according to the size of the collection box and flat plate carts, it is possible to put 15 collection boxes per line, and an aisle with 60cm between 2 lines. In total 15 lines, so 15* 15=225 boxes.

For orders from E-commerce, products will be first store in warehouse without outer package then packaged after get the order, so the layout is different with orders of export.

According to real situation, products for export need more area, so here comes up this layout.

The workbench in finishing workshop will be changed. The original layout wastes too much area, and difficult to move plastics boxes. Employees need to go far away to get socks. With this layout employees can get products just turn around. It saves a lot of time and space.

6.4 Order picking process by using new software

As we have introduced several new facilities, so here make a new process for order picking.

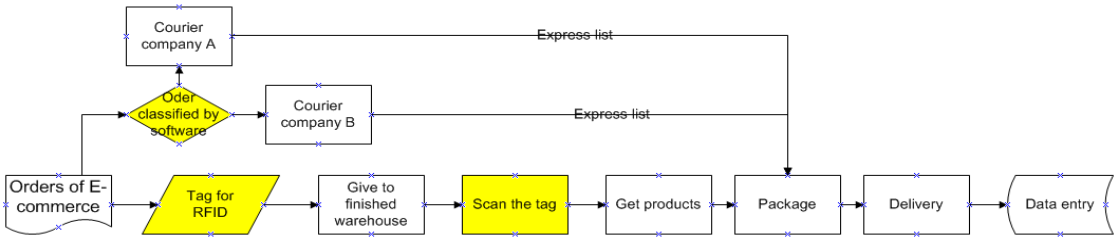


Table 6.7: New order picking flow

The steps in yellow are changed with the old order picking process.

First of all use order classified software to separate the orders automatically, according to the result, send the data to courier companies. Ask the courier companies prepare for delivering those orders.

Then write the information on tags used for RFID. Then give the tags to finished products warehouse.

After get the tags, the staff in warehouse should put the tag separately in small finishing boxes. Then put those finishing boxes on the flat plate carts. As the reader is on the flat plate carts, the staff can read the information and find the products in warehouse.

After get the products, it is time to package them with Express list on the surface.

Then deliver the order, and enter the data into ERP system.

The tags should be returned to E-commerce department every day before 5 pm.

All of those steps can be done within 1-2 hours. So we can advance the delivery time. Orders which received after 14:00 the day before and until 14:00 that day should be delivered on that day. (Courier will pick the packages at 16:00; preparation period is 1-2 hours, so make 14:00 as a standard is reasonable.)

Advantages:

- 6 orders can be done at the same time.
- Reduce time of sorting orders. Usually sorting orders needs spend a lot of time.
- Reduce mistakes. Order classify system will automatically sort the orders, there will be fewer mistakes.
- Reduce time of finding products. With RFID system, employees can easily find certain products in warehouse.
- Higher the customers' satisfaction rate. The total delivery period can reduce at least one day. Customers can receive the products as soon as possible.

6.5 Use internal communication to improve work efficiency and the ability of control.

According to the situation of Suofei, it is easy to see that the communication system is not perfect, in order to keep the management system operation effectively, all employees need to communicate each other with reasonable and effective ways to solve problems. Internal communication cannot be reasons for making mistakes. The internal communication shall be implemented as the following ways.

- Meetings.

Chief meeting every week, the main tasks are discuss the process and troubles in this week, production, sales plan in next week.Daily meeting for production lines, to public the quality requirements and plan for the day.

- Oral and written communication

If the employee find there is quality problems happened in the production line, the employee should notice the production line leader or chief.

If the patrol officers find the employee is doing wrong operation, should notice the leader or chief.

If necessary, the requirements of orders should be print on paper and send to every work shop.

- Communication with computer software

The ERP system has the function of sharing information in the organization. Suofei should make use of this function. It can save time and reduce mistakes coursed by written communication.

Other software like E-mail, QQ also should be used in some specialized situation.

- Telephone calls and fax can be used when emergency.

6.6 Staff

As described before, the staff does not have enough skill to use the high-tech facilities. So Company Suofei should organize several training courses.

- Train the staff in E-commerce department, warehouse department, workshop to use RFID system.
- Train the staff in E-commerce department to use order classified system.
- Train the staff in office and chives in workshop to use ERP system.
- Train the chief to use computer to communicate.

Chapter7. Cost and payback period

7.1 Cost

In order to make the payback period clear to see, here I list the cost from December 2012 until May 2013. December 2012 is the first month of investment, a lot of money will be spent. The costs of next few months are all most the same, contain cost of Maintenance, depreciation, staff training and so on, so here put them in one table.

Investment on 2012 /12			
Items	**Amount**	**Price(￥)**	**Total(￥)**
Order classified software	1	8000	8000
RFID system			
Portable reader	3	3000	9000
Antenna	4	500	2000
Tag (read and write)	450	2	900
Other	1	1000	1000
Collection boxes	235	50	11750
Flat plate carts	2	200	400
Cost of change layout	1	80000	80000
Staff training	1	3000	3000
Total(￥)			**116050**

Table 7.1: Investment in December 2012

Investment on 2013 /01/02/03/04/05			
Items	**Amount**	**Price(￥)**	**Total(￥)**
Depreciation	1	300	300

Maintenance fees	1	500	500
Staff training	1	2000	2000
Other	1	1000	1000
Total(￥)			**3800**

Table 7.2: Investment in year 2013/01/02/03/04

7.2 Net profit

According to the forecast, from December 2012 the net profit from E-commerce is list in the following table.

Main type	Net profit of single product	2012 / 12		2013 / 01		2013 / 02		2013 / 03		2013 / 04	
		Sales	Net profit	Sales	Net profit	Sales	Net profit	Sales	Net profit	Sales	Net profit
Children's socks (0-2)	3.5	5366.9	18784.15	5712	19992	6063.05	21220.675	6404.75	22416.625	6754.1	23639.35
Children's socks (3-5)	4	3986.5	15946	4161.6	16646.4	4334.15	17336.6	4513.5	18054	4686.9	18747.6
Children's socks (6-8)	4	4249.15	16996.6	4526.25	18105	4804.2	19216.8	5112.75	20451	5384.75	21539
Children's socks (9-12)	4.5	3887.05	17491.73	4117.4	18528.3	4357.1	19606.95	4527.95	20375.775	4773.6	21481.2
Women's short sock	5	6205	31025	6511.85	32559.25	6834.85	34174.25	7131.5	35657.5	7451.95	37259.75
Women's stocking	6	4710.7	28264.2	4875.6	29253.6	5068.55	30411.3	5122.95	30737.7	5324.4	31946.4
Women's tights	6.5	3874.3	25182.95	3995	25967.5	4048.55	26315.575	4009.45	26061.425	4110.6	26718.9
Men's short sock	6	6460.85	38765.1	6939.4	41636.4	7393.3	44359.8	7890.55	47343.3	8347.85	50087.1
Men's stocking	6.5	1785.85	11608.03	1847.05	12005.83	1921	12486.5	1965.2	12773.8	2039.15	13254.475
Silk short sock	2	12193.25	24386.5	13347.6	26695.1	14547.8	29095.5	15697.8	31395.6	16887	33773.9
Silk stocking	3	13313.55	39940.65	14590.3	43770.75	15918.8	47756.4	17198.05	51594.15	18513	55539
Total(￥)			268390.9		285160.1		301980.35		316860.88		333986.68

Table 7.3: Net profit from E-commerce

7.3 Payback period

Payback period in capital budgeting refers to the period of time required for the return on an investment to "repay" the sum of the original investment.[13] In order to calculate the payback period, first need to calculate the profit taken by the investment. According to the analysis in the previous paragraph, the E-commerce will have bottleneck in December 2012.

[13] http://en.wikipedia.org/wiki/Payback_period

So the profit from investment is the increments between the following months and December.

Month	Total net profit	Net profit in 2012/12	Net profit from investment
2013 01	285160.1	268390.9	16769.225
2013 02	301980.4	268390.9	33589.45
2013 03	316860.9	268390.9	48469.975
2013 04	333986.7	268390.9	65595.775

Table 7.4: Net profit from investment from 2013/01 to 2013/04

Then, we can figure out the payback period.

Month	Cost	Net profit from optimize	Payback period
2012 12	116050		
2013 01	3800	16769.225	-103080.775
2013 02	3800	33589.45	-73291.325
2013 03	3800	48469.975	-28621.35
2013 04	3800	65595.775	33174.425

Table 7.5: Payback period

So after 5 months, in April 2013, the investment can be paid back.

Chapter8. Risks

Sales risks: As the recommendations are given based on the forecasting of sales within next 2 years. In case the real sales amount cannot reach the amount, the optimizing cannot be fully used. Or the real sales amount increases so fast that far more than the forecast sales, the optimizing may not be suitable enough.

Financial risks: Although the investment in this project is not quite huge to Suofei, but there are also likely to occur lack of funds, or even Suofei may close down in the next few months.

Technical risks: RFID is absolutely new to Suofei, how to install the system in a right way is a risk. On the other hand, the convergence of RFID system and ERP system may difficult. The data scanned by RFID should be store in the database of ERP system. So the convergence of the two systems is quite important.

Personnel risks: In case the employees cannot learn how to use the new facilities, although Suofei will hold the staff training. As said before, a lot of the operation staff are with low education level, maybe it is difficult to train them.

Time risks: In case the instalments take too much time than expected. The dead line is too fixed, before January 2013, the instalments should be finished.

Environmental risks: Earthquake, storm, and coldness may occur; the instalments cannot be handled, or even the production activities will stop.

Policy risks: Government may not support traditional handicrafts operated in cities around Yangtze River Delta, which includes Wuxi.

Other risks: In case Company Suofei gives up to do E-commerce, or fire in the factory and etc.

Chapter9. Conclusions and recommendations

9.1 Conclusions

After doing the research, here we make a conclusion of all the results, and also there are several main problems which will affect the internal logistics of E-commerce.

- Order sizes increasing quite fast. The order sizes in next 2 years will increase about 4 times, that means the customer amount, information, delivery quantity will also increase 4 times. But the lead time cannot be longer or even shorter; so the future optimizing of internal logistics system should be based on the increasing of order sizes.
- Customer satisfaction rate of delivery period is too low. Only 25% of customers are satisfied with the delivery period. So we should shorter the period. We can reduce the lead time and waiting time of the internal logistics system.
- Safety stock is too high, and not reasonable. According to the order sizes from February to June, some socks only sold 4 pairs a day, but some sold 54 pairs. So the safety sock should be set based on the real situation, cannot use the uniform standard. On the other hand, high safety stock will lead the high stock level; money is wasting, while warehouse cannot be used high efficiency.
- Lay-out should be changed, not only the overall layout of whole organization, but also inside department, such as warehouse and finishing workshop. The current layout leads a lot of repeat movement, and too complex. In order to shorter the lead time, reduce waiting time and decrease the mistakes, the best way is to change layout. What's more, in order to better control the E-commerce, it is best to build a separate warehouse for E-commerce.
- The logistics facilities are backward. Moving is relay on human power, it is unsafe, and cannot be JIT. No shelves in warehouse, so the usage in not high. No facilities like RFID are being used in Suofei, but E-commerce in future will have huge information, without RFID it is quite easy to make mistakes. Also enter data into ERP system is by manual control, will make information delay and loss.
- Information exchange system has problems. Change information by paper is backward, because paper is easy to loss and destroys, and sometime even be forgotten.
- Stock level in finished products warehouse is too high. Besides the products for export orders, the products for E-commerce are too much. In total 240 types make the warehouse crowded and complex.
- Employees are not skilled enough. Most of them do not have the experience of using high-tech facilities, or do not have the chance to learn how to use. This is an obstacle for improving the working efficiency.

9.2 Recommendations

In order to optimize the internal logistics to meet the development of E-commerce in Suofei, I will give several suggestions.

Set up new safety stocks:

Children's 0-2, Children's 3-5, Children's 6-8, Children's 9-12, Women's short sock, Women's stocking, Women's tights, Men's short sock and Men's stocking this 8 types have the safety sock of 40 pairs which can satisfy orders for at least 2 days. The maximum inventory is 140 pairs per type. The maximum inventory for all types is 32,480 pairs

Silk short socks and silk stockings have the safety stock of 800 which also can satisfy order for at least 2 days. The maximum inventory is 2000 pairs per type. Maximum inventory for all types is 16,000 pairs.

Introduction new facilities in aspects of stocking, order picking, transportation and management:

Smaller size of plastic box: 56*40*50 cm, this is special for stock products for E-commerce.

Smaller Flat plate carts then original: 48*73 cm, which is used to assort the new plastic boxes.

Small finishing box**:** with the size of 22*20*15cm. It is used for store the products required in orders temporary.

Software used for classify the orders: to simplify the process of sorting orders.

RFID system used to simplify the order picking process.

Change the Layout of the whole organization and also inside several workshops and warehouses:

Change the layout of the whole organization to make the goods flow smoothly like a cycle.

Change the layout inside finishing workshop to increase the utilization. Change the layout inside finished products warehouse in order to provide a warehouse for E-commerce.

Change the order picking process by using new software so that can advance the delivery time.

By using RFID system, and order classified software, the total order picking process can be finished in 2 hours. So we can advance the delivery time.

Use internal communication to improve work efficiency and the ability of control.

All kinds of internal communication should be taken in the company such as meetings; oral and written communication; communication with computer software; telephone calls and fax.

Last but not the least Staff training is important.

In order to make the staff skilled enough to operate the new facilities and also increase the utilization of original facilities like ERP system. Suofei should hold several courses to train the staff.

Thank you for your read. Again, I wish this report can give Company Suofei some useful help and finally the recommendations can be implemented in the company.

Resources

Article: “Assessment Form Graduation Phase” on Blackboard, Stenden College.

Book: “Project management” by Roel Grit.

Book: “Logistics management and strategy” by Alan Harrison, Remko van Hoek.

Book: “E-distribution” by Lawrence Barry, Jennings Daniel.

Book: “Warehouse Management” Chinese edition. By Stuart Emmett

Report: Monthly sales report of Company Suofei.

Website: http://solution.rfidworld.com.cn/2009_4/2009427171218983.html

Website: http://wenku.baidu.com/view/5dd64601bed5b9f3f90f1cc8.html

Website: http://wenku.baidu.com/view/3889ee6f58fafab069dc029d.html

Website: http://wenku.baidu.com/view/45c80f274b35eefdc8d3331e.html

Appendix1. Detailed forecast data for monthly

Month[14]	Children's socks(0-2)	Coefficient[15]	Forecast
2	2156		
3	2578		
4	2956		
5	3645		
6	3740		
7	4285.5	0.85	3642.675
8	4700.6	0.85	3995.51
9	5104.33	0.85	4338.681
10	5458.864	0.85	4640.034
11	5934.8262	0.85	5044.602
12	6313.89896	0.85	5366.814
13	6719.632068	0.85	5711.687
14	7132.001974	0.85	6062.202
15	7534.350038	0.85	6404.198
16	7945.577882	0.85	6753.741
17	8353.475808	0.85	7100.454
18	8761.373734	0.85	7447.168
19	9168.716674	0.85	7793.409
20	9576.967773	0.85	8140.423
21	9984.628569	0.85	8486.934
22	10392.43063	0.85	8833.566
23	10800.23118	0.85	9180.197
24	11208.50238	0.85	9527.227
25	11616.15366	0.85	9873.731
26	12024.52846	0.85	10220.85
27	12432.40471	0.85	10567.54
28	12840.41652	0.85	10914.35
29	13248.42494	0.85	11261.16
30	13656.26138	0.85	11607.82

Month	Children's socks(3-5)	Coefficient	Forecast
2	2689		
3	2871		
4	3078		
5	3144		
6	3526		
7	3645.7	0.85	3098.845
8	3852.16	0.85	3274.336
9	4064.178	0.85	3454.551
10	4296.3624	0.85	3651.908
11	4464.64092	0.85	3794.945
12	4689.233536	0.85	3985.849
13	4895.697969	0.85	4161.343
14	5098.795887	0.85	4333.977
15	5309.74642	0.85	4513.284
16	5513.040631	0.85	4686.085
17	5719.205962	0.85	4861.325
18	5925.371294	0.85	5036.566
19	6132.015146	0.85	5212.213
20	6337.875964	0.85	5387.195
21	6544.245754	0.85	5562.609
22	6750.493739	0.85	5737.92
23	6956.74303	0.85	5913.232
24	7162.729867	0.85	6088.32
25	7369.079195	0.85	6263.717
26	7574.804683	0.85	6438.584
27	7781.057519	0.85	6613.899
28	7987.153324	0.85	6789.08
29	8193.212489	0.85	6964.231
30	8399.464037	0.85	7139.544

[14] In order to use the forecasting formula in Excel, the month should be written in Consecutive numbers. The first 5 number stands for February 2012 to June 2012.

[15] The sales price now is 15% off, so when do forecast, it is necessary to time the coefficient of 0.85.

Month	Children's socks(6-8)	Coefficient	Forecast
2	1896		
3	2013		
4	2148		
5	2579		
6	3078		
7	3221.8	0.85	2738.53
8	3612.24	0.85	3070.404
9	3999.192	0.85	3399.313
10	4310.4336	0.85	3663.869
11	4617.01088	0.85	3924.459
12	4998.719904	0.85	4248.912
13	5324.752883	0.85	4526.04
14	5651.844275	0.85	4804.068
15	6014.0368	0.85	5111.931
16	6335.869728	0.85	5385.489
17	6672.837504	0.85	5671.912
18	7009.805281	0.85	5958.334
19	7349.295533	0.85	6246.901
20	7684.658098	0.85	6531.959
21	8022.70366	0.85	6819.298
22	8360.107137	0.85	7106.091
23	8697.517494	0.85	7392.89
24	9034.688573	0.85	7679.485
25	9372.397427	0.85	7966.538
26	9706.817766	0.85	8250.795
27	10044.79604	0.85	8538.077
28	10381.62616	0.85	8824.382
29	10717.94733	0.85	9110.255
30	11055.63463	0.85	9397.289

Month	Children's socks(9-12)	Coefficient	Forecast
2	1507		
3	2079		
4	2845		
5	2978		
6	2784		
7	3474.5	0.85	2953.325
8	3651.1	0.85	3103.435
9	3779.13	0.85	3212.261
10	4074.154	0.85	3463.031
11	4418.0582	0.85	3755.349
12	4572.43956	0.85	3886.574
13	4843.458548	0.85	4116.94
14	5125.530858	0.85	4356.701
15	5326.73434	0.85	4527.724
16	5615.781799	0.85	4773.415
17	5871.887766	0.85	4991.105
18	6127.993734	0.85	5208.795
19	6378.609452	0.85	5421.818
20	6638.209214	0.85	5642.478
21	6891.969348	0.85	5858.174
22	7147.127	0.85	6075.058
23	7402.269678	0.85	6291.929
24	7658.74589	0.85	6509.934
25	7913.076331	0.85	6726.115
26	8174.564331	0.85	6948.38
27	8428.86104	0.85	7164.532
28	8685.429172	0.85	7382.615
29	8942.880735	0.85	7601.449
30	9197.608888	0.85	7817.968

Month	Women's short sock	Coeffi cient	Forecast
2	3580		
3	3845		
4	4507		
5	4813		
6	5019		
7	5506.6	0.85	4680.61
8	5888.68	0.85	5005.378
9	6183.944	0.85	5256.352
10	6565.7152	0.85	5580.858
11	6964.02016	0.85	5919.417
12	7299.354528	0.85	6204.451
13	7660.770342	0.85	6511.655
14	8040.94845	0.85	6834.806
15	8389.401982	0.85	7130.992
16	8766.820756	0.85	7451.798
17	9133.377564	0.85	7763.371
18	9499.934372	0.85	8074.944
19	9864.680852	0.85	8384.979
20	10232.38969	0.85	8697.531
21	10598.17299	0.85	9008.447
22	10964.41711	0.85	9319.755
23	11330.65628	0.85	9631.058
24	11698.25505	0.85	9943.517
25	12064.04243	0.85	10254.44
26	12432.18991	0.85	10567.36
27	12798.59168	0.85	10878.8
28	13165.48485	0.85	11190.66
29	13532.41544	0.85	11502.55
30	13898.73101	0.85	11813.92

Month	Women's stocking	Coeffi cient	Forecast
2	2909		
3	3548		
4	4807		
5	4756		
6	4004		
7	5024.2	0.85	4270.57
8	5072.66	0.85	4311.761
9	4972.628	0.85	4226.734
10	5216.4724	0.85	4434.002
11	5570.00392	0.85	4734.503
12	5541.818936	0.85	4710.546
13	5735.424789	0.85	4875.111
14	5962.551643	0.85	5068.169
15	6026.794413	0.85	5122.775
16	6263.681814	0.85	5324.13
17	6435.827478	0.85	5470.453
18	6607.973142	0.85	5616.777
19	6769.328516	0.85	5753.929
20	6948.340728	0.85	5906.09
21	7115.875996	0.85	6048.495
22	7286.157883	0.85	6193.234
23	7456.410342	0.85	6337.949
24	7630.001504	0.85	6485.501
25	7798.51406	0.85	6628.737
26	7981.093764	0.85	6783.93
27	8150.028155	0.85	6927.524
28	8323.225703	0.85	7074.742
29	8497.961385	0.85	7223.267
30	8667.565432	0.85	7367.431

Month	Women's tights	Coeffi cient	Forecast
2	2850		
3	3956		
4	4845		
5	4224		
6	3904		
7	4668.6	0.85	3968.31
8	4464.78	0.85	3795.063
9	4326.524	0.85	3677.545
10	4547.3292	0.85	3865.23
11	4665.62136	0.85	3965.778
12	4557.548488	0.85	3873.916
13	4669.75091	0.85	3969.288
14	4762.356724	0.85	4048.003
15	4716.341545	0.85	4008.89
16	4835.587066	0.85	4110.249
17	4892.859824	0.85	4158.931
18	4950.132583	0.85	4207.613
19	4997.076547	0.85	4247.515
20	5060.922174	0.85	4301.784
21	5113.781721	0.85	4346.714
22	5169.270415	0.85	4393.88
23	5224.730939	0.85	4441.021
24	5280.242534	0.85	4488.206
25	5334.666538	0.85	4534.467
26	5402.556045	0.85	4592.173
27	5455.245352	0.85	4636.959
28	5512.896038	0.85	4685.962
29	5572.887048	0.85	4736.954
30	5626.998435	0.85	4782.949

Month	Men's short sock	Coeffi cient	Forecast
2	2144		
3	2846		
4	2947		
5	3570		
6	4407		
7	4757.8	0.85	4044.13
8	5290.64	0.85	4497.044
9	5957.012	0.85	5063.46
10	6493.7896	0.85	5519.721
11	6993.08568	0.85	5944.123
12	7600.581744	0.85	6460.494
13	8163.808955	0.85	6939.238
14	8697.771412	0.85	7393.106
15	9282.292422	0.85	7889.949
16	9820.409997	0.85	8347.348
17	10375.92886	0.85	8819.54
18	10931.44772	0.85	9291.731
19	11489.8668	0.85	9766.387
20	12043.54007	0.85	10237.01
21	12600.29812	0.85	10710.25
22	13156.31793	0.85	11182.87
23	13712.34565	0.85	11655.49
24	14266.24352	0.85	12126.31
25	14822.98539	0.85	12599.54
26	15375.94628	0.85	13069.55
27	15931.73669	0.85	13541.98
28	16486.72633	0.85	14013.72
29	17041.64272	0.85	14485.4
30	17597.55923	0.85	14957.93

Month	Men's stocking	Coeffi cient	Forecast
2	1289		
3	1309		
4	1745		
5	1578		
6	1624		
7	1790.7	0.85	1522.095
8	1862.06	0.85	1582.751
9	1853.998	0.85	1575.898
10	1978.7684	0.85	1681.953
11	2053.75572	0.85	1745.692
12	2100.702376	0.85	1785.597
13	2172.969641	0.85	1847.024
14	2260.002005	0.85	1921.002
15	2312.053233	0.85	1965.245
16	2398.299458	0.85	2038.555
17	2471.722559	0.85	2100.964
18	2545.14566	0.85	2163.374
19	2616.431573	0.85	2223.967
20	2691.214703	0.85	2287.532
21	2763.724642	0.85	2349.166
22	2836.778592	0.85	2411.262
23	2909.826714	0.85	2473.353
24	2984.03055	0.85	2536.426
25	3056.63517	0.85	2598.14
26	3132.026012	0.85	2662.222
27	3205.050396	0.85	2724.293
28	3278.780725	0.85	2786.964
29	3352.679244	0.85	2849.777
30	3425.713466	0.85	2911.856

Month	silk short sock	Coeffi cient	Forecast
2	579		
3	1507		
4	3501		
5	4897		
6	5877		
7	7468	0.85	6347.8
8	8939.4	0.85	7598.49
9	10170.82	0.85	8645.197
10	11553.456	0.85	9820.438
11	13018.4548	0.85	11065.69
12	14344.51584	0.85	12192.84
13	15702.68927	0.85	13347.29
14	17114.4267	0.85	14547.26
15	18467.2303	0.85	15697.15
16	19866.71424	0.85	16886.71
17	21248.69305	0.85	18061.39
18	22630.67187	0.85	19236.07
19	24009.73316	0.85	20408.27
20	25393.56858	0.85	21584.53
21	26774.30081	0.85	22758.16
22	28155.77569	0.85	23932.41
23	29537.24261	0.85	25106.66
24	30922.32001	0.85	26283.97
25	32302.77494	0.85	27457.36
26	33687.0334	0.85	28633.98
27	35069.44365	0.85	29809.03
28	36452.24843	0.85	30984.41
29	37834.72175	0.85	32159.51
30	39216.64057	0.85	33334.14

Month	Silk stocking	Coefficient	Forecast
2	603		
3	1453		
4	3860		
5	4897		
6	6480		
7	8018	0.85	6815.3
8	9666.6	0.85	8216.61
9	11004.58	0.85	9353.893
10	12633.764	0.85	10738.7
11	14148.8212	0.85	12026.5
12	15662.99496	0.85	13313.55
13	17164.46137	0.85	14589.79
14	18727.62241	0.85	15918.48
15	20232.65723	0.85	17197.76
16	21780.3557	0.85	18513.3
17	23312.05529	0.85	19815.25
18	24843.75489	0.85	21117.19
19	26372.78801	0.85	22416.87
20	27906.18445	0.85	23720.26
21	29436.74474	0.85	25021.23
22	30967.98376	0.85	26322.79
23	32499.21551	0.85	27624.33
24	34034.52224	0.85	28929.34
25	35564.67404	0.85	30229.97
26	37098.3021	0.85	31533.56
27	38630.76809	0.85	32836.15
28	40163.37762	0.85	34138.87
29	41695.47026	0.85	35441.15
30	43227.29458	0.85	36743.2

Appendix2. Basic information in workshops in Suofei

Waving workshop	
Maximum output per month (pair)	
Stockings	160,000
Short socks	220,000
How many waving machines are there	40
Dose the machine need rest?	No
How many days do staff rest per month?	Besides 2 days a week, vocation are also rest
How many operators in one shift	4
How many shifts?	3
In total how many operators	12
Other staff there?	3 chives, 3 mechanic
Sewing workshop	
Time need for sewing	
By machine	350 pairs/ hour
By manual	180 pairs/ hour
How many auto machines	2
How many manual machines	3
Dose the machine need rest?	No
How many operators in one shift	8
How many shifts?	1
How many staff in total	10
How many days do staff rest per month?	Besides 2 days a week, vocations are also rest
Shaping workshop	
How many socks can be shaped at once	
Stockings	500
Short socks	500
How many machines are there	1
How long for once shaping	20 min
How long for put socks on board/one staff	
Stockings	100 pairs/ 15 min
Short socks	100 pairs/ 15 min

How long is the cool down time	15 min
How long is the boot time	15 min
How many operators in one shift	3,4
How many shifts?	1
How many staffs in total	5
How many days do staff rest per month?	Besides 2 days a week, vocations are also rest
Finishing workshop	
How many socks can be packaged per day	1800 pairs/ one person
How many staffs in one shift	6,7
How many staffs in total	9
How many shifts?	1
How many days do staff rest per month?	Besides 2 days a week, vocations are also rest