How to achieve cost down and value up in Shanghai Pinzhi Manufacturing Co. Ltd?

---Graduation Thesis

Graduation Thesis
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Executive summary
The main objective of this research is to find out the factors which lead to the high costs in the supply chain and give recommendations on how to control or lower the production costs by optimizing the supply chain in P.Z. Company. The main research question is: How to achieve cost down and value up in Shanghai P.Z. Manufacturing Company? To support the resolving the main research question, the sub questions are defined both in the basis of the literature and the findings. These sub questions can help answer the main research question step by step.

The sub questions are:
- What are the main costs by determining the cost drivers through P.Z.’s supply chain?
- How to create procurement value by cooperating with P.Z.’s supplier to manage the raw material?
- How could P.Z. reduce its non-value added activities and consequently decrease its manufacturing costs for its family product?
- What kind of technology can be applied in P.Z. Company to lower the cost?

The paper described the current situation of P.Z. Company in 3 fields, namely procurement, warehouse and storage, and technology. The first cost contributor is raw material procurement. The unstable of the supplier, slow response, inferior raw material quality add more procurement cost. Besides, production in the warehouse existed wastes and non-value added activities which consequently increased the labor and production cost which ranks the second biggest cost. The last one comes from the traditional way of operation. Paper based system leads to the low efficiency of operation in warehouse. Due to lack of the advance technology system, P.Z. cannot achieve the information sharing, interchange within both internal and external to the company, which added the total lead time and inventory cost.
The main recommendation for P.Z. Company is to make a strategic sourcing plan and develop a supplier relationship management to reduce the procurement cost. From the warehouse perspective, the production line is improved by analyzing the VSM, which eliminates the wastes and unnecessary steps or activities during the production process. Providing the lean manufacturing thinking within the employees in the warehouse can enhance the productivity. New order management system, warehouse management system and electronic database interchange is considered to be installed instead of the paper system work, which achieves better communication between departments in company and the suppliers outside the company.
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Chapter 1 Introduction

1.1 Company background
Shanghai Pinzhi Manufacturing Co. Ltd is a Chinese private owned furniture company founded in 1992. At the beginning, it ran a family business which focused on making the wood furniture in a rental workshop and sold it to domestic retailers and wholesalers. Due to the changing times, the booming Chinese real estate brought a large number of new houses to thousands of households. Thus it greatly increased the demand of furniture consuming. The orders from big supermarkets and retail store sprang up. This reason boosted P.Z. Company a quick development during the latter 5 years. In 1997, P.Z. Company made a big step by establishing its own headquarter and manufacturing base in Nan Xiang District, Shanghai with more than 85,000 square meters including the construction area. They also purchased the advanced equipment from developed countries such as, Germany, Japan, Italy, and America. Now it is a large standardized and comprehensive furniture enterprise that integrates independent design, manufacturing and sales. The working team is around 550 staffs.

It provides an exclusive range of contemporary, modern and classic furniture for B2B and B2C, which including home, school, office, hotel, and shopping mall. It has 3 styles of furniture, high class pastoral style furniture, new classical wood furniture, and local Shanghai style furniture. Much of the furniture is made from solid wood furniture (beds, sofas, tables and chair), panel furniture and metal furniture, which is designed for long wear and usefulness. It also provides the pre-sale service (design and plan) in sale service (packaging, install, distribution) and after sale service (five guarantees) to customers. It sets up booths in the big shopping mall within 20 domestic cities and it also exported to other 20 countries, like Canada, United States, Europe, Korea and its brand is widely recognized by both home and abroad.

1.1.1 Company supply chain parties

Supplier
Local Wood Mill, chemical factory, glass manufactory, packaging materials plant and Hardware Company are direct suppliers to provide raw materials for furniture manufacturing. P.Z. orders certain quantities of wood from Shanghai Shunxin Wood Industry Co., Ltd. once a month and other different components from other suppliers each week. After 1995, property fever that gripped many areas in the past year had hit Shanghai, which caused the demand of the furniture soaring in China. More and more suppliers started their own furniture business. As a result, the original supplier cannot provide enough materials constantly to meet such a massive demand. Besides, the scandal of heavy metal excess of the standards and inferior paint restricts the number of suppliers.

Third party provider
P.Z. Company corporates with Grand Shine Import & Export Logistics Co, Ltd who is responsible for transporting the finished furniture or assembly parts from China to the
foreign manufacturers.

Customer

P.Z. aims to B2C business and B2B business. The customers are local consumers and foreign manufacturers. Its sales networks are scattered in 20 cities in the east of China like Shanghai, Nanjing, Hangzhou, Ningbo, Fuzhou, Jinan, Qingdao etc. and 20 cities overseas, such as Canada, US, EU, and Korea, etc.

Company supply chain

The following chart generally shows P.Z.’s current supply chain process.

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**Figure 1 P.Z. Company Supply Chain**

*Source: Author designed*
1.2 Problem definition
In the past 6 months, the sales volume of P.Z. Company had been decreased gradually for the reason that the competitors provided a cheaper price for the same product mainly because they optimized supply chain, which won a majority of market share. At the same time, investment of factory and equipment greatly fall behind compared with its competitors led to the increasing operational costs in the supply chain. In addition, P.Z is using a traditional way of manufacturing, which increases wastes in the warehouse and production process. Therefore, the profit margins in P.Z. Company became smaller and smaller. P.Z. is now facing pressure both from its competitors and internal of the company. Under this circumstance, the manager realized that if they want to win the market back, they have to cut down the cost by improving the supply chain. So the main research problem of this thesis can be defined as: P.Z. Manufacturing Company has high production cost and combined with relatively high costs in the supply chain.

1.2.1 Fishbone analysis (Ishikawa diagram)
In order to analyze the possible causes and effects of high production costs which may be generated in the supply chain, Ishikawa diagram is an ideal analysis tool can be used in the research. There are 4 areas which influence the production cost, namely, suppliers, manufacturing, warehouse, technology. The 4 elements help to create the research objectives and research questions.

![Figure 2 Ishikawa diagram](Image)

1.3 Main research objective and the research question
1.3.1 Research objective
The main objective of this research is to find out the factors which lead to the high production costs in the supply chain and give recommendations on how to control or lower the total costs by optimizing the supply chain in P.Z. Company. The research will be conducted based on four areas which are supplier, manufacturing, warehouse and technology so the objective can be divided into sub objectives as following:

- To determine the cost driver the main cost generated in the supply chain

- To look at the current situation between suppliers and P.Z. Company, and give advices on how to cooperate with its suppliers to add more value in P.Z. Company.

- Find out the cause of high cost and wastes generated during the manufacturing process in the warehouse, and give some advices on controlling or reducing it.

- Figure out technologies that existed in P.Z. and suggest the new technology tool that may help lower the operational cost.

1.3.2 Research question

In accordance with the Ishikawa diagram and research objective, the main research question of this thesis can be designed as follows:

✧ How to achieve cost down and value up in Shanghai P.Z. Furniture Manufacturing Co, Ltd?

The main question is composed of the following sub questions:

Q1: What are the main costs by determining the cost drivers through P.Z.’s supply chain?

Q2: How to create procurement value and reduce the procurement cost by managing and cooperating with P.Z.’s suppliers?

Q3: How could P.Z. reduce its non-value added activities and consequently decrease its manufacturing costs for its family product?

Q4: What kind of technology can be applied in P.Z. Company to lower the cost?

1.4 Chapter summary

This chapter aimed at giving basic information about the company to readers. This will cover the company introduction, research problem definition, identified research questions. In conclusion, readers can know the general logic underlying the entire thesis and the involvement of the author in this chapter.
Chapter 2 Literature review

2.1 Theoretical framework and conceptual model

This paper tries to demonstrate how P.Z. Company could reduce its production cost by improving its supply chain and simultaneously achieving value up. For this purpose, a conceptual model is proposed to figure out the possible causes of high production cost and draw the relationship between key concepts. The conceptual model links with the problem definition, the research objective, theoretical framework, methodology and data analysis. Based upon a literature search and preliminary research, the model consists of 3 sections: independent variable, mediating variable and dependent variable. It can be seen in the following diagram. The conceptual model is presented as follows to show the relationship between independent, mediating and dependent variables.

![Conceptual Model]

**Figure 3 Conceptual Model**
*Source: Author designed*

i) Independent variable
It is the cause while the dependent variable is the result. According to (Porter 1985) Cost drivers are the structural determinants of the cost of an activity, reflecting any linkages or interrelationships that affect it. Cost drivers in the supply chain are listed by material quality, demand forecasting, material handling, order processing,
warehousing and storage, quality, cost of expediting, shortages, etc. (George 2002). The first step in this research is the determination of the major supply chain cost driver for PZ. In the conceptual model the cost drivers are listed as findings to research question 1, see chapter 4. These cost drivers are assumed to influence the dependent variable high production cost.

ii) Mediating variable
The mediating variable “supply management”, “lean manufacturing”, “information technology” explains the relationship between the independent variable and dependent variable.

Supply management is defined by (David et al. 2005) as a complementary discipline that encompasses the alignment of organizations, processes, and systems for strategic sourcing, contract management, supplier management, spend analysis to continuously improve global supply for best-value performance in support of the strategic objectives of the business. As stated in the problem definition, there is a high production cost in P.Z. Company, therefore, one of the costs of production is the cost of raw materials cost and shortages. Reducing even slightly on each unit can have a substantial impact on the total cost. Good material quality can be both satisfied the requirements of the finished product and also reduce the total procurement cost. In addition, material handling is also related to total lead time from order to the customer. The first mediating variable “supply management” is assumed to influence the result of high production cost.

The theoretical analysis showed that “lean manufacturing" is the second factor of high production cost since it defines how each process generates the costs and some unnecessary cost can be found through the process flow by analyzing the value stream map. Minimizing the process cost will consequently decrease the production cost. “warehouse and storage” are considered as one of cost driver that influenced the result. The observation showed that the some operation arrangements are out of order in the P.Z. warehouse, such as waiting for semi-finished product turnover, moving too frequently due to the backlog of inventory which consumed labor and time, extra processing like checking and testing could be recombined and merged. Obsolescence also means wastes which are the other factor directly cause the high production cost.

The last factor of high production cost contributed to the “information technology”. P.Z. Company is totally traditional manual labor work, there is no information sharing with supplier and company, lack of integration within company departments. Sometimes due to the lack of communication, the information will be inaccurate and directly influence the demand forecast and order processing. Although the manual labor is cheaper than installing the new systems, it causes long lead time and inefficient work. From the long term consideration, it costs more money on the production, so the information technology is the last factor which results in the high production cost.
iii) Dependent variable
There is only one dependent variable, which is the outcome of variables. In this paper, the high production cost is the dependent variable. The variables above are to explain why the production cost generated and the dependent variable is trying to predict the result.

2.2 Cost driver
A factor that can cause a change in the cost of an activity is called cost driver. There are many cost drivers attach to one activity. According to (George 2002), the cost driver origin in 3 main areas, which are listed as follows. Some of them are also the cost drivers which related to the supply, manufacturing and technology in P.Z. Company.

- Demand forecasting
P.Z. Company does the forecast according to the historical data. It also considers the influence brought by the promotion. However, all the forecast is estimated by manual calculation and people’s experience, the accuracy could not be guaranteed. As a result, the error estimated will cause the excessive inventory, reducing the flexibility of cash flow and also increase the operation cost.

- Material handling
Why do the workers spend so much time moving and handling material? Because the correct material is not where they need it, when they need it. It might be easy to blame labor for being unproductive. However, the labor is simply doing the job within their abilities with what they have been given. The way to solve the material handling problems lies with procurement management. The procurement manager reveals that material handling tasks consume approximately 40% of total efforts in the furniture manufacturing industry. That’s also the reason why it causes a lot of cost.

- Warehouse and storage
Warehousing cost is comparatively a big cost in manufacturing company, which included the storage fee, packaging and labor fee. Warehousing cost is mainly regard to the quantity of goods, the size of the warehouse, type of the warehouse and warehouse rate. But the type of the warehouse is always determined by the characteristic of the goods. The rate is made by the negotiation between the suppliers after the contract is signed. The time of storage is decided in the daily operation. Therefore, as for P.Z. Company, reduce the quantity of goods in storage, speed up the goods delivery. Both two ways can obviously shorten the time of storage and the quantity, which have a positive impact on reducing the warehousing cost.

Motivation
Through determining the cost driver through the supply chain, P.Z. can better understand what kind of costs are existed in the company, and by analyzing the relationship between activities and cost drivers, P.Z. can get a clear direction of how to
improve these activities to reduce the total costs.

2.3 Push and pull strategy
There are two production strategies in the supply chain. One is push strategy, another is pull strategy. The traditional manufacturing uses push strategy, the production is decided based on the long time forecast. Manufactures forecast the demand by the orders from retailer’s warehouse. Contrary to the push strategy, pull strategy explains that the production is driven by the actual demand. Thus it is coordinated with the real customer rather than the forecast. Adopting the pull strategy, P.Z. doesn't need to carry inventory cost, all the products are produced according to the orders. It seems that pull system has much attraction to P.Z. Company. However, if the lead time is too long to respond to demand, it will be difficult to implement the pull strategy. As for P.Z. Company, the production strategy may combine both push and pull type. It depends on the inventory forms of materials, work in process and finished items and how to deal with the actual demand.

![Figure 4 Comparison of push strategy and pull strategy](source: Vivek Sehgal, (2009). Enterprise Supply Chain Management: Integrating Best in Class Processes. Wiley)

In order to make a push or pull decision, P.Z. Company need to balance the cost of inventory, fulfillment cycle time, etc. The factors that influence these elements are presented in the diagram above. It helps P.Z. to make wise decisions.

✧ Demand variability
The demand uncertainty in P.Z. Company is comparably high, the quantities of products are hard to forecast due to the competitive furniture market and the supply lag, so obviously the push strategy is not suitable for P.Z. however, the pull strategy is
more flexible on this case.

❖ Product Variability
P.Z. Company put forward different series of wood furniture in each quarter. The types can be made to meet the needs of customer personalization, so the products are customized and high variability. Under this situation, pull strategy may be more effective than the push strategy. It might also be noted that the lead time must be controlled and managed.

❖ Economies of Scale
P.Z. has large economies of scale although it has high customization. Push and pull strategy can all be adopted in different character product.

❖ Manufacturing Setup Changes
The manufacturing setup change in P.Z. is not costly and quickly. It also doesn’t affect the production efficiency. So the pull strategy is needed to be considered.

❖ Lead-time
The lead time combined with replenishment, production and distribution to fulfill demand is slightly higher in P.Z. Company, totally 12days. It helps to accumulate the inventory for the push system thus the end demand can be fulfilled quickly.

Above all, the conclusion is that P.Z. is more suitable to adopt the pull strategy in the earlier stage, which means make to order by actual demand. It can also use the push strategy to distribute the product according to the fixed time schedule in the latter part of the supply chain.

2.4 Procurement strategy
Procurement becomes more strategic in the coming future. It guides a company to build a clear framework and an efficient way to lower the cost of supply chain and at the same time consistent with company’s goal and value. Most of literature discussed in procurement aspects is related to the supplier numbers, pricing strategies, item level strategy, managing the supply base, developing the supplier relationship with a multi-functional department and supporting the operational requirements. Various procurement strategies aid company to reach different goals respectively.

The procurement strategy from (Soellner 1999) pointed out that the purpose of the procurement strategy is to achieve total cost leadership, strategic position the company in the value chain and creating growth chances. 4 approaches can achieve these objectives by (Hess 2004)
(1) Sourcing concepts
It provides combinations of sub-strategies. The sub-strategies can be defined as elements like number of suppliers, supplier areas, etc. Select the most fixable alternatives and combine them in order to make strategic decision.
(2) Portfolio approaches
The portfolio model offers basic analysis for supplier classification and supply risks.

(3) Process approaches
By understanding the supply requirements, the alternatives to the method of standardized strategies should be provided. Such as, process steps, supplier measurement tool and coordination between internal and external in the company.

(4) Task-focused approaches
It focuses on dealing with the specific task related to cross-functional coordination, for example, supplier relationship management.

According to (Bowersox et al 2010), it pointed out that there are 3 types of procurement strategies listing as follows.

(1) Volume consolidation
This strategy means reduce the number of suppliers. The benefits can be ascribed to reduction of costs by handling fewer suppliers, less supply risk, and lower transaction cost. It depends on both suppliers performance and buyers satisfaction. As for P.Z. Company, it means it has to determine the single supplier to be the long term cooperation supplier to offer the high volume of raw materials. It needs to build mutual trust among the two parties.

(2) Supplier Operational Integration
This is another strategy to integrate the process and activities with buyer and supplier so as to improve the operations. It aims at eliminating the possible steps, cutting waste and reducing the operation cost. The information sharing and communication can be achieved within two parties.

(3) Value Management
This strategy has to do with the reduction of total cost ownership, reducing the complexity during the process, and allow the supplier to be involved in the product design stage.

Motivation
From the literature, it can be concluded that the procurement strategy is about picking up the appropriate number of suppliers, setting up the criteria for supplier selection, establishing stable relationship with suppliers, choosing the strategy based on the company goal oriented. At present, the original supplier cannot constantly offer the raw materials to P.Z. Company due to the mass demand and low price. So P.Z. has to look for another stable supplier who can offer reasonable price and long term cooperation. By understanding different procurement strategies, P.Z. can adjust its supply base according to its current situation and adopt the combination strategies to optimize the supply line. It is obvious that P.Z. is facing the supplier shortage, so the first and foremost thing is to find appropriate suppliers by the procurement strategies and then build the strategic cooperation relationship with them. Procurement cost ranks the first among all costs, which mean it is the core strategy contributing to the success in cost reduction.

2.5 Supplier relationship management (SRM)
Supplier relationship management (SRM) is the systematic, enterprise-wide assessment of suppliers’ assets and capabilities with respect to overall business strategy. It determines what activities are engaged in with various suppliers, and planning and execution of all interactions with suppliers, in a coordinated fashion across the relationship life cycle, to maximize the value realized through those interactions. The basic content of SRM included following aspects:

(1) Requirement analysis
The accurate and timely analysis helps the company save the expense and gain the competitive advantage in procurement.

(2) Classification and supplier’s selection
Supplier can be divided into 3 types, transactional, strategic, and large volume types. According to different types of suppliers, company set up the suitable management method to deal with them so that it can achieve the efficient management. The supplier selection is including many elements like, techniques, capacity, competition, response speed, service quality, time control, etc.

(3) Build collaborative relationship
Based on choosing the right supplier, company can develop the cooperation strategies with them, taking a performance measurement for suppliers within regularly time and thus can improve the transparency during the purchasing process, which can also reduce the lead time and enhance the satisfaction on both sides.

Motivation
Now the supplier shortage and slow response is a problem for P.Z. Company, it needs to look for new suppliers. However, most of new suppliers are temporary business which costs more than the original supplier. If P.Z. wants to reduce the procurement cost, it needs to build a collaborative relationship with suppliers rather than short term dealings. Through maintaining an effective long term cooperation relationship with qualified suppliers, both parties gain profitable business. P.Z. Company can additional value in the procurement and supply chain. This paper will set up the SRM strategy for P.Z. Company to improve procurement processes and to a great extent reduced costs and adding value.

2.6 Lean manufacturing
Lean manufacturing is regarded to eliminate wastes in every part of operations. (Garza et al. 2011) defines seven sources of waste in lean system: inventory, excess production, waiting time, excess transport, processing waste, product defects, and inefficient work methods. P.Z. should make an effort on eliminating the seven wastes to reduce operating and production cost and also to increase the product quality level. (Tamara 2009) pointed out that eliminating processing waste is about reducing the physical waste which generated by the manufacturing and discarding it out of the manufacturing process. He mentioned eight ways regarding how to reduce manufacturing process waste, among which, recycling manufacturing materials as much as possible is mentioned. By this way, P.Z. should recycle manufacturing materials as much as possible they can and reuse the waste or find other
manufactures who can turn the waste into valuable goods, therefore to eliminate the wastes and bring economic benefits to the company.

**Motivation**

Lean is the most important part in this thesis, it directly related to the production strategy. Lean concept is a good guide for P.Z. Company to eliminate the unnecessary production and inventory cost. Compared with the price of the raw material to the suppliers, lean thinking provides a better way to find the unnecessary cost from internal company. In addition, from a traditional way, when thinking about company waste reducing, people always mention raw material savings, labor cost reducing. However, Lean concept helps people to focus on a wider aspect including eliminating the process wasting, time, movement, information, employee movement. Lean concept aims at reducing wasting in more aspects in order to help P.Z. Company utilize their resource more efficiently.

2.7 Value stream process mapping

Value streams, which include both value-added and non-value-added activities, are the actions required to create a product or service from raw material until it reaches the customer. (Happe 2012) By analyzing the value stream map of P.Z. Company, it can provide a clear understanding of the process by visualizing the process, through finding out the sources of waste, and thus eliminate non-value-added activities. The outcome is to reduce the production, inventory cost and shorten the lead time by improving the VSM for the purpose of making the whole supply chain more effectively and efficiently.

The steps of implementation:
1. Identify the target product, product family, or service.
2. Draw while on the shop floor a current state value stream map, which shows the current steps, delays, and information flows required to deliver the target product or service.
3. Assess the current map in terms of creating flow by eliminating waste.
4. Draw a future state value stream map.
5. Work toward the future state condition.

**Motivation**

During this research, P.Z. has the potential to improve its supply chain by the aid of using data from the VSM. It uses the VSM from supply chain point of view from the supplier to the end customer. Through the VSM, it understands the optimum stock levels for production, ensure that output meets demand. The processing data are one of the most important keys to affect the VSM. The total time taken including both waiting and processing time needed to be calculated on the part of the map. From measuring the process takes, dealing with the problems it may occur and finally can come up with the best solution.

2.8 Logistics information system
Logistics information system (LIS) can be considered as the core of an information system which converts data into information for the purpose of making decisions, and interfacing the information with decision-assisting methods. The system is consists of 3 elements, the input, the database and its associated manipulations, and the output (Ballou 1999). Data gain from customers, company records and company personnel are which supports planning and operating logistics system belongs to input. The output included the reports of the cost or performance statistics, the reports of the inventory or ordering progress, and also in the form of documents, for example, transportation bills of lading and freight.

LIS provides opportunity for company to share information conveniently and pricing reasonably throughout the supply chain. It improves the communication between the different functional area, such as procurement, production, finance, logistics, vendors and customers. The information can be orders, stocks, shipping days, production scheduling, and sales. The typical LIS subsystem applied in operational link is WMS, which can both achieve sharing the information and decision making.

Motivation
The need for real time information will become crucial in the mass demand furniture market, data exchange and information sharing is the most important function in LIS subsystem. It can help P.Z. to achieve the communication between internal and external. At the same time, putting emphasis on flexible IT-systems may deal with large amounts of data and are easy to be interconnected. This will lead to the system integration software and the process of creating standards in the supply chain. P.Z. Company should think about improving the LIS, and do not ignore its compatibility with other systems. If the LIS runs well in P.Z. Company, it will save a lot of cost during the operation process. P.Z. Company should consider the long term expectation and whole (the whole) supply chain picture for establishing the LIS and sub-systems.

2.9 Information and communications technology
Information and communications technology usually abbreviated as ICT, which is usually a more general term that stresses the role of unified communications and the integration of telecommunications, computers, middleware as well as necessary software, storage- and audio-visual systems, which enable users to create, access, store, transmit, and manipulate information (Susan 2007). The works of Parsons (1983), Porter and Millar (1985) pointed out the importance of the ICT, determines the firms’ competitive advantage. According to (Bowersox and Closs 1996), ICT seem to have the role of lower cost and better services that could be provided. According to (Langley 1986), the ICT are (is) important to logistics, since they make available the right information, at the right time and at the right place.

Motivation
The information technology system in P.Z. Company is inefficient. Most of the work in the manufacturing is done by manual labor, causing the error data and time
consuming. Only by understanding and researching what kind of technology system can be used to help the company update the information system, the company can optimize its supply chain. Before implementing, the previous analysis of the investment in a new system, such as the return on investment will be expected to look at. The research findings will show the results that which kind of IT system is suitable for P.Z. Company.

2.10 Hoshin plan
The word “Hoshin” was originally from Chinese words. The Hoshin planning is just like a compass for giving the direction of business processes. It is the strategic tool to control that your organization to make quick turns, changes, and adjustments before it involved in a crisis. Hoshin Planning means keeping the actions and innovations of people aligned with organization's strategic intent. Hoshin Planning is a management tool used to identify “gaps.” The difference between the current target and future target is gap. Yet some gaps are more strategically important than others. Using Key Performance Indicators (KPI's), is the job of management to focus on their company towards those few vital (vital few) priorities that will keep or bring the company into alignment with the demands of its markets.

Motivation
P.Z. can use Hoshin to diagnose the gap between current and future target. By improving this gap, it can achieve the alignment of operations and its strategic intent. In the discussing chapter, the tool will be used to illustrate the process and the matrix will show the big picture of their alignment.

2.11 Chapter summary
In this chapter, readers can find the definition of core evaluation concepts, the theories used in the research and the answers of literature-based questions. The theories are grouped into four catalogues: cost drivers, procurement, lean manufacture, logistics information system. However, first of all, necessary basic concepts are given to clarify the essences of the research.
Chapter 3 Research methodology

3.1 Research design
Research design is considered as a "blueprint" for research, dealing with the structure of the research process. It has to do with the conceptual design and technical research design. (Sam 1980)

- Conceptual research design
The conceptual design of the research is consists of 3 elements: the research framework shows a top down research process. It begins with determining the research goal, figuring out the problem that wished to be solved, based on the problem definition, the sub objectives are given, and then setting the research questions which are relevant to the sub objectives from 3 aspects of the P.Z. Company: Supplier, manufacturing and technology. In each aspect, the research question will be answered by the collected information and literature reviews. Finally, the conclusions and recommendation will be given based on the results of the research. The design framework can be seen in the Appendix III.

- Technical research design
Technical research design is composed of the research strategy selection, research type, data collection method, and a clear and consistent research plan.
3.2 Research strategy
Research strategy defines a general approach to conduct the research investigation. 5 major research strategies are presented in the research design, they are survey, experiment, case study, desk research and grounded theory approach (Morris and Wood 1991). The strategy discussed what type of research is conducted. In P.Z. Company, qualitative research is chosen to be taken in this research. It will be used to investigate the P.Z. Company by case study. The qualitative research will be an In-depth interview and observation in this case.

3.2.1 Research type
Qualitative approach is regarded as the research type of this thesis. It is considered to be the behaviors and opinions of the subjective evaluation (Creswell 2007). By using the qualitative approach, researchers can gather an in-depth understanding of behavior and the reasons that govern such behavior.

3.2.2 Research method
One of the research method used in this thesis is case study. It emphasizes on detailed contextual analysis of a limited number of events or conditions and their relationships. (Yin 1984) defines that the case study is to study the current phenomenon within real life context. The topic of the thesis is to help P.Z. reduce production cost in the supply chain. Through a detailed observation in manufacturing and conducting interviews with all kinds of documents, it helps to investigate the real-life situations and gain a view of manufacturing operation, it can also be seen as a couple of evidence.

3.3 Data analysis and data collection method
3.3.1 Data analysis
The qualitative method is used to analyze the data in this thesis. It is carried on in 3 different kinds of studies: interviews, case study, and observation studies.

3.3.2 Data collection method
There are 2 types of collection method applied in this research: primary data collection and secondary data. This thesis plans to use temporary analysis to analyze the collected data.

3.3.2.1 Primary data collection
Types of interview
The primary data will be collected by interviews because it can get valuable information of the company. It can access more information from different departments of the company to better know the whole company situation. The primary data can also be collected when communicating with different interviewees. The interview type can be conducted as a structured and semi-structured interview. Some questions are predetermined and standardized while others are non-standardized open questions.
Sample size and sampling
To answer the research question through the qualitative research, the judgmental sampling method is used in this research. Judgment sampling is where the researcher using his own experience and knowledge to select the sample to be interviewed without use of any mathematical or statistical tools (Edwards 1990). It is easy to be understood and no need to waste time on statistics analysis.

5 interviews will be organized during the research. Flowing paragraph introduces how the interview will be conducted.

Face to face interviews: The main objective of the interview is to discuss the how the production costs generated and what the main factors are. It is conducted in different departments like procurement, manufacturing and financial department. 3 managers in these departments will be invited to participate in it. The time of each interview will be controlled in 20 minutes. Interviews will be recorded by a recording device and the interview transcript will be typed after all.

In-depth interviews: In order to find out what issues lead to high cost, in depth interviews from different parts of the supply chain, such as staffs who are working for these apartments, company suppliers and customers. They become the potential interviewees as well. Their opinions are collected as the primary data related to the research answers. The detailed interview plan can be seen in the table.

<table>
<thead>
<tr>
<th>Interview type</th>
<th>Interviewee</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face to face interview</td>
<td>Procurement</td>
<td>✓ Procurement process ✓ Supplier selection ✓ Relationship management</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td>✓ Basic operation process ✓ Warehouse management ✓ Existing information system</td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td>✓ Total cost measurement ✓ Production cost drivers</td>
</tr>
<tr>
<td>In-depth interview</td>
<td>Staff</td>
<td>✓ Awareness ✓ Training</td>
</tr>
<tr>
<td></td>
<td>Supplier</td>
<td>✓ Procurement process</td>
</tr>
<tr>
<td></td>
<td>Customer</td>
<td>✓ Customer satisfaction</td>
</tr>
</tbody>
</table>

Figure 6 Interview Plan
Source: Author designed

Observing
Through observing the warehouse environment and staffs behavior can better understand the situation and the operation process. Sometimes, the data or result may not be completely accurate, because everyone has his own opinion. Observation data collection is more reliable and can make up for the insufficient interview data.

To get the reliable data
Gubalincon proposes four criteria in qualitative research to pursue a trustworthy study (Guba 1981). Listed as follows:

a. Credibility-it looks internal validity
b. Transferability-preference to external validity
c. Dependability-it refers to information reliability
d. Confirm ability-it means objectivity

This thesis will consider these criteria on the collected data in order to meet the requirement of the trustworthiness in qualitative research.

3.3.2.2 Secondary data collection

Secondary research means to reprocess and reuse collected information as a reference to the research. The data are collected for another purpose rather than directly collected by this research. It is available from public records, journals, magazines, and newspapers.

3.4 Research plan

3.4.1 Research activities planning

The Gantt chart below shows the research activities planning including research stages and deliverables

<table>
<thead>
<tr>
<th>Activities/Time</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
<th>Week 11</th>
<th>Week 12</th>
<th>Week 13</th>
<th>Week 14</th>
<th>Week 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection from company documents and literature</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Company operation observation</td>
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<tr>
<td>Interview</td>
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<tr>
<td>Writing Interview transcript</td>
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</tr>
<tr>
<td>Analyze the data and answer research question</td>
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<tr>
<td>Conclude the results and put forward recommendation</td>
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</tr>
<tr>
<td>Finish writing the whole thesis and commented by supervisor</td>
<td></td>
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</tr>
<tr>
<td>Final thesis revised</td>
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</tr>
<tr>
<td>Prepare for the thesis defense</td>
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</tr>
</tbody>
</table>

*Figure 7 Research activities planning

*Source: Author designed*

3.4.2 Research risk

During the research, there might be potential obstacles to further explore the results. Such as:

- Lack of support – the organization may not be willing to reveal the company information not to provide the documentation.
- Unforeseen event – the changes of company property or the shift of supervisor could endanger the project time schedule

3.5 Chapter summary

In this chapter, the author presents the content related to the research processes to convince readers the capability of completing this research. First of all, the author shows the research design and research type. Then it respectively introduces the research method, techniques in data collecting and analyzing. The interviews are conducted to provide the necessary data and information.
Chapter 4 Findings

4.1 Finding 1

Q1: What are the main cost drivers in P.Z. Company?

For a manufacturing company, there are obvious attractions for managers to reduce costs. The first critical step is to find out what its true costs are. Costs in P.Z. manufacturing company are presented in the production cost, which included: procurement cost, warehouse and storage cost, labor cost, utility expenses, etc. The pie chart shows the percentage of each part.

According to the interview from the finance manager, the main cost origins from two areas, the procurement and the production. Following listed the cost drivers related to their activities within P.Z. Company. By analyzing their activities, P.Z. can understand the importance of these activities, why they generated high costs and also their interrelationships with production system. The cost drivers are listed as bellows:

(1) Quality inspection

Procurement is a very important step before production. Although the price is a key factor in the procurement, the good quality of the raw material is required. Shanghai Shunxin Wood Industry Co., Ltd is the current supplier of P.Z. Company. It provides cheaper materials with low quality. The wood material has many spots on the surface which because the wood is infected by the bacterium, it has a short life span, and requires more process to improve them. This resulted in high production cost for
finished products. In order to ensure the raw material quality, it needs inspection process, however, it is costly and time consuming. It needs labors, test facilities, and space to achieve. What is worse that the inventory will be piled up because of the inspection waiting time. Due to these problems, P.Z. needs to evaluate the suppliers in advance. If the supplier passed the performance assessment, the inspection step could be eliminated. The supplier evaluation tool and the results are shown in the second finding. It is critical for P.Z. to come up with strategic sourcing plan to balance the prince, cost and quality. It will be talked about in the recommendation part.

(2) Raw material procurement
P.Z. is facing with the problem of delay of raw material from suppliers and the inferior quality of material, the response of supplier is rather slow, the cause of delay exists in the links of production, quality control, packing and transport. This increased the total lead time and inventory, which causes the high cost and unsatisfied customers. The current procurement situation is described in the second findings. In order to improve it, P.Z. should build a good supplier relationship to guarantee a consistent supply environment. By doing this, the quality of material can be monitored at the beginning which could save the time and cost in the latter part of the production process.

(3) Warehouse and storage
The factors may influence the warehouse cost in P.Z. Company is summarized as the capital availability, product characteristics, economic conditions, seasonality of demand, production process in use. P.Z. uses traditional push system. Production plan is based on the capacity of the plan. The furniture is produced in the expectation that it will sell. When it produces faster than it can be sold, the stock will be piled up in the warehouse. If the sales could not be stimulated, the production line will be slowed down. In this situation, the function of warehousing is to store the excess production. Long production runs increase warehouse requirements which consequently add cost. However, with a pull system, it is unnecessary to stock. It monitors the demand based on the information, which offers better service by positioning inventory closer to the customer. It will also be mentioned in the recommendation part.

(4) Material handling
The first step of production is material sorting. It is all done by manual, which is a quite labor intensive part of warehousing. Each item is checked by personnel physically and places them into containers waited to be processed. It is a time-consuming process. Furthermore, errors may be occurred during the production which increases the rework cost and labor cost. So P.Z. needs to look for an automated system which may take the place of traditional manual work and achieve the cost savings and improve the product quality. The detailed system information will be introduced in the fourth finding.

(5) Demand forecasting
The accuracy of demand forecasting also influences the total cost. Inaccurately
demand forecasting may lead to excessive inventory or stock out. If P.Z. overestimates its demand, it will end up with more inventory than it needed which will consequently increase the labor and storage cost. On the one hand, furniture is a fast-moving fashion industry. It may encounter the loss of the unsold inventory. Under this circumstance, P.Z. has to sell its inventory at a discount, which decreases the company’s profit margins and income. On the other hand, if P.Z. chooses to make a last minute rush order, it may cause much higher supplier prices, and also reduce the net income. So an accurate forecasting can ensure enough supply to satisfy the demand. Thus, P.Z. need a tool to better forecast the weekly and monthly demand in advance so as to lower the inventory cost.

(6) Order processing
The order processing time is determined by the customer order cycle. It starts from the customer placements of the order to the receipt of the product. In P.Z. Company, the total cycle time for P.Z. is now 7 days. It is a bit longer since the company hasn’t a system for order entry and processing. It also delays the information of sales forecasting to the production department. It lower the efficiency of order allocation in the warehouse, the manager receive the information quite late so that he hasn’t enough time to plan the production task. It finally lead s to the high inventory cost and labor cost. Advanced order processing system is necessary to monitor and manage the warehouse and transport. It enables to reduce the order cycle by two days or more, which will be recommended in the latter part.

To sum up, the procurement and inventory cost is the two biggest costs existed in P.Z. Company. Cost drivers listed above explained the problem of its supplier and inventory. Analyzing the cost drivers and its related activities helps to determine the main cost and its direction of improvement.

4.2 Finding 2
Q2: How to create procurement value and reduce the procurement cost by managing and cooperating with P.Z.’s suppliers?

Current situation
Economic globalization vigorously promoted the furniture industry especially brings a good opportunity to the state owned company. As a double-edged sword, the economic globalization also formed a challenge to the furniture industry. U.S. loan crisis aroused an unstable financial market, which led to the plunge of the real estate. It is estimated by 2012 that the price of the house dropped to the bottom in the latest 3 years, P.Z. Company has 50% of furniture exported to U.S. which are all influenced deeply by the crisis. In the cost structure, the profit accounts for 30%, warehouse and storage 33%, procurement 49% respectively. Low production cost is the main competitive advantage in the market. With the decrease of export rebate, RMB continued to go up. The price of raw material soared in recent year. So how to control the procurement cost is the core of furniture development, in the cost structure, it can
be seen that if the price of raw material can be reduced by 5%, the profit can increase by 30%. So it has an important meaning to P.Z. Company. However, there are some problems existed in the current procurement. Supply management is only considered as a way to save cost. Company ignores the effects of the whole integration strategy. The issues are listed as follows:

- Low information sharing of procurement
  Due to the company and supplier all keep the information private, which lead to the block of knowing needs from both sides. It has to increase its inventory to avoid the uncertainty of the information block. Thus, the procurement and inventory cost also greatly goes up.

- Low efficiency of procurement quality controlling
  Buyer seldom participated in the quality control activity held by supplier. All the standard tests are done after receiving the raw material. This quality control lacks of cooperation, which made it difficult to control the quality of raw material and lengthen the lead time.

- The relationship between supplier and buyer is not close
  Lot of relationships is temporary. It doesn’t have a contract or cooperation. The quality of material cannot be guaranteed. On the one hand, P.Z. prefers to choose cheaper price among lots of suppliers. On the other hand, the supplier always raises the price suddenly as an excuse of changing market.

- The response of the supplier is slow
  Due to the lack of information feedback, it cannot adjust the procurement plan according to the changeable production requirement. The imbalance of the quantities, breeds, and frequency influenced the quick response or production.

By analyzing the above issues, P.Z. Company discussed some methods and measures to control and lower the costs.

**Desired situation**

P.Z. Company can manage its suppliers by the performance evaluation, and it can be done before building the long time partnership.

**Supplier Selection Criteria**

The diagram shows a structure of selection criteria. It consists of 8 dimensions which will be evaluated through different criteria. Supplier A and B are the main suppliers for P.Z. Company to evaluate.
Figure 10: Supplier selection criteria

Source: Author designed
### Developing a Supplier Evaluation and Selection Survey

The weighted criterion is used for evaluating the supplier A with weightings applied to each criterion to suit their relative importance to the P.Z. Company. It has 5 steps. Firstly, selecting dimensions such as, quality performance systems, management, techniques and process, production & controlling systems, delivery, service, location and cost factors as the categories in the evaluation. Secondly, assigning weights reflect the importance of the category. Thirdly, subcategories are identified to be evaluated, the sum of weights in subcategories should be equal the total weights of the performance category. Fourthly, scoring the categories and subcategories, the score is the higher the better. It ranges within 1-5. The last step is to calculate the category by using the formula. Finally the overall total score presents the evaluation score of supplier A. P.Z. Company can choose an appropriate supplier based on the scores of its supplier.

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Subweight</th>
<th>Score (1-5)</th>
<th>Weighted Score</th>
<th>Subtotal</th>
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</thead>
<tbody>
<tr>
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<td>3</td>
<td>4</td>
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<td>Management commitment</td>
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<td>Safety &amp; training</td>
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<td>Management &amp; employee</td>
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<td>15</td>
<td>3</td>
<td>3</td>
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<td>Quality management (TQM)</td>
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<td>4</td>
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<tr>
<td>employee’s skill</td>
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<td>4</td>
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</tr>
<tr>
<td>willingness of employees to contribute to improved operations</td>
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<td>4</td>
<td>4</td>
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<tr>
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<td>Technology</td>
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<td>Methods</td>
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<td>Production Scheduling &amp; Control Systems</td>
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<td>Service</td>
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<td><strong>Total Score</strong></td>
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</table>

*Figure 11 Supplier evaluation survey

*Source: Author designed*
Supplier Scorecard Used for new supplier B.

<table>
<thead>
<tr>
<th>Performance</th>
<th>Rating</th>
<th>Weight</th>
<th>Final Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology &amp; Process</td>
<td>70</td>
<td>0.20</td>
<td>14.0</td>
</tr>
<tr>
<td>Quality performance system</td>
<td>80</td>
<td>0.12</td>
<td>9.6</td>
</tr>
<tr>
<td>Management</td>
<td>80</td>
<td>0.14</td>
<td>11.2</td>
</tr>
<tr>
<td>Production scheduling &amp; control systems</td>
<td>70</td>
<td>0.15</td>
<td>10.5</td>
</tr>
<tr>
<td>Cost</td>
<td>80</td>
<td>0.14</td>
<td>11.2</td>
</tr>
<tr>
<td>Delivery</td>
<td>80</td>
<td>0.10</td>
<td>8.0</td>
</tr>
<tr>
<td>Service</td>
<td>90</td>
<td>0.05</td>
<td>4.5</td>
</tr>
<tr>
<td>Location</td>
<td>80</td>
<td>0.10</td>
<td>8.0</td>
</tr>
<tr>
<td>Total score</td>
<td></td>
<td></td>
<td>77.0</td>
</tr>
</tbody>
</table>

**Figure 12 The Weighted-Criteria Evaluation System**
*Source: Author designed*

Performance of the suppliers will be measured and published on a monthly basis. Each supplier will be rated on the metrics above. Each metric will be individually scored in a percentage number. As is shown in the box, technology, management, cost account for higher percentages of overall score, it means the supplier B performance is well in these 3 categories, which also means the other categories, like quality, location, and delivery should be enhanced in the future operation.

According to the scorecard, we know that as being our loyal supplier, supplier A does a good job in the past decades, while it still has some insufficient aspects which hampered the development of the strategic sourcing. The main problems faced 2 areas. Firstly, lack of technical constraints to guarantee the raw material quantity. Secondly, the location is further than the new supplier B, which takes longer time to deliver the raw material. So we are now considering to corporate with supplier B as our new partner, at the same time we still keep the supplier A as our fundamental supplier.
4.3 Finding 3

Q3: How could P.Z. reduce its non-value added activities and consequently decrease its manufacturing costs for its family product?

Current situation

P.Z. picked up the cabinet as the key product to be analyzed by value stream map. The current state map is used to analyze each factor of the production process. The purpose is to better utilize the staff, facility, location and sources in order to reduce the cost as well as the improvement of quality and lead time.

Details of the current state map of cabinet production

- Customer place order per week
- Demand for cabinet has been forecast 200 per day
- Available production time is 30 days per month, 8hrs per day
- Suppliers deliver on a weekly basis
- Cabinet is produced in single model/color
- Takt time = Effective Working Time per Shift/Customer Requirement per Shift
  \[\text{Takt time} = \frac{60\times60\times8\times30}{200\times30} = 144\text{secs}\]

\[\text{Total V/A} = 5880\text{secs}\]
\[\text{Total lead time} = 60\text{days}\]

Figure 14 Current state map

Source: Author designed
Analysis of the current state map
According to the observation in P.Z.’s warehouse, it has nearly 1000 square meters. The area for the production machine is 300 square meters. However, the area for material and semi-product occupied 700 square meters. The aisle has 100 square meters. The material and semi-product flow slowly in each process. Some are still waited and abandoned. The problem can be summarized as follows:
- Inventory in WIP is too long 46 days
- Long lead time: 60 days
- The delivery term from supplier is so long that it stayed for 168hrs, which lead to extending the total lead time of the product.
- The allocation of staff is in the production process is not even.
- Insufficient staff utilization
- 70% square meters of the areas in warehouse are storing the material and semi-product
- The material and semi-product need labor and many times of moving equipment.
- Too much labor is used on manual movement.

It can be also seen from VSM that this push production existed lots of waste, the owner just think that as long as the machine is operating, it can make profit, but he doesn’t know the inventory he made equals wastes cost.

Identified the non-value added activities and improve the value added activities will be the second thing to do. According to the VSM, the total value added time is 5880secs, which equals 98mins. It is including:
(1) Wood cutting 6mins (VA)
(2) Polishing 5mins (NVA1)
(3) Assemble 7mins (NVA2)
(4) Painting 30min (VA)
(5) Drying 40mins (NVA3)
(6) Stick label 4min (NVA4)
(7) Packaging 6mins (VA)

According to the current state map, it can be seen that the total value added time is 5880secs. However, 3360secs is spent on non-value added activities, by eliminating the non-value added activities, it can reduce the lead time, work in process, and save more production cost.
Desired situation
The future stated map is drawn to show a desired situation of production process.

During the whole process, the non-value added time is 56mins, which improved 36.7% of the total process. After being discussed by the managers in P.Z. Company, lot of revisions has been made to improve the process. Firstly, polishing and assemble can be merged into wood cutting, it will save 12mins. Wood cutting time will be shortening by advanced machine. Drying process takes such a long time for waiting. It is adjusted that the process of sticking label on the packaging can be done in advance so that it could take advantage of the waiting time. Sticking the label and packaging can be done in one step. The packaging material will be put near the storage place which will save the labor movements. After these adjustments, the total non-value added time is incredibly reduced from 98 mins to 56 mins, which improve the nearly 36% productivity.
### Production process

<table>
<thead>
<tr>
<th>Process</th>
<th>Before improvement (mins)</th>
<th>After improvement (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood cutting</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Polishing</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Assemble</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Painting</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Drying</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>Stick label</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Packaging</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

**Figure 16 Comparison between before and after improvement**

*Source: Author designed*

Improvement of the production line

a. Merge different process, adjusting the human resource

Through the communication between the technique workers, the one who is responsible for packaging can directly stick the labels on the packaged box. At present, the packaging for 3 people is still a heavy load working, however, the worker in label sticking is quite free. So in the new situation, two processes can be merged into one process. Arrange 2 labors working in the packaging process, by doing this, it can relieve the pressure from packaging work, and it can also shorten the total lead time.

b. Implement EDI

Implement EDI, reduce the lead time of product work in process. In future value stream map, an information flow is built between supplier and P.Z.’s customer. P.Z. can know the customer needs immediately by the electronic data transfer, which can achieve the information accuracy. P.Z. firstly check the information about the raw material, and then conduct to assemble the semi-product, which decrease the risk of demand changing.

By improving the future state map, merged label stick and packaging into one process, build the EDI information system. Both of them achieve the changing from the traditional push system to the pull system. It can shorten the wip, enhance the working efficiency, reducing the lead time. The whole added activities are flown by the small bathes, therefore it generated few inventory. Through the building of the supermarket, the production speed can be well controlled and it added large value after the improvement.

### Total cycle time

<table>
<thead>
<tr>
<th></th>
<th>Total cycle time</th>
<th>WIP Time</th>
<th>Total lead time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current state map</td>
<td>5880secs</td>
<td>46days</td>
<td>60days</td>
</tr>
<tr>
<td>Future state map</td>
<td>4740secs</td>
<td>34days</td>
<td>41days</td>
</tr>
</tbody>
</table>

**Figure 17 Comparison between old and new VSM**

*Source: Author designed*
As shown by results, the total lead time is reduced from 60 days to 41 days, WIP also decreased from 46 days to 34 days. The total cost obviously goes down, the cabinet is delivered sooner after the packaging, it reduced the inventory cost, merging the 3 activities into 1 process helps to eliminate the repeated work and unreasonable procedure.

4.4 Finding 4

Q4: What kind of technology can be applied in P.Z. Company to lower cost?

Current situation

Ordering process

The ordering process starts from the customer communication to the customer delivery. The first step is to communicate with customers on the telephone, email, or online chatting. During the communication process, customer makes an inquiry about the furniture, P.Z. noted down the demand of furniture types, quantities, and the delivery address. After the customer demand is confirmed, the stock needed to be checked in the warehouse. Due to there is no warehouse information system in P.Z., the stock situation has to be known until the latest of the day. Normally it takes two days for checking, if the inventory is enough, the salesman will contact with the customer to confirm the orders. They move on to the price negotiation. After both sides agree with the price, it will perform credit check, which will take another 1 day. After that the order will be acceptable. It takes 4 days in total order processing.

![Figure 18 Order processing](image-url)
Paper based work
Work in the P.Z. warehouse is all done by manual operation. It hasn’t installed any information technology system. All the information is recorded by paper documentation. When the finished product is stored in the warehouse, the staff is asked to calculate the number of different types of products every day. The human brain cannot compare with the computer system. It brings lot (a lot) of errors, such as counting the wrong numbers of the product, the manual inaccurate statistics, which cannot match the response from the market. The information updating is quite slow, the sales couldn’t receive the number of finished product and the procurement manager isn’t clear about the raw material they actually needed in one day. This situation caused the information sharing is not frequent. It is hard to make a decision of making or stock and consequently cause the extra operation and inventory cost. Furthermore, information transition speed is pretty slow due to the paper work, P.Z. doesn’t have a central database to store all the products information. Most of the data are historical which doesn’t reflect the real situation. Some important decisions have to be waited until the next day due to the information delay.

Desired situation
Application of Logistics information system
ICT impact on warehouse operation
It is introduced in the literature that ICT is widely used to support the operation process. As for P.Z. the implementation of ICT can solve the problems of slow information transferring, information sharing and integration. The impact can be summarized as 3 aspects: Firstly, it greatly reduces the paper work and manual work. The communication between supplier, manufacturer, and customer is more smoothly than before. The real data can be got from the first time, which improves the accuracy of the demand forecast. Secondly, facility, equipment utilization can be enhanced and save more labors. Thirdly, the order processing cycle time will be shortened, which enhance the customer satisfaction.

Expected application of ICT system
According to the deep interview by managers from warehouse department, some expected ICT system is considered to be applied in P.Z. Company. The table below shows the types of systems with their function, activity and expected results.

<table>
<thead>
<tr>
<th>ICT Function</th>
<th>Activity</th>
<th>Expected result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central data bases</td>
<td>Each department can access to the database system</td>
<td>Data and information sharing</td>
</tr>
<tr>
<td>EDI</td>
<td>Information communication between all departments</td>
<td>Information transfer</td>
</tr>
<tr>
<td>WMS</td>
<td>Material handling and</td>
<td>Automatically warehouse</td>
</tr>
</tbody>
</table>
Central Database
In order to share data and information between departments, P.Z. is planning to install data base and data warehouse. It speeds up the relationship development between the manufacturer and supplier. Moreover, it improves the decision-making process of operators with the usability of consistent information. Central database is the core of the information system. The first thing for P.Z. is to collect the data and input these data into the database. It should include the suppliers and customers, company own information and the inventory situation. By doing this, P.Z. can make a forecast in advance and share with its suppliers to prepare the raw materials in the early begin.

Electronic Data Interchange (EDI)
EDI helps to transfer the information between computers. With EDI, P.Z. can reduce manual data entry, eliminating the need for a paper based system and improved cycle times. It enhances the operational efficiency from order to shipment and each step in the supply chain. The expected results can be summarized as internal and external views:

- Improve the internal flow of operation-with the EDI implemented in P.Z. the manufactures enable to move information during the entire operation with faster speed and more accuracy.
- Enhance the external flow of partnership relationship-the manufacturers can control the step from order to ship cycle more flexible and visible. The effective EDI can help reduce the cycle time and cut costs through making information on inventory, orders available on just in time basis.

Warehouse Management System (WMS)
The function of WMS is to help P.Z. streamline the warehouse operation. It can make material handling and scheduling of the work effectively and efficiently. The expected results can be shown in 4 aspects:

- Inventory-Using mobile wireless terminals and barcode scanner can provide a clear inventory level. It can provide order fill rates, avoid wastes labor by inaccurate records.
- Labor-WMS operates without paper, all the work is done by wireless terminal, which enhance the productivity by 15% to 30%. It also saved the labor cost due to the automatic computer system.
- Space-WMS can make a design for the layout of the warehouse, managing the locations and improve the space utilization.
- Accuracy-WMS provide nearly 100% inventory including the quantity of each item in its location, which greatly saves operational costs.
Installing the WMS, and meet the needs of requirements of any warehouse operation in user friendly, flexible and cost effective way.

To sum up, if P.Z. wants to lower the current operation cost, it has to do with the information system. Firstly, it needs to establish the central database and make all the departments engaged in it. Next thing is to install the EDI to achieve the information exchange between supplier, manufacturer and customers. WMS needs to be installed at the same time to streamline the working process, reducing the paper work, errors and shorten the total lead time. The faster the information technology is applied in P.Z. the more efficient will be seen in the future.

4.5 chapter summary
In this chapter, the author will present all related evidence that was achieved from the research activities. These evidences will be elaborated based on the previous literature; and be catalogued into three sub-sections - findings in principles.
Chapter 5 Discussion

5.1 Comparison between push and pull system related to the cost drivers

The table shows the characteristics of the push and pulls systems which are related to the cost drivers. It can be seen that the current push system have some disadvantages. As for procurement, the manufacturer receives the order forecast from retailers, the changing of demand is much bigger than the actual customer demand, which will make it more difficult to plan and manage the raw material purchasing. When it comes across the peak period, it needs to find more suppliers to supplement the resources which will cost higher than the normal period. In terms of the warehouse and storage, due to the emergent production shift, it may lead to the increasing cost of movement. The forecast is always inaccurate as sales can be unpredictable, which cause excessive inventory. This increases costs for storing these goods. In the pull system, the merits are far more exceed than its drawbacks. The production is driven by the customer demand other than the forecast. It doesn’t need too much inventory, only need to respond to the orders. It can shorten the lead time and lower the mobility of the manufacture. It is a customer centric system which constantly changing the design to meet the customers' needs and also the customers are more satisfied.

<table>
<thead>
<tr>
<th>Cost Drivers</th>
<th>Current Push System</th>
<th>Desired Pull System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material supplier</td>
<td>Fluctuation demand</td>
<td>Stable demand</td>
</tr>
<tr>
<td>Warehouse and storage</td>
<td>Excessive inventory</td>
<td>Inventory within control</td>
</tr>
<tr>
<td>Material handling</td>
<td>Movement increasing</td>
<td>Saving resource utilization</td>
</tr>
<tr>
<td>Demand forecasting</td>
<td>Inaccurate forecasting</td>
<td>Responded by order</td>
</tr>
<tr>
<td>Order processing</td>
<td>Long lead time</td>
<td>Short lead time</td>
</tr>
<tr>
<td>Quality</td>
<td>Low customer satisfaction</td>
<td>Customer oriented</td>
</tr>
</tbody>
</table>

![Figure 20 Comparison between push and pull system related to the cost drivers](image)

Source: Author designed

5.2 Comparison between three production systems

<table>
<thead>
<tr>
<th>Production system</th>
<th>Manual</th>
<th>Mass production</th>
<th>Lean manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product feature</td>
<td>Completely meet customer needs</td>
<td>Single standard and Diversified and series</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>Flexible, cheaper</td>
<td>Exclusive, expensive</td>
<td>High efficient, Flexible</td>
</tr>
<tr>
<td>Task</td>
<td>Rough and plentiful</td>
<td>Delicate, simple, repeat</td>
<td>Plentiful and skillful</td>
</tr>
<tr>
<td>Operator</td>
<td>High operation skill</td>
<td>Need not special skill</td>
<td>Multi skills</td>
</tr>
<tr>
<td>Inventory level</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Manufacturing cost</td>
<td>High</td>
<td>Low</td>
<td>Lower</td>
</tr>
<tr>
<td>Product quality</td>
<td>Low</td>
<td>High</td>
<td>Higher</td>
</tr>
<tr>
<td>----------------</td>
<td>-----</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>Market demand</td>
<td>fewest</td>
<td>Demand over supply</td>
<td>Buyer power</td>
</tr>
</tbody>
</table>

*Figure 21 Comparison of 3 ways of production*

*Source: Author designed*

Through the comparison of three ways of production, it can be seen that each production way must experience a process from development to decline. It is obvious to see that lean manufacturing integrate the advantages of manual and mass production ways, at the same time, it overcomes the disadvantages of two production ways, which make it become the most vitality production ways in the current market.

### 5.3 Alignment the SMART operations and objectives to its strategic intent in P.Z. Company

The table below shows the KPI of P.Z. Company, comparing with its current performance and target performance. The statistics could answer the questions that whether the current operations in P.Z. could align its strategic intent or not. Procurement and manufacturing are the two main areas to be studied.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Key performance indicators (KPI)</th>
<th>Current Performance</th>
<th>Target Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost KPI's</td>
<td>Cost of purchasing order</td>
<td>-10%</td>
<td>+15%</td>
</tr>
<tr>
<td></td>
<td>Cost reduction</td>
<td>-15%</td>
<td>+10%</td>
</tr>
<tr>
<td></td>
<td>Procurement ROI</td>
<td>-10%</td>
<td>+20%</td>
</tr>
<tr>
<td>Quality KPI's</td>
<td>Supplier quality rating</td>
<td>-8%</td>
<td>+18%</td>
</tr>
<tr>
<td></td>
<td>Return to Vendor cost</td>
<td>-5%</td>
<td>+10%</td>
</tr>
<tr>
<td></td>
<td>Percentage of suppliers certified</td>
<td>-5%</td>
<td>+15%</td>
</tr>
<tr>
<td>Delivery KPI's</td>
<td>Availability</td>
<td>-15%</td>
<td>+15%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost KPI's</td>
<td>Material cost product</td>
<td>-18%</td>
<td>+12%</td>
</tr>
<tr>
<td></td>
<td>Labor costs per unit manufactured</td>
<td>-10%</td>
<td>+10%</td>
</tr>
<tr>
<td></td>
<td>Production cost per unit</td>
<td>-12%</td>
<td>+15%</td>
</tr>
<tr>
<td>Material management</td>
<td>Demand material caused by error of workers</td>
<td>-17%</td>
<td>+23%</td>
</tr>
<tr>
<td></td>
<td>Material defect</td>
<td>-12%</td>
<td>+18%</td>
</tr>
</tbody>
</table>
caused by material

<table>
<thead>
<tr>
<th>Work in process</th>
<th>Number of days</th>
<th>-10%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of work in process</td>
<td>-10%</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

| Cycle time | Production within takt time | -18% | +25% |

| Equipment | OEE(overall equipment effectiveness) | -9% | 10% |

<table>
<thead>
<tr>
<th>Quality</th>
<th>Quality control</th>
<th>-10%</th>
<th>15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rework</td>
<td>-18%</td>
<td>+22%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 22 Current and target KPI performance

Source: Author designed

I. Procurement KPI

a. Cost KPI’s

1. Cost of Purchasing Order at the current situation is 25% lower than the expected situation.
2. Cost Reduction = Actual Purchasing Price – Last Price Paid, resulted in 25% gap between the actual and expected.
3. Procurement ROI = (Cost Reduction + Cost Avoidance)/Cost of Procurement Operation, 30% need to be enhanced.

b. Quality KPI’s

1. Supplier Quality Rating = (Lots Accepted/Lots Inspected) x (Samples Accepted/Samples Inspected) x 100, it is calculated that 10% gap is existed.
2. Return to Vendor Cost, 15% need to be improved
3. Percentage of Suppliers Certified, 20% is expected to be raised.

c. Delivery KPI’s

Availability = No. of times goods were available from supplier/No. of orders placed with the supplier. It has lot of space to be improved, 30% between actual and expected.

II. Manufacturing KPI

a. Cost KPI’s

1. Material cost product, 30% gap lies in real and expected
2. Labor costs per unit manufactured, 20% could be changed in two situations.
3. Production cost per unit, 27% is expected to be raised.

b. Material management

1. Demand material caused by error of workers, 40% gap between real and expected.
2. Material defect caused by material, 30% could be enhanced.

c. Work in process

1. Number of days, 10% could be reduced.
2. Number of units, 10% could be increased.
3. Value of work in process, 20% will be achieved.
d. Cycle time
Production within takt time, total 43% will be improved.

e. Equipment
OEE (overall equipment effectiveness), adding 10% will be reached to the expected.

f. Quality
1. Quality control, 25% gap between actual and expected.
2. Rework, 40% need to be changed during the improvement.

From the above statics, the conclusion is that the current KPI of P.Z. Company is almost negative than expected both in procurement and manufacturing area. P.Z. Company lacks of a comprehensive framework to integrate the whole management system, in order to improve these KPI, P.Z. come up an executive tool to align the operational objectivities to its strategic intent. It will be introduced detailed in the discussion chapter.

5.4 Hoshin plan
As mentioned in the last paragraph, a specific tool will be introduced to link the strategy to execution. It is called Hoshin X-Matrix. It helps P.Z. to determine the direction to be competitive in the next few years. The Hoshin management process included the president's diagnosis, plan adjusting, and implementation.

President's diagnosis
It focuses on identifying the difference between the planned outcomes and what was actually achieved. (Ron Meier, et al. 2010) Firstly, set up some evaluation standards for P.Z. Company. They are listed as follows:
• Procurement
• Manufacturing
• Information technology
• Sales & Marketing
• Transportation & Distribution
• Finance & Accounting
Figure 23 Outcome from President’s Diagnosis
Source: Author designed

As can be seen in the chart, the main large gaps appeared in the areas of procurement, manufacturing, information & technology, market & sales, transportation & distribution, and finance and accounting. These gaps are regarded as the objectives for X-Matrix, which lies at the bottom of the matrix.

<table>
<thead>
<tr>
<th></th>
<th>Establish ABC cost analysis to control the cost</th>
<th>•</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do promotion in regular seasons and holidays</td>
<td>•</td>
</tr>
<tr>
<td>•</td>
<td>Expand retailer stores and set up support offices in different cities</td>
<td>•</td>
</tr>
<tr>
<td>•</td>
<td>Install EDI and ERP to achieve information sharing and integration</td>
<td>•</td>
</tr>
<tr>
<td>•</td>
<td>Develop an material management to control WIP and inventory</td>
<td>•</td>
</tr>
<tr>
<td>•</td>
<td>Develop supplier evaluation for pre-supplier and future supplier</td>
<td>•</td>
</tr>
<tr>
<td>Make decision on the investment of new facility</td>
<td>Install TSM to track the vehicle, and set up the DC close to the store</td>
<td>Expand the export business to European countries</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>• Reduce the existed supplier and add quality supplier</td>
<td>• Eliminate the wastes during the production process</td>
<td>• Upgrade the system and test it</td>
</tr>
<tr>
<td>• Reduce total cost in the supply chain</td>
<td>• Speed up the order processing and reducing the 5% error</td>
<td>• Making advertisement 20 times a day on TV</td>
</tr>
<tr>
<td>• Decrease the procurement cost of 20% of the total cost</td>
<td>• Increase the frequency of furniture turnover</td>
<td>• Reduce the total cost in P.Z. Company by aligning the strategic intend with operational smart objectives</td>
</tr>
</tbody>
</table>

**Figure 24 X metrics of Hoshin planning**

*Source: Author designed*

**Top level improvement**

The metrics give a clear direction for mid-term and long term goals. So this tool helps to define the guidelines under the organization. It combines with the company's vision and mission. It is inserted to the left of the X in the matrix.

**Second level Tactical improvement plans**

This level involves all managers in a coordinated way in company's annual planning cycle. It is the job of functional managers to align the projects and supporting the activities. It is above the X in the matrix.

**Key success indicators and outcomes**

It presents the critical success factor of the company, which located in the right of the X. These figures have correlations with the tactical improvement plans.

5.5 Chapter summary

This chapter discussed further questions from the chapter 4. Firstly, it talks about the advantages and disadvantages of the push and pull system that related to the cost
driver. Secondly, compared with the features of 3 production systems, P.Z. can find out which one is suitable for it and will be adopted in the future. Thirdly, the Hoshin plan used to discuss the gap between current and target performance, finding the problems and make new plans to achieve the alignment of smart operations and objectives to its strategic intent. The detailed information is presented in the metrics.
Chapter 6 Conclusion and recommendation

6.1 Conclusion
Finding 1 explained the cost structure and the cost driver in P.Z. Company. The production cost consists of procurement, manufacturing, labor and utility costs. Among them, the procurement cost ranks the first which accounts for 42% of the total cost. Next come to the manufacturing cost, 33%, and the labor cost, 18% respectively. Cost drivers come from 6 activities: raw material quality, procurement, warehouse and storage, material handling, demand forecasting, and order processing. These activities are major involved in two fields: procurement and inventory. From the supplier's perspective, the main cost generated from the inferior raw material and low response of suppliers. From the manufacturer's point of view, the high cost of inventory and material handling ascribed to the long lead time, wasted in the production process and traditional manual working. The inaccuracy of demand forecast and low efficiency of order processing all influence the inventory cost fluctuation and customer satisfaction.

Finding 2 listed some problems existed in the current procurement. They can be summarized as 4 reasons: low information sharing between company and supplier; low efficiency of raw material quality control; neglect supplier relationship; slow response from suppliers. In order to solve these problems, P.Z. comes up the supplier evaluation survey and supplier scorecard as measurement tools to test the current supplier A and help to choose the suitable future supplier B. The results present that from all elements that be measured, the scores of technical constraints to guarantee the raw materials are lower and the location is far, which increase the transport cost and delivery time. However, supplier B can make up for its demerits. Therefore, P.Z. Company decided to corporate with supplier B as a new supplier, and also keeps the royal supplier A as fundamental supplier.

It is shown in finding 3 that there are lots of non-value added activities during the whole production process. These activities lead to the wastes of materials, labors and extra costs. VSM is helpful to analyze these activities and find out the improvement ways. P.Z. chose cabinet as an example to be analyzed. From the current state map, the problem is ascribed as long lead time; uneven allocation of staff during the production process; insufficient staff utilization; too many labor movements; According to the problem, P.Z. create a future state map with its improvement. Based on identifying the value added activities and non-value added activities, the non-valued added time is reduced. Through merging the process of non-value added activities and adjusting the labor allocation, the productivity is obviously improved. The total lead time is reduced from 60 days to 41 days, work in process also decreased from 46 days to 34 days.

In finding 4, it talked about the information technology applied to current and desired situation. Before the application of the ICT, the ordering process takes a long time to
complete. It doesn’t have a computer order entry system, which leads to a long lead time in the supply chain. Furthermore, work in the P.Z. warehouse is all done by manual operation. It hasn’t installed any information technology system, which caused errors, no information sharing, high inventory and labor cost. After discussion of the 3 impact on application of ICT, P.Z. decided to install central database, electronic data interchange, and warehouse management system. By doing this, P.Z. can achieve the information integration, sharing and communication within the internal and external to the company. In the meanwhile, streamline the whole working process.

6.2 Recommendation
6.2.1 Procurement strategy

**Improve the procurement management**
- Make procurement division, clear procedure, makes clear responsibility, procedure, and standardized and orderly.
- Centralized order volume, give privileges to the royal suppliers
- Enhance the management of raw material sources, develop the new suppliers, and form an evaluation and performance comment system.
- Make reasonable sourcing plan, according to the transport method, unit price and freight, calculate the procurement cost and compare with the raw material cost.
- Conducting finance analysis from the product development period, because 80% of product cost is determined at the beginning development period, which means raw material procurement cost can be greatly reduced by this analysis.
- Build price information management network. Master information about product price changing in the market, and then filter the current product price, offering the criteria for procurement.
- Create reward and punishment system. Reward personnel who purchase the lower price than the standard price. If the purchasing price is higher than the standard price, it needs personnel to explain the situation. The punishment will be given if it the circumstance is unreasonable.

**Develop the supplier relationship management**
- Implement the preference strategy. The key materials of the supplier must be passed the quality check, finance assessment.
- Implement the information sharing strategy. Through sharing the information of procurement, operation, and competition, it can shorten the business process thus improve the procurement quality and efficiency.
- Develop relationship strategy. Establish the common management system in supplier partnership relationship, business coordinator relationship and competitive relationship.
- Implement the monitor strategy. Capture accidents during the procurement such as order forecast, sales forecast, in order to response and adjust quickly.
- Implement the stimulation strategy. Motivate the supplier in regular time with fairness and justice principle.
6.2.2 Provide lean thinking training
Lean thinking should be deeply implemented from the top level managers to the down level workers. It is the premise of the lean manufacturing thinking. The employees must change the way and attitude toward to the work, the management level should give a guidance and supervision to the production.

Implementation should be on time production, which means the market as orientation. Produce the high quality product in the right time and right quantities. Pull production depends on the market.

Motivate employees, enhance the employee initiative. Each one has responsibility. Anyone has the right to stop the production line to solve the problem if he finds the breakdown accident.

Regard the improvement as the basic lean manufacturing. Continue to revise and improve the operation way, quality and production structure. The activities that cannot add values such as excessive inventory, waiting, movement are all considered wastes, it must be eliminated by the employees striving. The goal should be made clear including the final target and specified targets in each stage. Set the standard like efficiency improvement criteria, task criteria, status criteria, and test criteria.

Implement total quality management. The quality checking is conducted in each process, cultivate the quality awareness of each employees mind. If meet the quality problem, according to the circumstance, the production line may stop producing until the problem has been solved. It guarantees the unqualified product and invalid production.

Convergence properly is also important to be improved. Lean manufacturing is a link by link work, the early step is unstable may lead to the latter step delayed, and at the same time causes inevitable wastes. So this need a series of methods which match the P.Z.’s real situation, mastered and implemented by all the staffs on the spot.

6.2.3 Choose the right production system-Combination of push and pull system
In order to improve the competitive advantage, the furniture is met to the needs of not only satisfied the personalized requirements but also the short lead time with low cost. It must design the partial components and functions of the furniture in advance. Making 60%-70% common components, under this premise, the push system can be conducted in terms of the standard component, common component, stocking the lowest quotes, which make production evenly. When P.Z. receive the orders from customers, using pull system to produce the non-standard component, and then combined and package with the standard and common components to reach the purpose of the quickest responding to the market.

6.2.4 New order management system
Installing the new order management system instead of the old one can help company to have a quick response of requesting and decision making. The main merits of this system are to decrease the total lead time and avoid extra costs from the changings. It offers a big picture of the company operation process, including the orders status, order payment etc. It is a user friendly system that will be implemented in the P.Z. Company.

6.3 Implementation plan
6.3.1 Timeline and activities

<table>
<thead>
<tr>
<th>Timing</th>
<th>Short term(&lt;6months)</th>
<th>Long term(&gt;6months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation</td>
<td>Specific</td>
<td>Smart</td>
</tr>
</tbody>
</table>
| **Procurement strategy** | • Negotiations on big supplier contracts for raw materials<br>
|                      | • Cutting all costs by a minimum 4% per year<br>
|                      | • Long-term investment-contract the parts supply and customer support for new series of furniture for 3 years. | • Invention of a state-of-art vendor monitoring/purchasing control system<br>
|                      |                                                                                 | • Use of internet-based platforms for reverse auctions<br>
|                      |                                                                                 | • Information exchange concerning suppliers to improve predictability of demand and reduce bull whip effects |
| **Lean manufacturing** | • Provide lean thinking training<br>
|                      | • Invite expert to give speech and guidance<br>
|                      | • Calculating PCE on the VSM for analysis<br>
|                      | • Shorten lead times<br>                                                                 | • Introduce innovative products to spur growth<br>
|                      |                                                                                 | • Benchmarking return on asset against other companies with a similar model or product type<br>
|                      |                                                                                 | • Reallocating costs to individual product family<br>|
| **Information and technology** | Advanced order processing system | • Invention of a state-of-art vendor monitoring/purchasing control system<br>
|                      |                                                                                 | • Use of internet-based platforms for reverse auctions<br> |
6.4 Cost and benefit analysis

The cost comparison provides the evidence of cost down from all kinds of logistics statistics.

Current Logistics cost rate \(= \frac{\text{logistics cost}}{\text{sales}} \times 100\%\)
\[= \left( \frac{4801,060}{6583,250} \right) \times 100\%\]
\[= 72.9\%\]

Procurement: raw material saving + quality guarantee saving + labor saving
\[= (30\% \times 2016,440) + (50\% \times 864,190) = 1037,027\]

Warehouse and storage: 36\%(production saving) \times 1584,680 = 570,484.8

Technologies: Labor saving + utility expense saving \(= 20\% \times 336,070 = 100,821\)

Investment of installing information technology system: 100,00

Total cost saving: 1037,027 + 570,484.8 + 100,821 - 100,00 = 1698,322.8

Desired Current Logistics cost rate \(= \frac{\text{logistics cost}}{\text{sales}} \times 100\%\)
\[= \left( \frac{4801,060}{6583,250} \right) \times 100\%\]
\[= 47.1\%\]

The result shows the cost saving is possible within 1 year in P.Z. Company. The statistic shows that 1698,322.8 RMB has been saved, which improves by 35.4\%. The logistics cost rate reduced by nearly 50\% percentage by the end of year. By implementing correct and quick turnaround in P.Z. Company, the profit will become healthy in the future days.
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**Appendix**

I. Financial status

P.Z. Income statement from 31/12/2011 to 31/12/2012

<table>
<thead>
<tr>
<th>Profitability (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales/Operating revenue</td>
</tr>
<tr>
<td>Cost of goods sold</td>
</tr>
<tr>
<td>Operating profit</td>
</tr>
<tr>
<td>Tax</td>
</tr>
<tr>
<td>Net profit</td>
</tr>
</tbody>
</table>

**Production cost**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement expense</td>
</tr>
<tr>
<td>Inventory</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Utility expense</td>
</tr>
<tr>
<td>Total production cost</td>
</tr>
</tbody>
</table>

II. Interview

**Interview 1**

Date: May.16

Place: P.Z. procurement department

Respondent: Guo Jin- procurement manager of P.Z. Company

Topic: Procurement cost control in P.Z.

Description: The interview takes place in P.Z. Company between the author and procurement manager. The topic is around the procurement cost. During the interview, the manager gives some information about the background of furniture’s raw material procurement. The manager also analyzed the factors that may influence the procurement cost, which is supplier price, quantity, strategy, supplier relationship, materials market information and logistics information system, etc.
Key points:
1. Talk about the current situation about the furniture industry
2. The main problem existed in the raw material procurement
3. Analysis of cost driver or factors of procurement
4. Selection process and criteria of suppliers
5. The current relationship between suppliers
6. Put forward some suggestions on controlling the procurement cost

Interview 2
Date: May.16
Place: P.Z. Warehouse
Respondent: Den Chao - warehouse manager of P.Z. Company
Topic: Procurement cost control in P.Z.

Description: After visiting and observation the warehouse, the interview is conducted in the warehouse office. The purpose of this interview is to know the daily operation in the P.Z. warehouse, such as the production process, activities, the manual working etc. By knowing the detailed activities in each process, author can better analyze the wastes and non-value added activities in order to improve the production line.

Key points:
1. Knowing the procedure of the furniture production, recording each step and detailed information about the activities.
2. The allocation of the labor in each task
3. Total production time, order processing cycle time and lead time is recorded
4. The function of different kinds of paper work
5. Study the current information system

Interview 3
Date: May.16
Place: P.Z. financial department
Respondent: Xu Min - Finance manager of P.Z. Company
Topic: Determined the cost driver in the supply chain and knowing the percentage of each area.

Description: The interview aimed at figuring out the cost structure in P.Z. Company. Knowing the proportion of each cost helps to find the research direction and form the research question. By analyzing the cost drivers through the supply chain, author can better understand the relationship between cost generation and the relative activities.

Key points:
1. Types of cost involved in the supply chain
2. Listed the cost driver in the production process
3. Classify the activities into the cost driver
4. Find out the relationship between cost driver and its production system
Interview 4
Date: May.23
Place: P.Z. warehouse
Respondent: Wang zhiwei & Zhang Hua – staffs working in P.Z. warehouse and employees in the administration office
Topic: To know the feelings of being staff in P.Z. Company and what kind of problem that is often happened during the work

Description: Two staffs are invited to this interview. One comes from the warehouse; the other comes from the office. Two people are responsible for different jobs. The interview is trying to know the problems or difficult process to finish the task. By asking two people from different departments can get various points of view toward the problems.
Key points:
1. Knowing the major tasks in each field
2. The feelings of working in the warehouse and administration office
3. Discuss the advantage and disadvantage of the daily operation
4. The attitude toward implementing lean manufacturing

Interview 5
Date: May.23
Place: Shunxin Wood Industry Co., Ltd
Respondent: Mu Zi – Sales manager of Shunxin Wood Industry Co., Ltd

Description: The interview took place in the supplier company. The purpose of the interview is to learn about the ordering process of the raw material. The normal procedure that dealt with the procurement manager is presented. Asking about the communication way between the supplier and the manufacturer can help to analyze the information situation in P.Z. Company.
Key points:
1. Kind of raw material they offered to P.Z.
2. The quality or standard control of supplier

Interview 6
Date: May.33
Place: Shunxin Wood Industry Co., Ltd
Respondent: Number of customers who bought furniture in P.Z. Company.

Description: The interview is started among the group of customers who have bought the furniture. The most important goal of the interview is to study the satisfaction of these customers. Knowing the elements that causes them happy or sad.
Key points:
1. What kind of furniture the order the most
2. Special requirements or demands of the furniture
3. Figure out the merits and demerits of the furniture
4. Total time from order to receive
III. Research design framework

**Main objective**
Find out the factors which lead to the high production costs and give recommendations on how to control or lower the total costs by optimizing the supply chain.

**Problem definition**
High production cost is the main problem for P.Z. Company to lose the competitive advantage in the market.

**Objective 1**
To study the current cost drivers during the production process and determined what are the main costs in the P.Z. Company

**Objective 2**
To look at the current situation between suppliers and P.Z. Company, and give advices on how to cooperate with its suppliers to reduce the procurement cost

**Objective 3**
Find out the reason of high cost generated during the manufacturing process, and give some advices on controlling or reducing it.

**Objective 4**
Figure out the technologies that existed in P.Z. and suggest the new technology tool that may helpful lower the operational cost.

**Research question 1**
What are the main cost drivers in P.Z. Company?

**Research question 2**
How to create procurement value and reduce the procurement cost by cooperating with P.Z’s suppliers?

**Research question 3**
How could P.Z. reduce its non-value added activities and consequently decrease its manufacturing costs?

**Research question 4**
What kind of technology can be applied in P.Z. Company to lower cost?

**Research method**
- Secondary research
  - Analyze company information
  - Supply chain situation
  - Understand the raw material supplying process
- Primary research
  - Qualitative
  - Interviews with P.Z. management and employees
  - Observing the company operation

**Conclusion and recommendation**