KEMI-TORNIO UNIVERSITY OF APPLIED SCIENCES

Design Scheme of Information Management System
The case of Tiansuo Electronic Technology Limited Company

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ABSTRACT

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This study is focused on designing an information management system (IMS) for Shan Dong Tiansuo Electronic Technology Co., LTD. The objectives of this research are to provide a scheme on the areas of design and suggestions for the implementation of the information management system to enhance information management of Tiansuo Company.

In order to achieve the objectives, the backgrounds and business processes of the case company need to be understood and analyzed to summarize the requirements. Following the analysis, on the basis of the descriptions of the requirements and the working principle of three layered B/S structure, the functional structures and system structure of IMS were designed. In the stage to follow, UML modeling was used to refine the functional structure of IMS, and describe the workflows of the activities. Lastly, the research gives the suggestions for implementing this IMS.

This research is based on constructive method, including document analysis. Documentary analysis is a common method to collect useful data for this research. The constructive method was used to construct the solutions of functional structures of IMS in the analysis and design processes. The outputs of this research are a design scheme of IMS for the case company with clear descriptions of system structure and functional structure of IMS, with alternative suggestions for implementation.

Keywords: Information Management System, Dong Tiansuo Electronic Technology Co., LTD, three layered B/S structure, UML modeling.

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1 INTRODUCTION

Robertson gave points of views about information management in 2005. He suggests that improving information management practices is the top issues for many public and private enterprises. Effective information management is not easy. There are lots of systems to integrate, a large number of business needs to meet, and the complex organizational and cultural issues to address. However, information management is not just the technology. It is about the business process and practices which are meant to create and use information. It is also about the structure of information, the content quality and more. (Robertson 2005.)

In the movement of information era, information becomes the most important resource for the enterprises management. Management work refers to making effective decisions. However, the correct degree of decisions largely depends on the quality of information. Information management is usually more complex in enterprises. Due to a large amount of information, computer technology supports enterprises to complete information management effectively. These promote enterprise information management to move towards scientific, standardization and automation.

The importance of information management is very clear. Enterprises need a system to manage their information and data in an effective way, and to protect information in a secure environment. This research focuses on analyzing and designing an information management system (IMS is also called Enterprise Resource Planning) for a case company. The case company is a newly-founded company. I will give the backgrounds of the case company in the following subchapter. After that I will discuss the objectives and research questions. Lastly, the thesis structure will be introduced.

1.1Background information

In this thesis, the name of case company is Tiansuo Electronic Technology Limited Company. Tiansuo Electronic Technology Limited Company is the official name of the case company. In the text to follow, I will use Tiansuo Company to stand for the official name. Tiansuo Company is a new medium-sized company, since it was set up in 2011. It is located in Dezhou, ShanDong province, China. It is a manufacturing company mainly to produce electronic equipment. The characteristic of the company products is utilizing solar power to generate electricity.

The chief Executive Officer (hereinafter CEO) is Australian and does not live in China at present. He invests in this company and employs a Chinese person as the general manager of this company. The name of the general manager is Mr. Yao. Mr. Yao conducts all the managerial tasks in the case company. Tiansuo Company has six departments which are development department, production department, sales departments, financing department, planning department and human-resource department. Tiansuo Company has been operating since the beginning of 2012. It took in many new workers in February of this year. They must pass the stringent training before they start to work, otherwise they will be fired. (Tiansuo Company 2011.)

1.2 Objectives and research questions

The objectives of this thesis are focusing on making a design scheme of information management system and proposing the alternative suggestions to implement the IMS for Tiansuo Company. Information management is series of activities that refer to planning, organizing, and controlling various information and resources, which are developed and utilized according to the enterprise's requirements (Management-Hub.com 2012).

This thesis will be expanded from these two keywords design and implementation. In order to make the design scheme, requirement analysis is a vital step. Following the

analysis, the main works of design process will be focused on functional structure and system structure of IMS based on the result of requirement analysis. On the basis of designed scheme, I will come up with two suggestions to implement the suggested information management system.

In order to achieve the objective of this thesis, two research questions are addressed as listed and discussed below.

1. What kind of functional structure and solution of IMS serves best for the management of Tiansuo Company?

   Firstly, the information management system was explored from the management requirements' and needs' points of view as the starting point. System requirements analysis is an important link before the design process. The business processes are the base to get the requirements. The basic task of system requirements is to answer the questions of "what the system must do?" and come up with the complete, accurate, and specific requirements for the target system (i.e. IMS). The aim of the IMS is to meet the demands of users. The functional structure and solution of IMS focus on the users' demands and the system requirements.

   The second aspect is concentrating on how the system is serving the management of the case company. The important question to answer here is what architectural structures and solutions are the best for IMS of the Tiansuo. For example, a three-layer model was found appropriate in this case. UML modeling was used to design the functional structure of the IMS with the results of requirement.

2. What kinds of suggestions are appropriate to implement the suggested IMS?

   Here I am giving practical suggestions that help in implementing the planned IMS. Appropriate platforms, implementation tools, hardware devices and database system are recommended here. Choosing the most suitable tools is important to process the stages of design and implementation, the basic request is interaction with each other. Another suggestion is the most suitable software packages will be used in implementing. I evaluate the quality of information management system for the case company as well.

1.3 Thesis structure

The theoretical principle for this thesis is to make a scheme of designing an information management system for Tiansuo Company based on B/S architecture and UML modeling. This thesis is divided into 5 chapters.

Chapter one presented above introduce the research background information and motivation, research objectives and research questions. Chapter two explains the research methodology. It presents research methods and research processes. Chapter three provides the business process diagram of Tiansuo Company with detailed descriptions in section one. Section two focuses on requirement analysis and functional problems for development. Chapter four focuses on planning and designing the system structure and functional structures of IMS of Tiansuo Company. The system architecture will be designed based on the theoretical knowledge of three layered B/S structure. Then I will build the overall structure of IMS, and model UML diagrams to description the functions and activities of IMS. The result of this study will be discussed with two suggestions of implementation of the IMS. It also includes the evaluation of the quality of the suggested IMS using SWOT analysis.

2 RESEARCH METHODOLOGY

This chapter focuses on the research methods that were used to collect, analyze the useful information, and to construct the system structure and functional structure of IMS. The aim of these methods is exploring a solution to answer the research questions. This chapter includes the research methods section and research processes section.

2.1 Research methods

This research draws form the constructive method. The research methodology of this thesis is based on documentary analysis. “It is the systematic examination of instructional documents such as syllabi, assignments, lectures notes, and course evaluation results in order to identify instructional need and challenges and describe an instructional activity”(The University of Texas at Austin 2011). I have searched many articles for the documentary analysis. I selected articles which contained the keywords “information management “or “information management system” or “B/S three layered structure”. From these articles, I used the reference section to identify further articles. I made a brief plan for my documentary analysis as follows:

The first step in a case study is to know the working context of the case company. In this work, the first step included studying the backgrounds and structure of Tiansuo Company. The second step was to identify the needs and requirements of Tiansuo Company. I needed to clear the purpose of the documents analysis. I started with clear goals concerning what I have to learn to narrow the searching scope. I should download or save all the related resources. The final step was to read and analyze these sources information, delete all the useless resource and save the useful resource in file.

Constructive method was chosen based on the research questions and the area of research. “The constructive research approach is a research procedure for producing

innovative constructive, intended to solved problems faced in the real world and, by that means, to make contribution to the theory of the discipline in which it is applied" (Lukka 2003). "Constructive research is one of the most important methods in the IS research field. The sub module "Constructive research" explains how one should understand design as research program and discusses such issues as the building process, evaluation of construction result, and action research. It concentrates on the methodology of the constructive research and on its challenges. It emphasizes that one of the most serious dilemmas in the constructive research is the scientist's ability to maintain a neutral, even critical, attitude, expected of the scientist during the overall process of the development and implementation of the innovation construction" (Caplinskas & Vasilecas 2004).

Constructive method is defined as managerial problem solved through the construction of models, diagrams, plans, organization etc. (Reed 2002). According to the requirements of Tiansuo, this method helped in constructing a solution to design the IMS that is the first aspect. The solutions include getting requirements through analyzing the current business process, designing and building the system structure and functional structure of IMS based on B/S structure, and proposing suggestions for implementing. The second aspect is demonstrating the solutions. I use diagrams to describe the system structure of Tiansuo, and to illustrate the activities that can happen in IMS. Then UML modeling can be used to refine the functions and activities of the IMS.

2.2 Research processes

I started this research with signing a contract with the case company at the beginning of February, 2012. They sent some documents about the information of Tiansuo Company to me. I knew the company's requirements. After that I discussed with a representative of the case company to decide the research objectives and questions. Then I had to search and review the literature which supports research objectives of my thesis.

Through reading and analyzing the literature I gained some ideas and talked with my supervisor of Tiansuo Company. Then I started to analyze the requirements of the case company, I spent nearly one month on building and analyzing the processes of each business until the middle of March, 2012. During that month, I had discussed with the productions manager of Tiansuo 5 times to modify the business processes. The main content of the interviews with case company was related with the requirements of the case company.

From the beginning of April, 2012, I started the process of writing and designing section chapter 4. The main works focus on the designing the diagrams of the system structure and the functional structure of the modules of IMS. Lastly, I processed the implementation chapter. There are two suggestions which came up with achieving the implementation of the planned IMS based on the results of designing.

3 THE BUSINESS PROCESS OF TIANSUO COMPANY

This chapter has two sections. The first section presents the business processes diagram of Tiansuo Company with the detailed descriptions. Through analyzing the materials from the company and reading sources information in network, I show some diagrams of the business processes of production management of Tiansuo Company. The second section shows the requirements of the case company and functional problems for development. The beginning of business process can be started as the case company receives the sales order from marketing.

Figure 1 below presents the whole business processes, and describes the relationships among the six departments. It also shows the material flow, capital flow and information flow among the activities of each department.

The activities of Tiansuo Company are not as Figure 1. Because the case company is too huge and time is limited for completed this research, I have talked with my supervisor and the production manager of company. The main work of this thesis focuses on the production management.

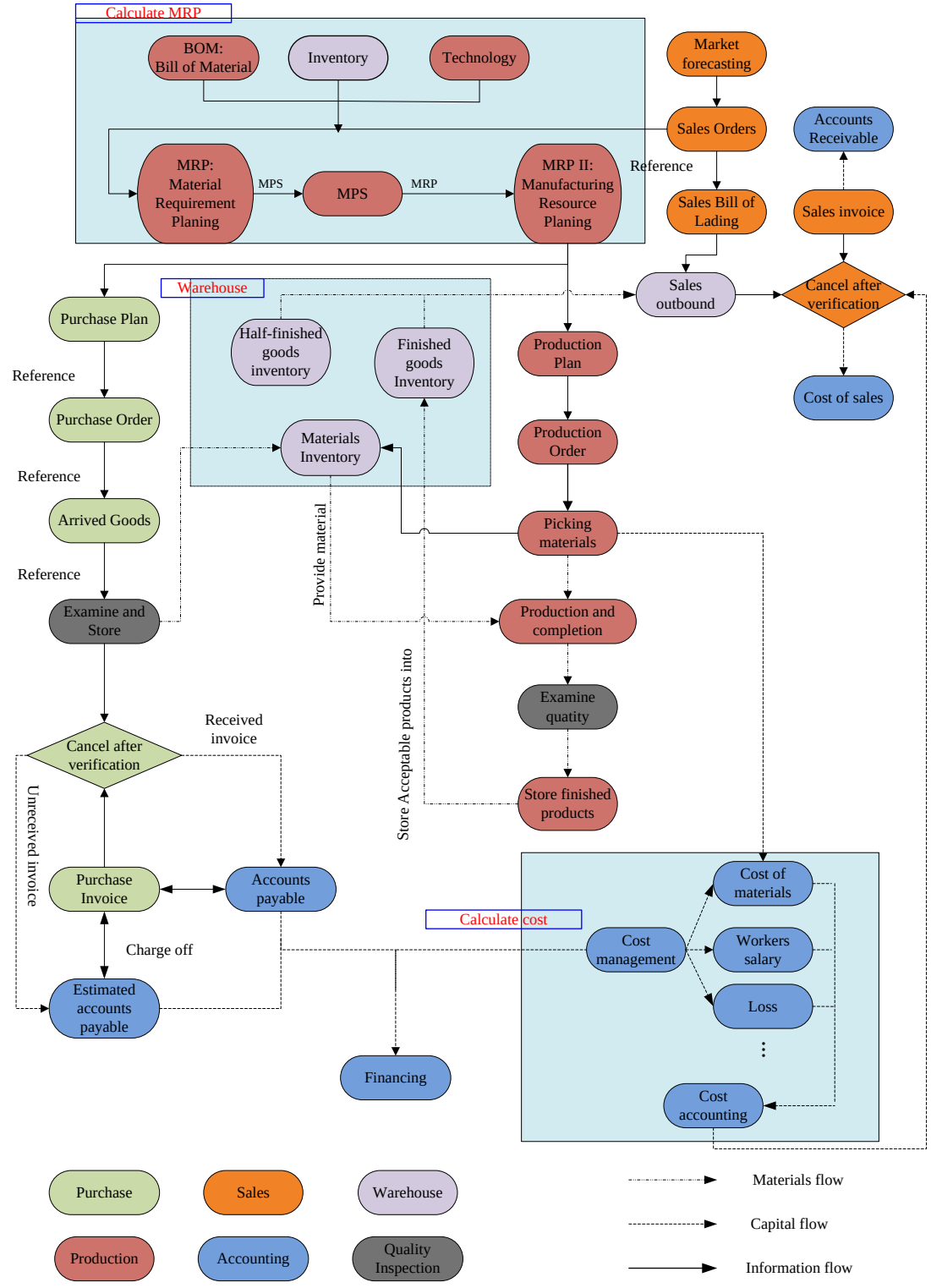

Figure 1. Entire Business Processes of Tiansuo Company

3.1 Modeling of the business processes of Tiansuo Company

The concept of production management is understood as producing goods or services due to the four production activities which are planning, organization, directing, and controlling. Production means converting raw materials into finished goods. Production management brings together the 6M's i.e. men, money, machines, materials, methods, and markets to satisfy the wants of the people. It manages and applies the decision-making regarding the quality, quantity, cost, time, management principle, etc., of the production. (Akrani 2011.)

Figure 2 below shows the business processes of production management. The production management contains purchase management, workshop management, warehouse management, and quality inspection management. This figure presents the interaction communication among these four managements with brief description of the business process. The business process of production management is divided into two layers, planning layer and execution layer. The aim of this section is to analyze the business processes of the execution layer. Before the analysis, the effects and knowledge of the planning layer have to know.

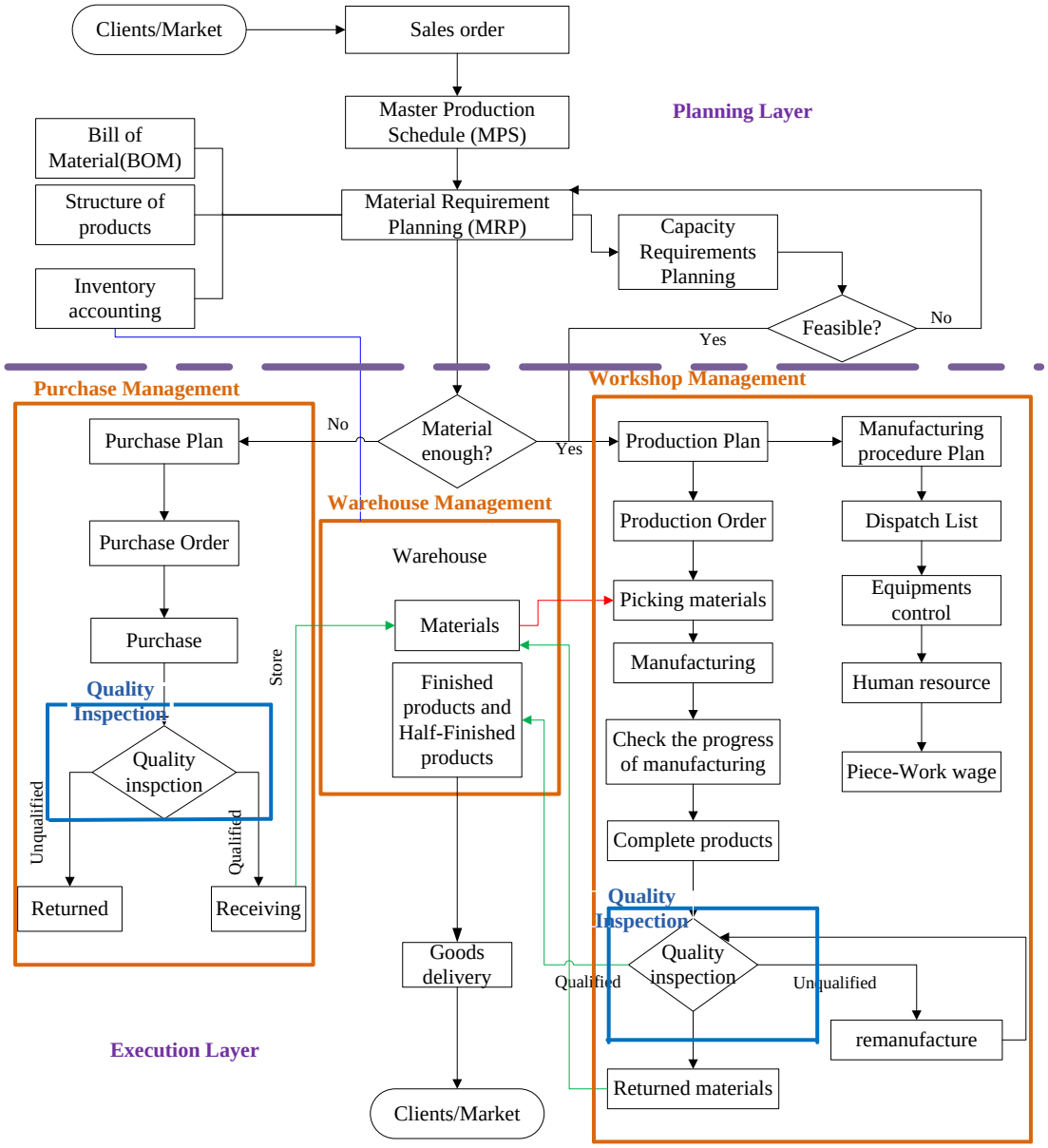

Figure 2. Business Processes of Production Management

The planning layer describes the generation of master production schedule (MPS) and material requirement planning (MRP) which are made in the planning department. Based on the generation of MRP and MPS, the businesses of the execution layer start to be processed. Analyzing the business processes of the planning department are not the aims of this research. In order to understand the execution layer, it is necessary to identify the concepts of MPS and MRS.

MPS is the production plan that supports supply chain work. It is aimed at formulating the detailed plan for the quantity and date of delivery of final products per period. It is built from the sales orders, sales forecasts, and finished good stock levels. The purposes of MPS are the following: forecast the customer demand per product, explore sales and operation plan into different parts for each period, define quantity and deadline for each product, follow current sales versus forecast, insure the required customer service level, and inform the customer service on the available-to-promise. (Logisitik.com 2012.)

MRP is a technique for inventory planning and maintenance. It is used to decide the amounts of materials needed in order to have the right inventory on hand to keep the production schedules operating at maximum efficiency. "MRP use the bill of materials required to produce a product, along with knowledge of existing inventory and the master production schedule to decide what materials to order." MRP list is used to make the list of the results of production and the quantity of materials was used in the production to produce the last run of product per the master production schedule. (Conjecture Corporation 2012.)

Firstly, each figure has some red symbols, which will be discussed in next section. The execution layer is complex. In order to explain the production management diagram, Figure 2 is separated into different diagram to help in understanding. From top to down, the purchase plan and the production plan is generated from material requirement planning.

Figure 3 shows the business processes of generating the purchase plan and the production plan.

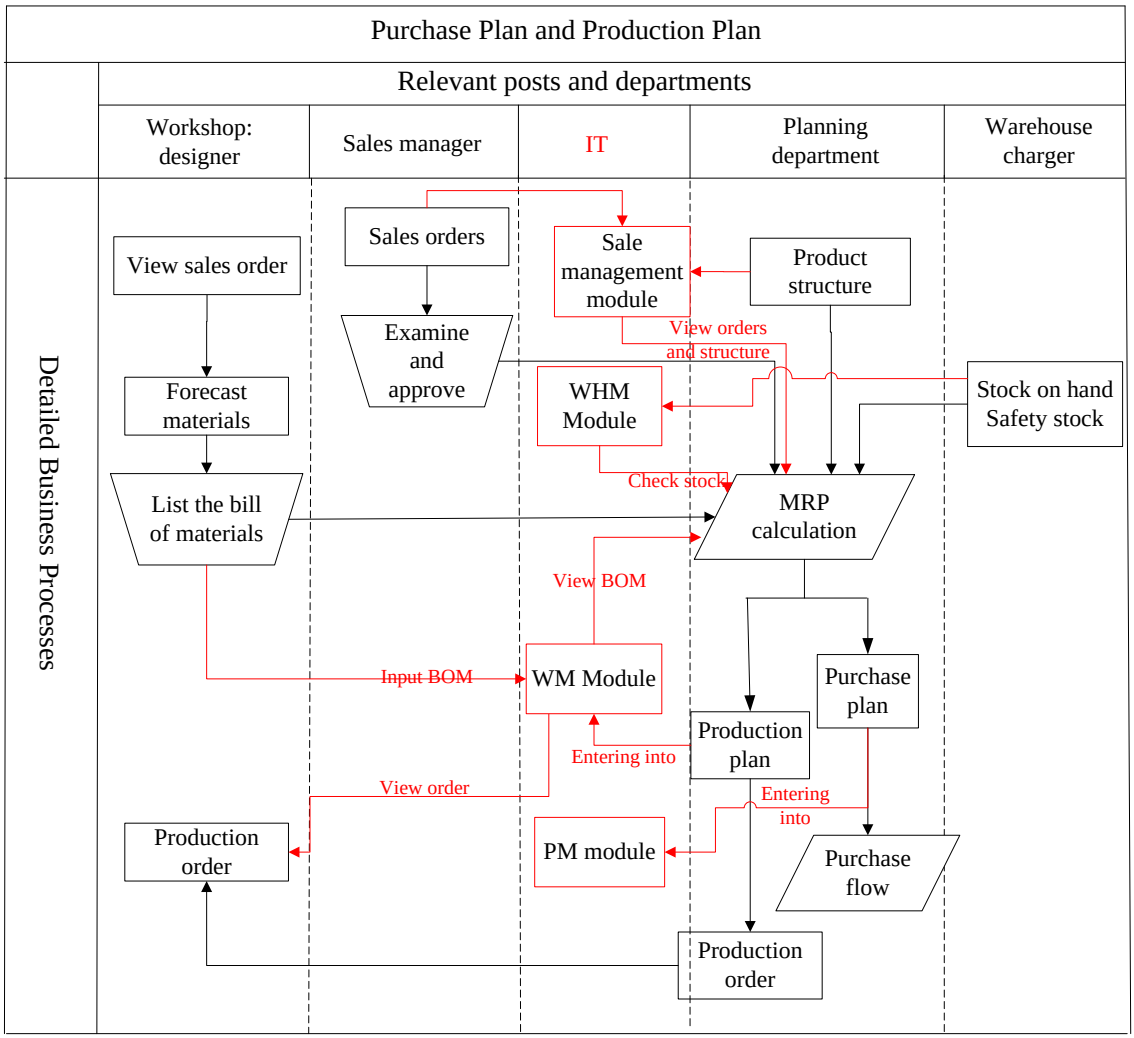

Figure 3. Business Processes of Purchase Plan and Production Plan

Since the salesman comes to an agreement with client, the contract must be audited by all departments. In workshop, the designer forecasts material and makes the bill of materials depends on the sales order. The workers of the planning office calculate the MRP (Material Requirement Planning) through analyzing the stock on hand, the product structure, the BOM and the sales order. According to the MRP, there are two situations. The first situation is that there are not enough in-store materials in warehouse for producing products. The purchase department must purchase materials from suppliers. The workers of the planning department generate and release the purchase plan and the production plan to the managers of purchase department and workshop department respectively.

The businesses of purchase department involve the general purchasing business, quality inspection of raw materials business, and purchase returned material business. The processes of each business are as shown in the following figures. Figure 4 illustrates the processes in general purchasing business.

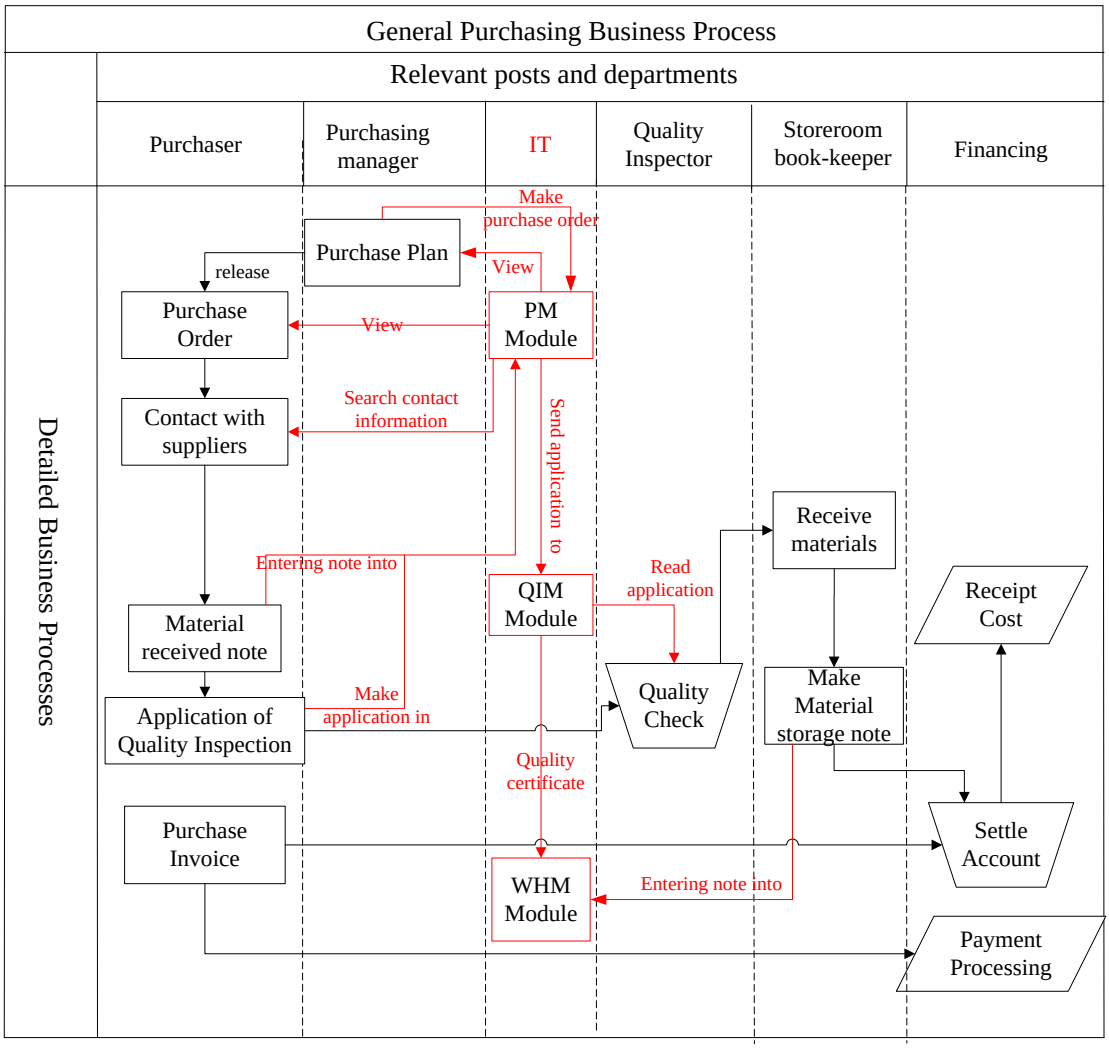

Figure 4. Business Processes of Generate Purchasing

The general purchasing business happens within three departments. The planning department gives the purchase plan to the purchasing manager. Then the purchasing manager makes the purchase order and releases to buyers. Buyers contact suppliers to purchase the required materials for productions. After buyer received materials, he fills

the delivery note and keeps them in documents. Then buyer makes and gives an application of quality inspection to the quality inspector. Quality inspector checks the quality of material and stores the qualified materials into warehouse.

According to above paragraph, the next business is about the quality inspection of purchased materials. The main point of the business processes is inspecting the quality of the purchased materials as shows in Figure 5.

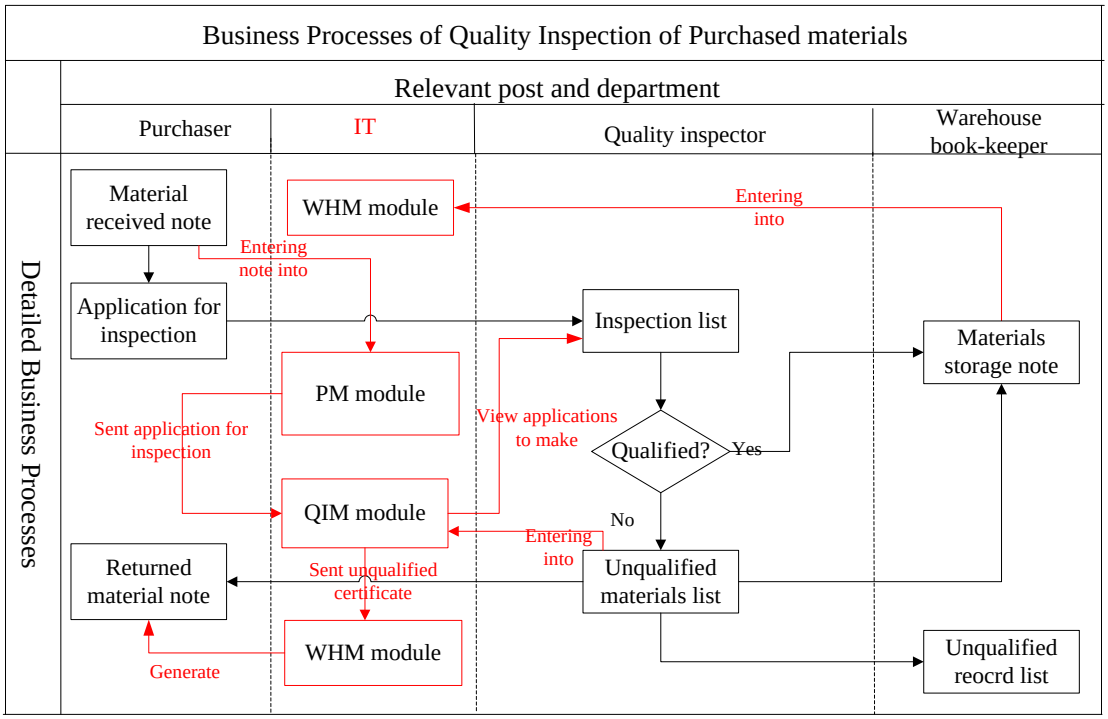

Figure 5. Business Processes of Quality Inspection of Purchased materials

The beginning of the business is that the purchaser generates an application of the quality inspection, and sends this application to the quality inspection department. The quality inspector makes the inspection list to check the quality of the purchased materials. If the materials are qualified, the inspector stores the materials into warehouse. The book-keeper fills the material storage note. Else inspector makes the unqualified materials list to help the purchaser to generate returned material note.

While the unqualified materials need to be returned back to supplier, or changed with qualified materials. Before storing material into warehouse, inspector found the unqualified materials. The inspector must inform purchase department, and purchaser connect with the supplier to change or return materials. If they cannot change materials, purchaser needs to return the unqualified materials and change the amount of the received material in materials received note.

If the materials had stored into warehouse, the inspector and the warehouse book-keeper prick out the unqualified materials to return back. The inspector gives the unqualified certificate to the purchase department, and the purchaser connects with the supplier to change or return unqualified materials. If they cannot change the unqualified materials, the purchaser needs to return these materials back to the supplier. The purchaser changes the account of the received materials. The book-keeper makes the delivery note and changes the data in the materials files. The business processes of returned materials are as shown in Figure 6.

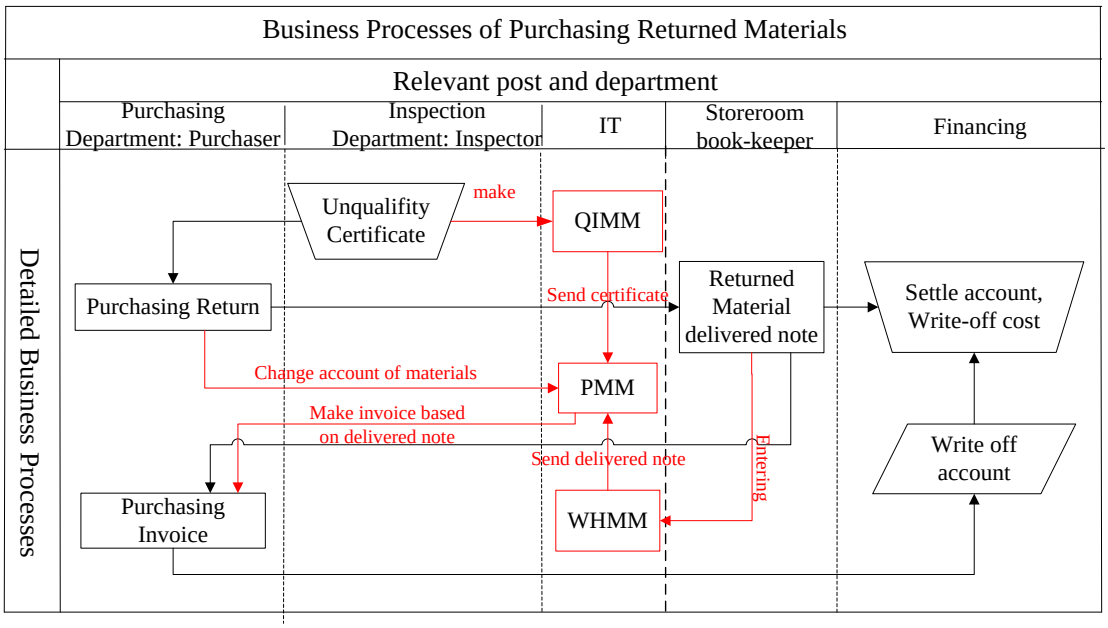

Figure 6. Business Processes of Purchasing Returned materials

The second situation is that the in-store materials are enough to produce all needed products in the warehouse. Then planning office does not need to make the purchase plan for the above purchasing businesses. The planning office just gives the production plan to the workshop manager. Then the workshop manager makes the production orders according to production plan. Before manufacturing products, there are some preparation works, such as preparing materials and checking equipments. Firstly, the workshop designer makes the picking list based on the production order. Based on the picking list, the workshop workers pick materials from the warehouse. Figure 3.7 shows the business processes of picking material.

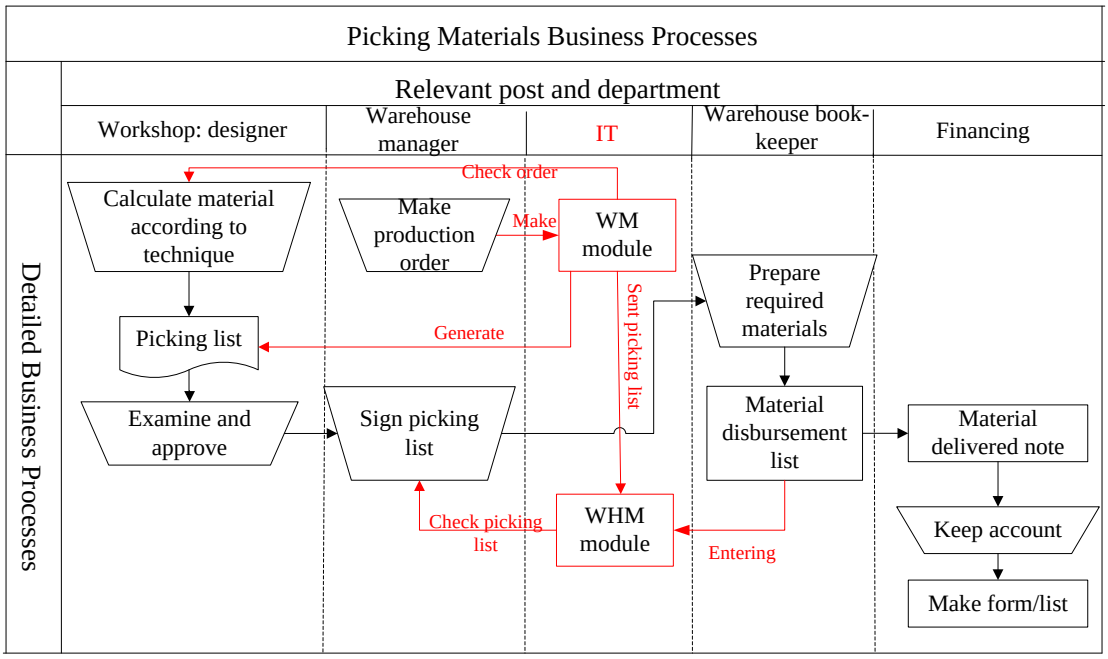

Figure 7. Business Processes of Picking Materials

The production manager releases the production order to the workshop designer. The workshop designer calculates materials use the techniques and the order of production to generate the picking list. After examining and approving the picking list, the warehouse manager signs name on it. The book-keeper prepares the required materials and fills the material delivered note in the warehouse documents.

The quality inspection of equipment is the other preparation work for production. The detailed descriptions for inspecting the quality of equipment as followed text.

In order to making sure the equipment can be operated normally, it is very necessary to check the quality of equipment. The workshop makes and gives an application of the quality inspection to the quality inspection department. The inspector makes the inspection list to check the situation of equipment. If the equipment is qualified, the inspector gives the certificates of the passed inspection. Else the inspector informs the repairer to repair the equipment. The following Figure 8 shows the business processes of the quality inspection of equipment.

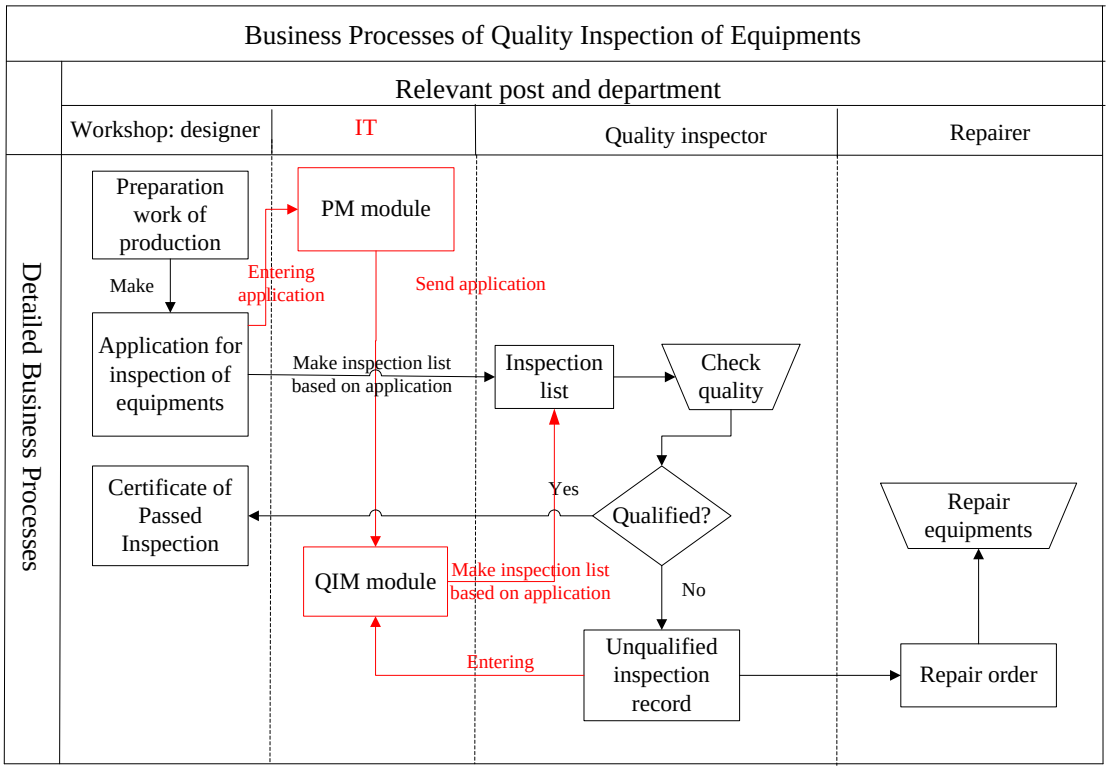

Figure 8. Business Processes of Quality Inspection of Equipments

After completion of the manufacturing product, the quality inspector must to check the quality of the finished product. The workshop designer inform inspector for inspecting quality by an application. If the final products are qualified, the inspector stores the final

products into the warehouse directly. Else the inspector informs the workshop for re-manufacturing the unqualified product. The detailed processes are very familiar with the qualify inspection of materials. The business processes of the quality inspection of the finished-products are as Figure 9.

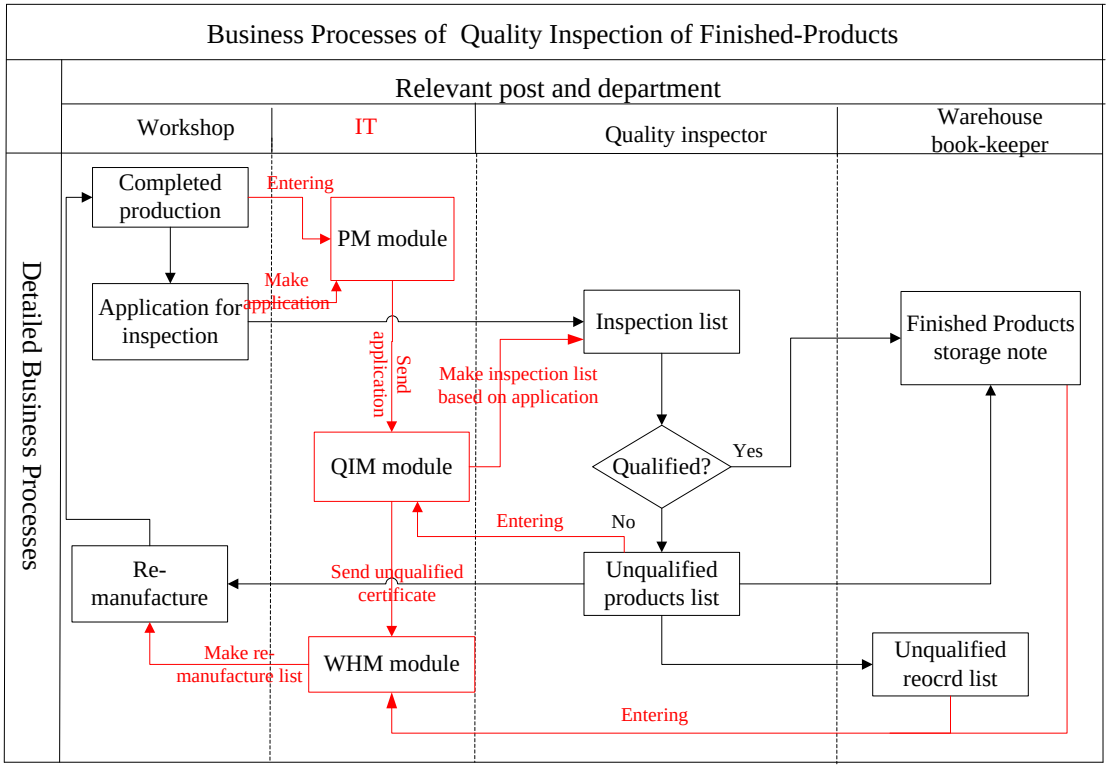

Figure 9. Business Processes of Quality Inspection of Finished-Products

Another figure describes the business processes of the production statistic which is used to calculate the materials, working hours, cost and working output. The detailed descriptions of this business processes are as following: the planning office generates the productive task form depends on the sales order. The designer forecasts material requirements and reports the results to planning office. The productive task form generates the production order with results of material requirements. Before manufacturing products, the workshop workers need picking materials from the warehouse. The warehouse book-keeper fills material delivered note. After the completion of producing products, the workshop designer generates the finished notice,

compares with the products order, and sums up the working hours, the working time and the consumption. If the finished notice is correspond with requirements of the production order without unqualified products, the workshop workers put the final products into storage. The warehouse book-keeper fills the finished products storage note.

The workers of the financing department calculate the cost of production on the basis of the numbers of the working hours, working time, consumption, and the notes of the material delivered and the final products. Figure 10 illustrates the business processes of the production statistic.

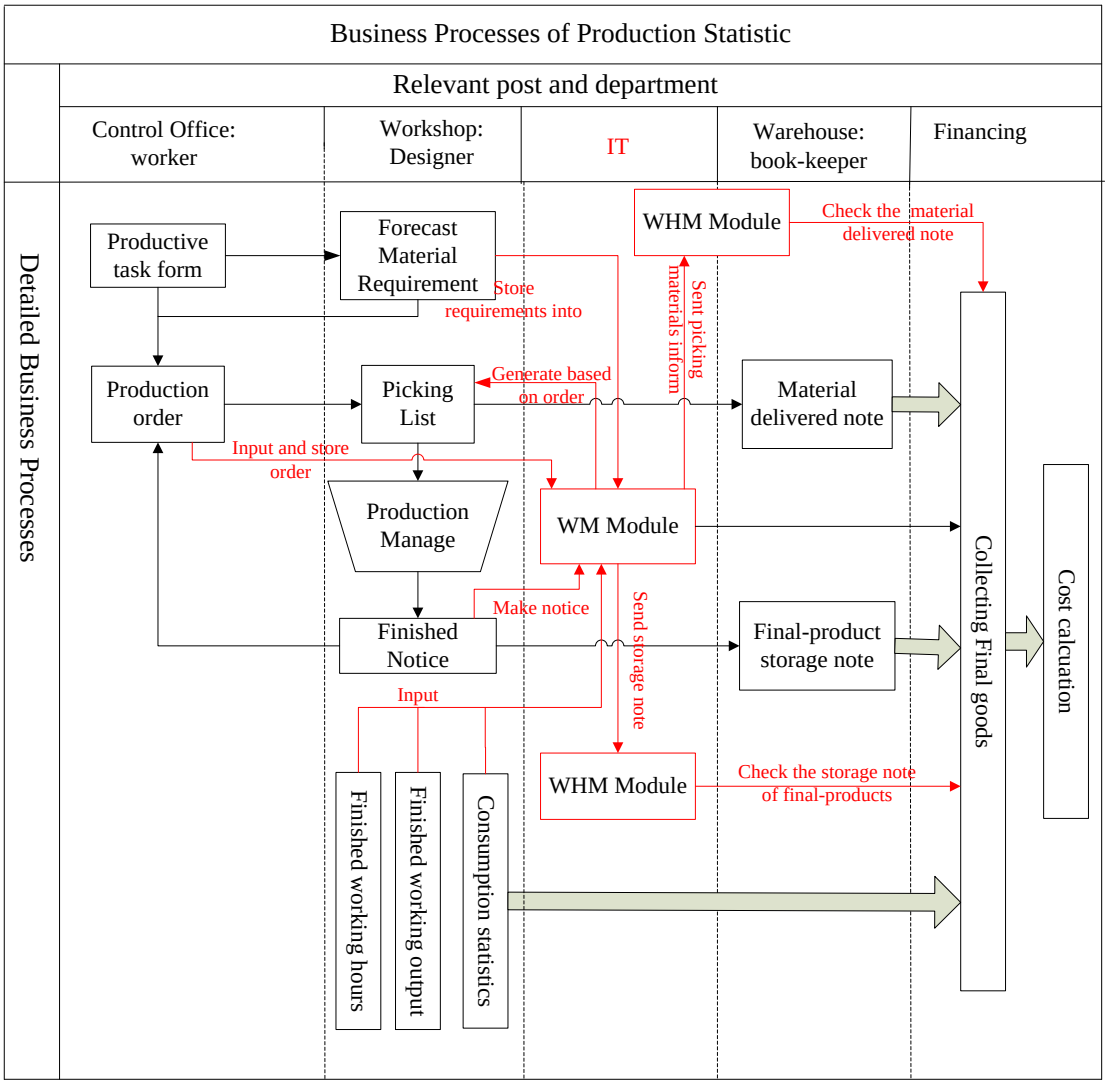

Figure 10. Business Processes of Production Statistic

The businesses in warehouse management are including storage businesses, outbound businesses, and inventory statistics. Firstly, the storage businesses in the warehouse include the storage of the final products and the storage of the purchased material businesses. Figure 11 below describes the business processes of the storage of the finished product.

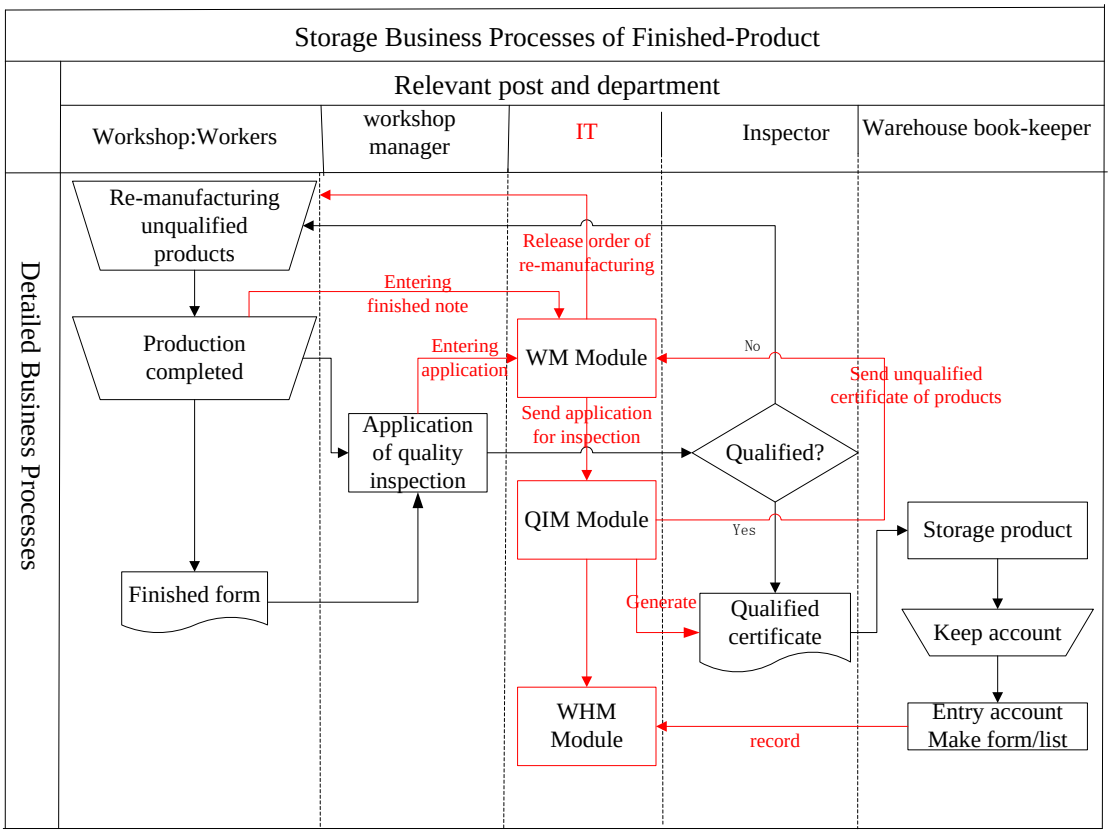

Figure 11. Storage Business Processes of Finished-Product

After the products are completed, the workshop workers make the finished form to the workshop manager. This manager sends the quality inspection list to the inspector. Inspector checks the quality whether the finished products are qualified, stores the qualified products into warehouse, and sends back the unqualified product for pre-manufacturing. For the qualified product, inspector makes the qualified certificate to help the book-keeper in keeping account.

The business processes of the storage of the purchased materials are similar with the Figure 11. The purchaser receives the raw materials and fills the material received note. The purchasing manager corresponds the note with the purchase order. According to the material received note, the purchasing manager sends an application of the quality inspection to the inspector. Inspector checks the quality to generate a qualified certificate for the qualified materials. The book-keeper makes the materials storage note based on the qualified certificate into account. And the inspector also informs the purchaser to return the unqualified materials to the supplier. Figure 12 presents the business processes of inspector stores the purchased materials into the warehouse.

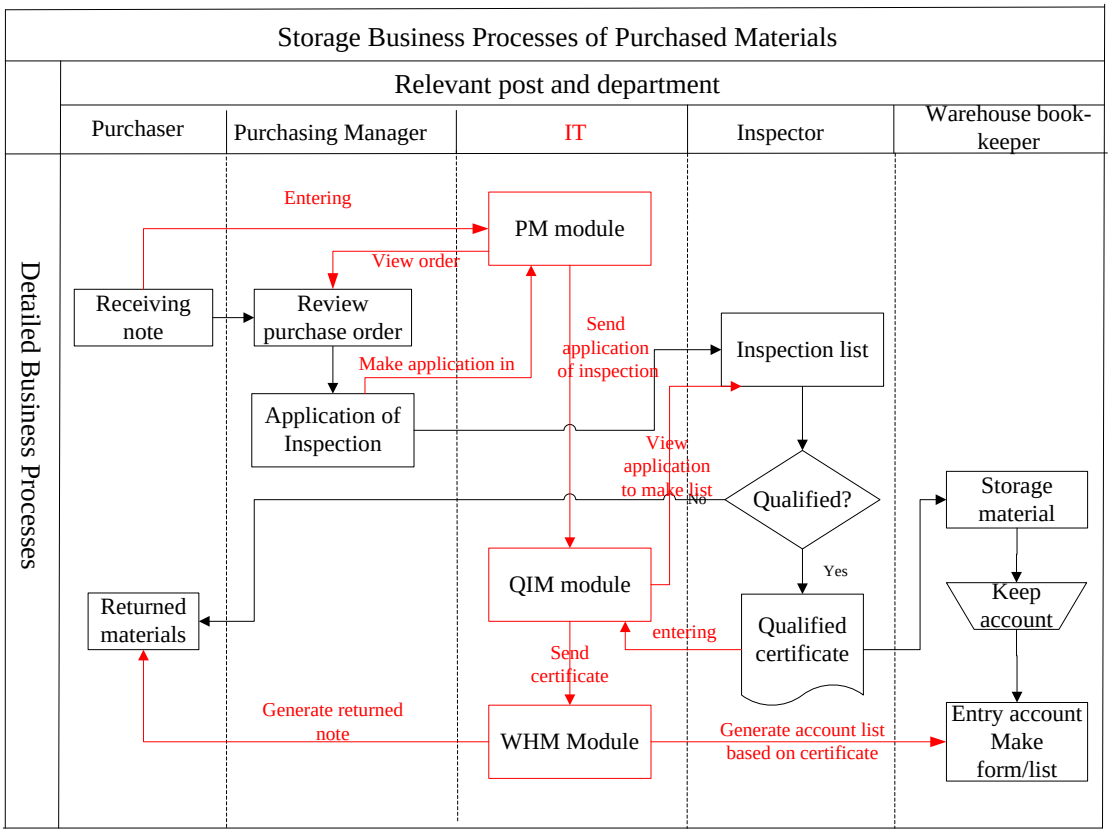

Figure 12. Storage Business Processes of Purchased Materials

Outbound business includes delivery of the finished products and delivery of the raw materials from warehouse. The delivery of the raw materials from warehouse includes picking materials for production and returned of the unqualified materials. The business

processes have been described before. The business processes of the delivery of finished products from the warehouse are shown in the following Figure 13. When the due date of the sales order arrives, the salesmen review the sales order and make the bill of lading. After the booker-keeper receives the bill of lading, he makes the finished products delivered note and gives it to warehouse manager for signing name. Then book-keeper delivers the finished product from the warehouse to the client. At the same time, the salesman informs the client to receive products.

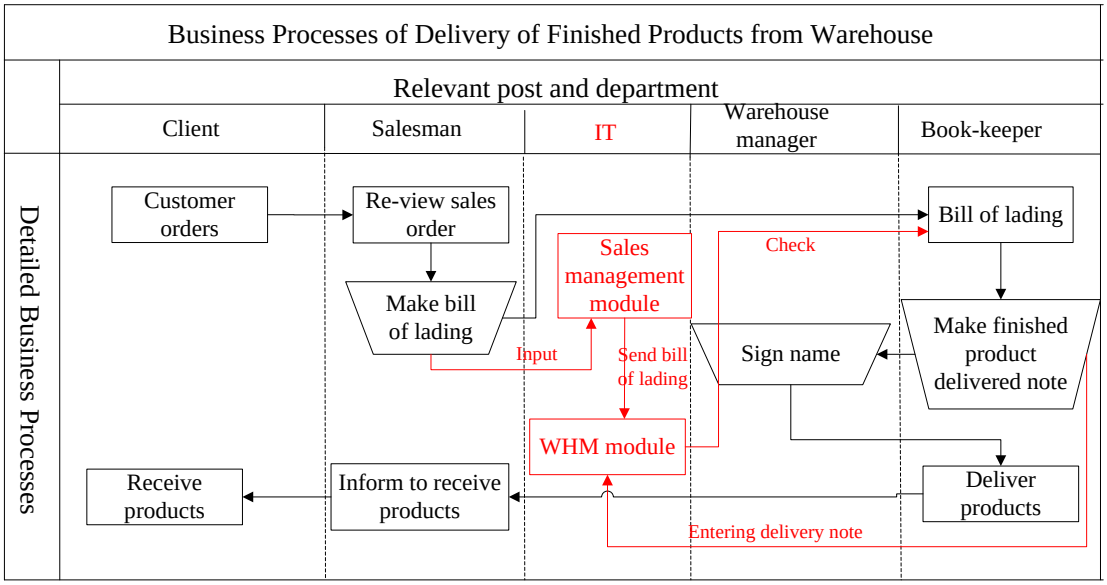

Figure 13. Business Processes of Delivery of Finished Products from Warehouse

Another business is inventory check which is one element in the phase of make MRP. Inventory check is to know the stock on hand and safety stock. It can help the planning office in making the production plan and the purchase plan. The inventory check business happens in the warehouse department. The inventory checker collects all the bills of storage and delivered notes from book-keeper, calculates the amounts of each products and materials, and lists the amounts. Through calculating the amount, the inventory checker can get the stock on hand, and the safety stock of warehouse. The figure is used to describe the business processes of the inventory check as following figure 14.

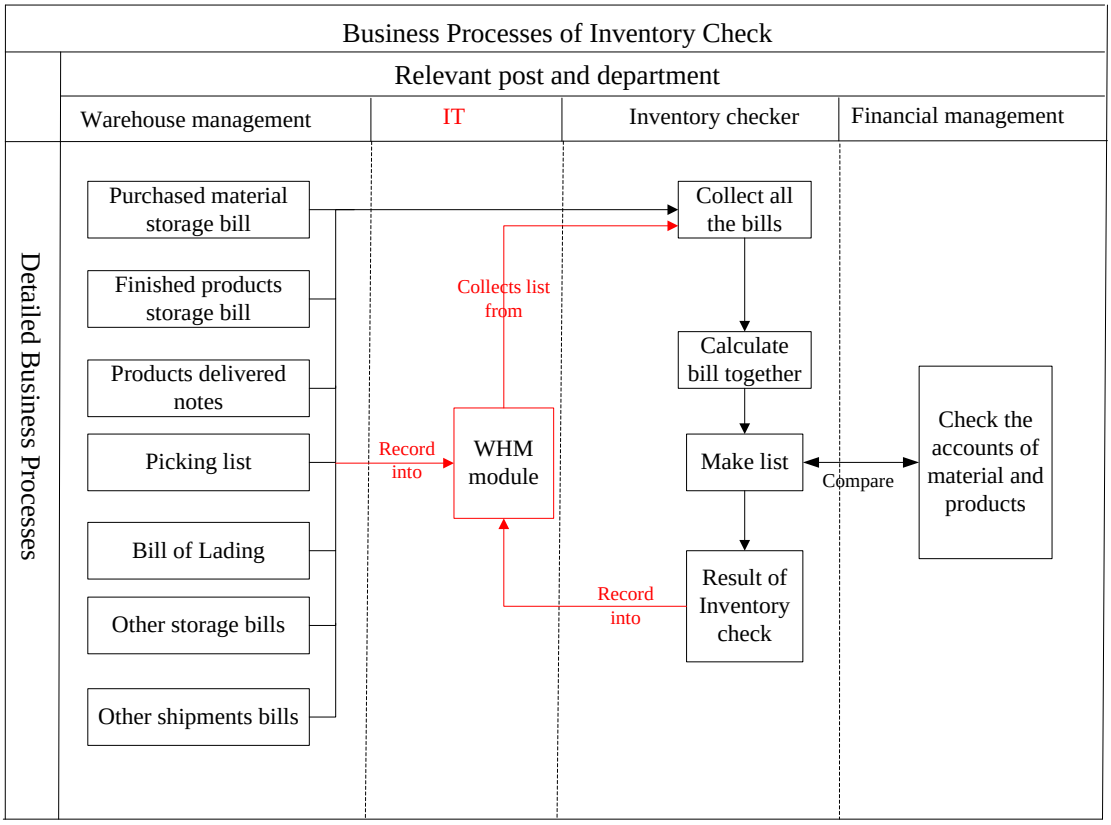

Figure 14. Business Processes of Inventory Check

3.2 Analysis of the business processes

There are two aspects in question one. The first aspect of question one is to answer the question of "what the system must to do?" This question is put especially from the management point of view. In this case, the management is equal to the user point of view. It is very critical to understand user requirements totally for designing a successful system. The benefits are including increasing productivity, enhancing quality of work, reducing costs, and improving user satisfaction. (Maguire & Bevan 2002.) The user requirements were gained through analyzing the above businesses processes diagrams.

3.2.1 Explain the requirements for development

This case company was set up in 2011. It is still in an early development stage now. It will confront with several severe difficulties and challenges. Through the above figures, it is clear to know that the information flow, capital flow, and materials flow are very large. Most information communications among the six departments relay on the hand work. The workload is very large and efficiency is not high.

However, information technology spreads constantly in the entire society. Usually the ability and quantity for the enterprise to obtain the information are increased. Information and data processes have become into the same importance as a strategic resource as human resource, capital resource, material resource, social relationship etc. In order to make better use of the modern information technology, and improve the management efficiency and level of Tiansuo, it is necessary to build up an own information management system to adapt the need of enterprise development.

Computer technology is widely applied in corporation management. It is imperative to utilize it for realizing the enterprise administration. Nowadays, most enterprises and industries are using computer technology as the base to do their business operations, including research, development, production, and the ways of delivery. Some small and medium-sized enterprises reply on the computers to help them in sale system, information management system, or operating all kinds of information, such as employees' profiles, suppliers' information, or clients' information. (Cortwell 2009.)

Information management system not only refers to the software systems, but includes the entire system of the business processes and resources which help enterprises to organize information together and to achieve the strategic goals. (Banks & Media 2012.) Therefore, a good information management system for an enterprise is of crucial importance. There are seven incomparable benefits of using computer to implement

information management system for managing information and data rather than hand work. These eight benefits are enhanced technology, efficiency, integrated information, user friendly, access to data, better communication access the departments, and increased security of data. Table 1 is used to describe the eight benefits. (Collegiate Project Services 2009.)

Table 1. Seven benefits of Information Management System (Collegiate Project Services 2009.)

Rank	Concerns	Typical Responses
1	Enhanced technology for the institution	• Current working method is traditional Help company technically on a par with other company • Management work keeps pace with the development of company
2	Efficiency in processes	• System reduce workload of hand working and current duplication of efforts • System streamline critical business process for many departments • Make data collection better and more efficient • Do not have to enter data and information by hand
3	Integrated information	• System replaces multiple, disconnected database with a single and integrated system • System integrate different systems and sources • There is the hope that system integrates with other system so that information will not have

		to be entered into several systems.
4	User friendly	• System provides easier access to information and overall improvements in its use by users • There is one expectation that system is easier to access
5	Access to data	• Better access to information and data
6	Better communication among the departments	• Improves communication between departments and regional company • Promotes more collaboration
7	Increased security data	• System improves the data integrity and security • Data restriction can be enhanced

Tiansuo Company is a new developing enterprise. It will increasingly expand as time goes on. At the same time, there will be more business that needs to be managed. If the case company still adopts the traditional hand work to deal with the business, it will be impossible to keep pace with the development of Tiansuo Company. Maybe it will impede the developments. For this reason, the production manager of the case company argues that it is the best time to have own information management system. Information management system can be improved with the development of enterprise. In this case, this information management system satisfies requirements of Tiansuo Company fully.

3.2.2 Functional problems and need for development

In the IT part of each figure, I added some red symbols. The purchase management modules abbreviate as PM module, workshop management modules is WM module for

short, the abbreviation of warehouse management module is WHM module, and quality inspection management module is QIM module for short.

The information of each department is independent. They store the information in files. If they search some information, they need spend much time on searching the files one by one. If Tiansuo Company has information management system, users or operators of the IMS can edit and search any related information that they want. The IMS can be used to search information automatically, and shows the required information in browser.

In each figure, it is clear that the communication of each business is related with more than one department. This point can be explained using the above Figure 4 as an example. The traditional business process has been explained. After adding the red symbols, the business processes will be changed compared with the existing processes.

The workers of the planning offices make and record the purchase planning into the planning management modules, and send the purchase plan and the production plan to the purchase management module and the workshop management module respectively. After the purchasing manger receives and view the purchase plan, the purchase order can be generated based on it. The purchaser searches the contact information of the suppliers from the supplier management of the purchase management module.

According to the requirements of the purchaser order, the contacted supplier delivers the materials to Tiansuo Company. The purchaser receives the required materials, records the materials received note into the PM module, and makes an application of the quality inspection in PM module. System sends the application to the quality inspection management module automatically. After finishing inspection, the inspector makes the quality certificate in the quality inspection management modules, and sends to the warehouse management module. According to the certificate, the warehouse

book-keeper takes and stores the materials into warehouse, and records the materials storage note into the WHM module.

From the above descriptions, information of each department is stored and saved into the information management system. The stored information is shared. Users can view the information with the own permissions. IMS can be used to prevent data and information from stealing, losing, damaging etc. Through analyzing the above business processes with the red symbols, the requirement of IMS will be discussed in chapter four.

4 PLANNING AND DESIGNING THE ARCHTECTURE OF THE IMS

This chapter gives answers to the second aspect of research question one. The aim of this chapter is to design the system structure based on the system architecture three layered B/S structure. This chapter is divided into three sections. The first section introduces the basic knowledge about B/S architecture. The second section focuses on designing the system structure of Information Management System based on B/S architecture. At last section is used to build UML modeling to refine the functional structure of IMS which will be presented by the use case diagrams, sequence diagram, activity diagram, and deployment diagram.

4.1 Introduction to B/S structure

This section describes the definition and working principles of B/S structure. The main points focus on the three layers, the functions and businesses of each layer, and the interaction communication between them.

4.1.1 Definition of B/S structure

Browser/ Server (B/S) structure is the browser and server architecture. It is changed and improved structure from Client/ Server (C/S) structure with the development of Internet technology. In this structure, the user interface is achieved through WWW browser, and few of business logics in browser. The main business logic is achieved on server. This can greatly decrease the computer load. (Java and J2EE Reference 2012.)

4.1.2 The working principle of B/S

B/S model is a three layered Browser-Web server-Database server structure. Browser is the user interface used to display information and to achieve interaction with web server.

There are a few logic works implemented in user interface. Web server is an application server, and this layer is mainly in charge of mostly business logic operations of the function modules, and interaction with the database layer. The database server is responsible for the input, output, storage, and management of the enterprise data. The three layered B/S structure mode and the interaction among them are shown in Figure 15. (Yang & Wang & Zhang 2009.)

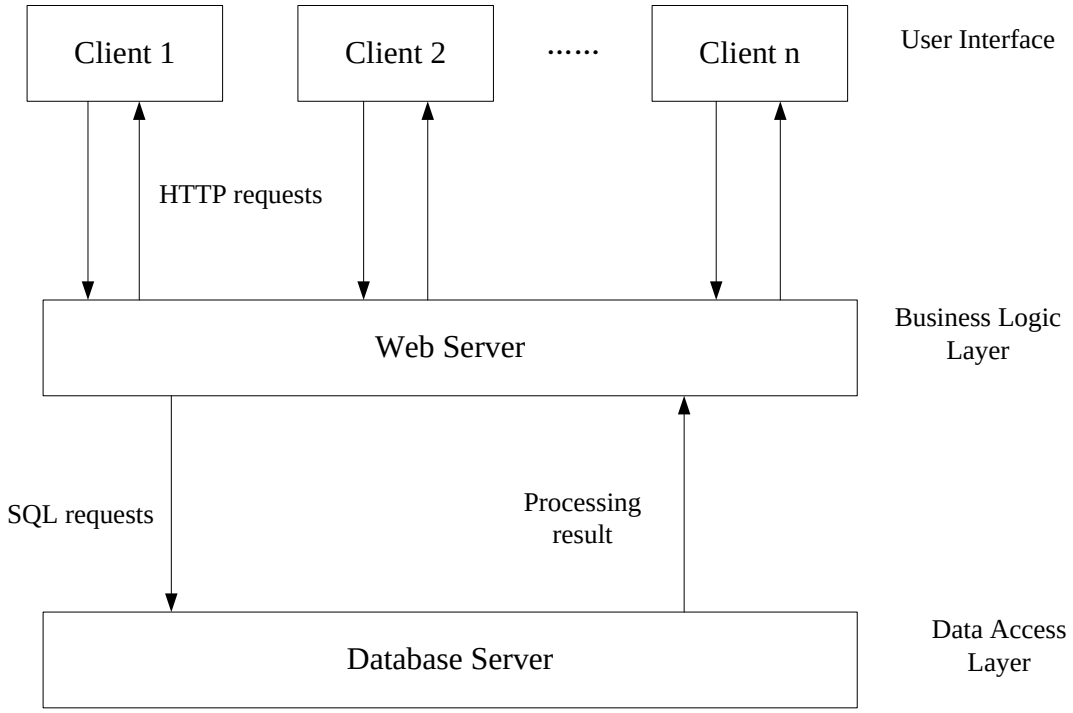

Figure 15. Three Layers of B/S architecture (Yang & Wang & Zhang 2009.)

The interaction communications among these three layers are shown as Figure 15. "A client runs the browser software, and the browser proposes the requirements of accessing database in hypertext forms. After Web server receives requirements, it will be converted to SQL statement and submitted to the database server. Database server verifies its validity and deals with the data. Then it returns results back to web server. Web server handles data to logic operation of business function according to the demand. After this, it transfers the results to HTML and XML document form. Finally,

web server contacts the browser with friendly web interface". (Yang & Wang & Zhang 2009.)

4.2 B/S structure and the IMS of Tiansuo

In this section, the main work focuses on designing the system structure of IMS based on the working principle of three layered B/S structure. Firstly, the company structure and the functional structure of the planned IMS need to be identified.

4.2.1 Company structure and functional structure of IMS

The functional structure of IMS should be designed by taking into consideration the requirements and needs of Tiansuo Company. Tiansuo Company contains six departments which are mentioned before. The main work of this thesis is to develop the management system which focuses on production department. Production department manage four small departments that are: purchase department, warehouse department, workshop department, and quality inspection department. The communication among these departments is illustrated in Figure 16.

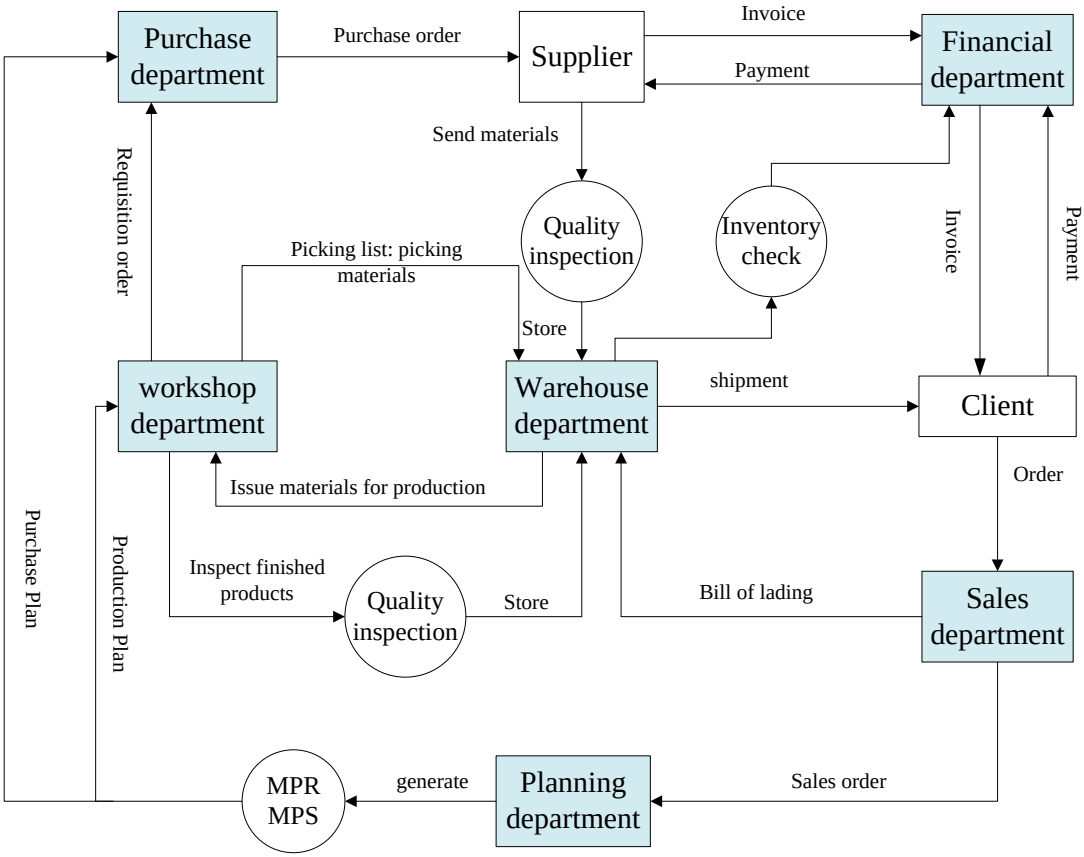

Figure 16. Relationships among Departments

The specific activities of each department are discussed in the descriptions below.

The purpose of the purchase department is to buy materials and to ensure that the materials match with the requirements of the case company that are based on the best price and best quality. There are many activities in the case company like: make purchase plan of row materials, build good relationship with suppliers, analyze and accessing the supply markets, make purchase order, release purchase order to suppliers, and receive materials from supplier and return the unqualified materials.

The working scopes of the workshop department are to organize and complete the production target, and manage the manufacturing process and production technologies. According to the sales order and production order, the activities of this department include making and executing the annual and monthly production plan, controlling the

progress of production, managing the process of production, allocating works and working times, picking up materials from the warehouse, cooperating with each manufacturing link to ensure the normal operations, making production reports, managing equipment, checking the output and quality of each production, and managing the production documents.

Warehouse management is responsible for managing the material and products. The activities of warehouse department contain that the row materials and products are put in storage and delivered from storage, confirm by the name, quality and quantity of materials and products, issue row materials for production, record and save shipments list and bill of lading, and inventory check.

The works of the quality inspection department are to check the quality of row materials, products and equipments. The activities include making the quality inspection plans for products, equipment, and materials. The workers take charge of analyzing quality problems, reporting them to the leaders, and managing all the documents of the quality inspection.

Based on the above detailed descriptions of these four departments, the overall requirements and deeds of the planned IMS is built and depicted in Figure 17.

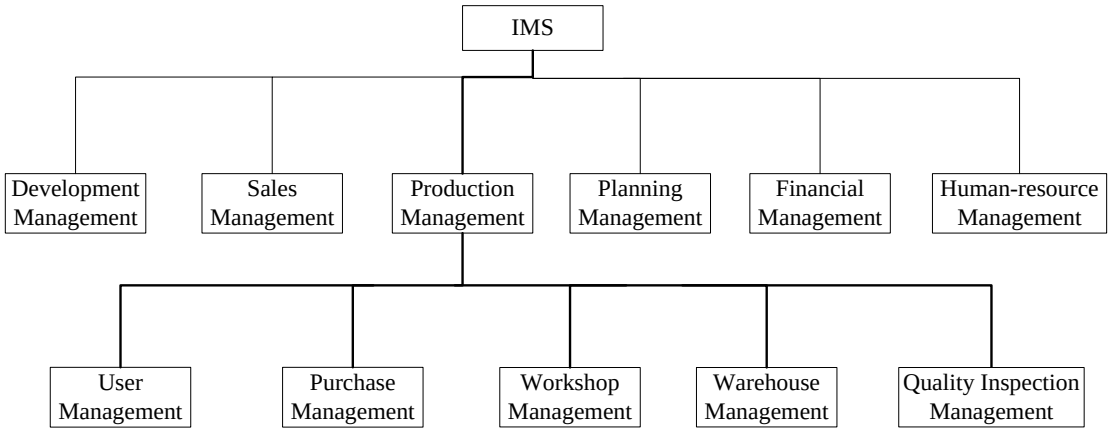

Figure17. Overall Structure of IMS

Figure 17 indicates that the production management system contains five modules which are user management, purchase management, workshop management, warehouse management, and quality inspection management. The detailed functional structure of each management module will be designed by the above descriptions of activities and businesses of each department.

Firstly, Figure 18 below describes the requirements and needs of the user management module. This module is visible displays in the user interface when the system administrator logs in to the information management system. System administrator is in charge of all the users and permissions of each user. When administrator goes into the user management module, there are four sections display in user interface. The users are separated into four groups depend on the four departments.

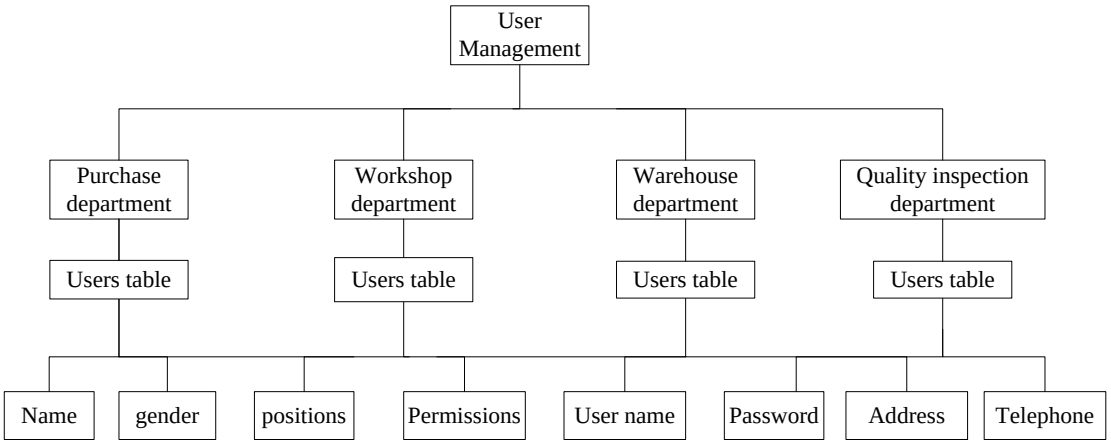

Figure 18. Requirements and Needs of User Management Module

The purchase management module includes purchase plan, purchase orders, supplier information, purchase order, returned materials, material received note. Each section has own properties. Figure 19 shows requirements and needs of the purchase management module, and the detailed contents of each session.

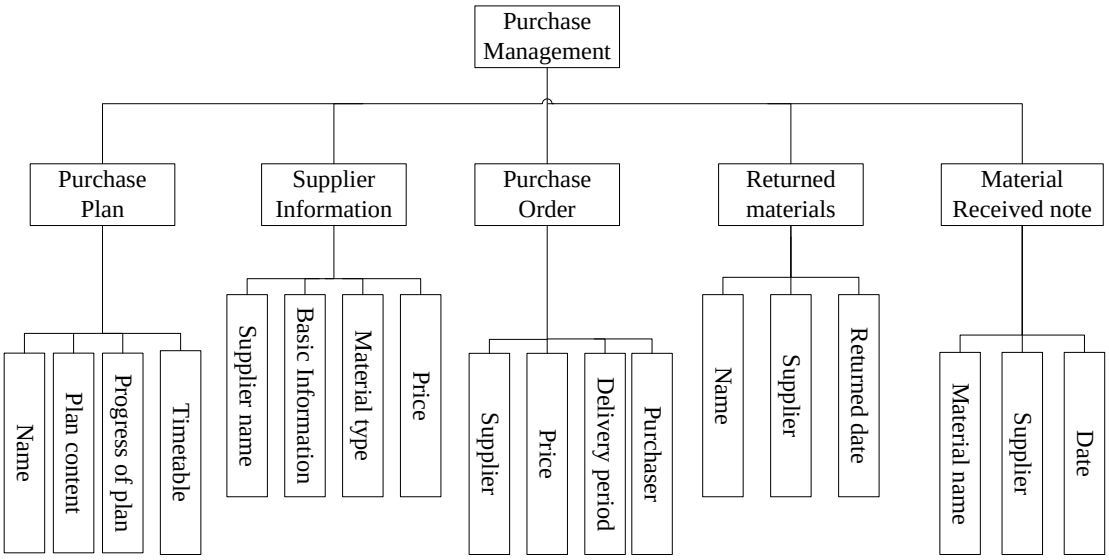

Figure 19. Requirements and Needs of Purchase Management Module

The workshop management module includes five sections which are production plan, product components and techniques, picking lists, works and equipments. Figure 20 below describes the requirements and needs of the workshop management module, and the contents of each session.

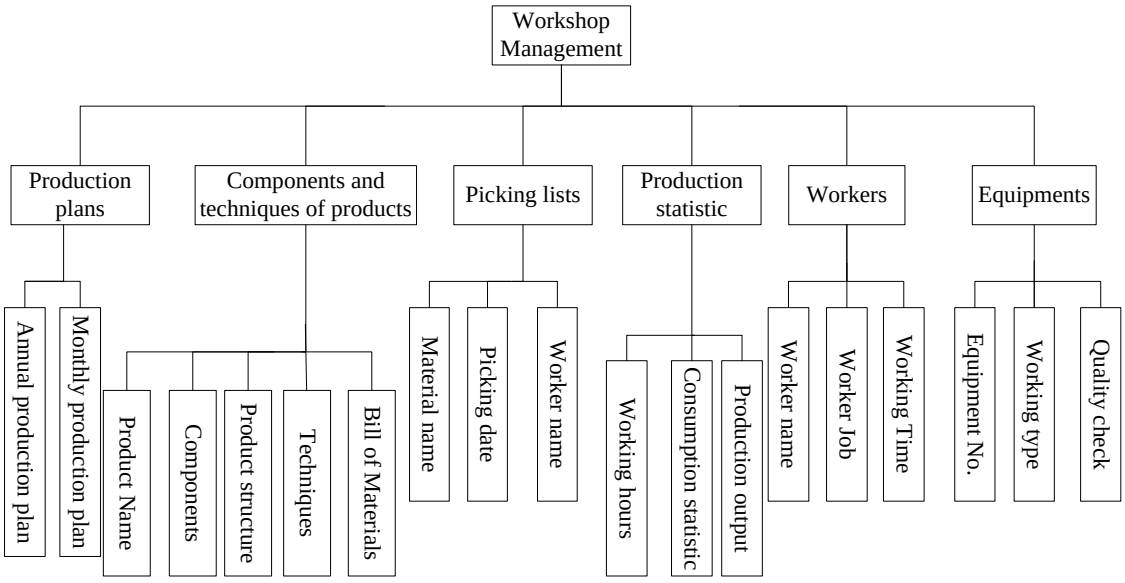

Figure 20. Requirements and Needs of Workshop Management Module

The warehouse management module is divided into six sections: storage notes, delivered notes, materials information, finished-products information, item query, unqualified records. The requirements and needs of the warehouse management module and the contents of each session are showing in Figure 21.

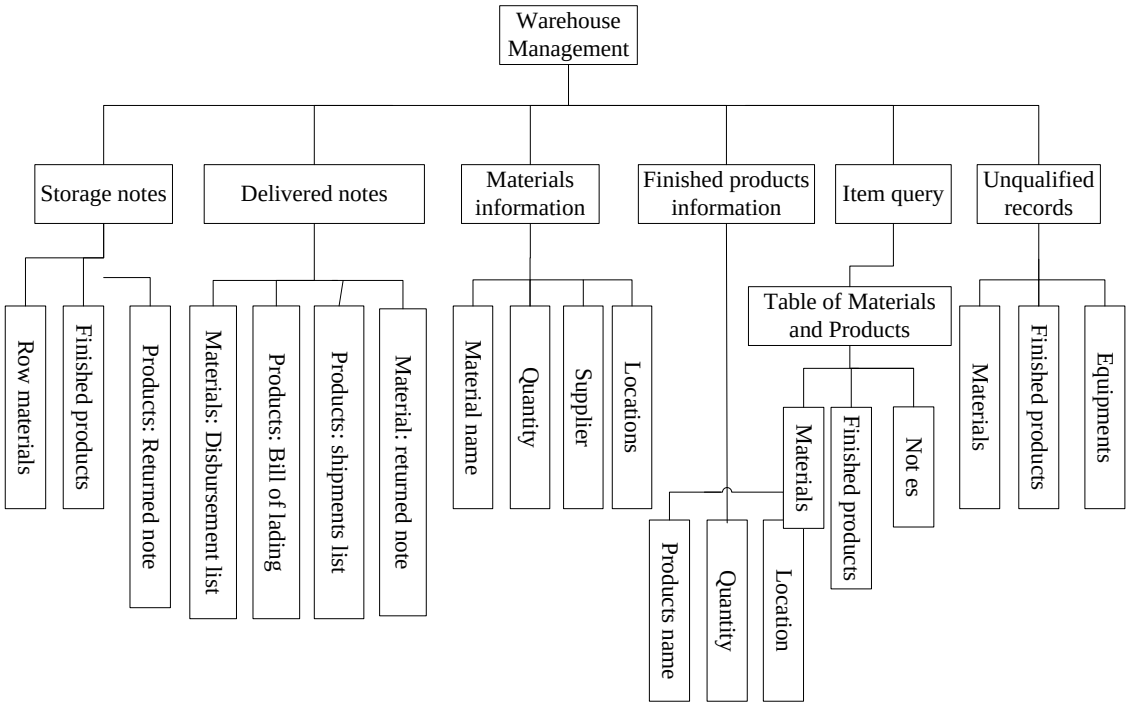

Figure 21. Requirement and Needs of Warehouse Management Module

Quality inspection management module mainly focuses on managing the quality inspection plan and inspection reports of material, products and equipments. The requirements and needs of the quality inspection management module and the contents of each session are shown in Figure 22.

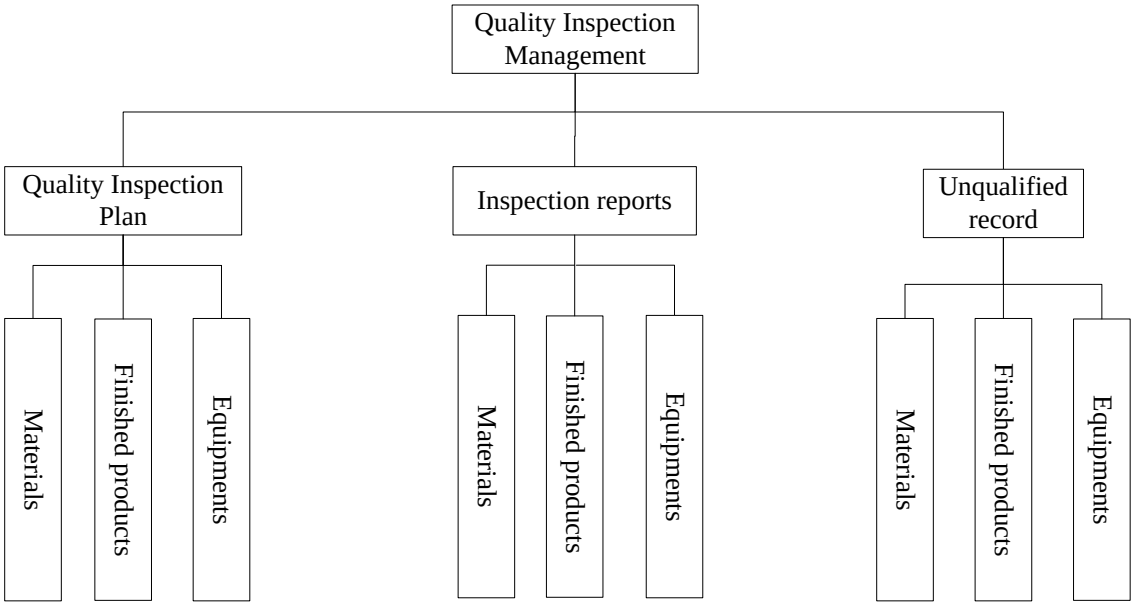

Figure 22. Requirements and Needs of Quality Inspection Management Module

4.2.2 System structure of IMS

In this section, the main work is to build the system structure of IMS based on the theoretical principle of B/S architecture. The system has three layers which are the display layer, logic layer and database layer, which are shown in Figure 23.

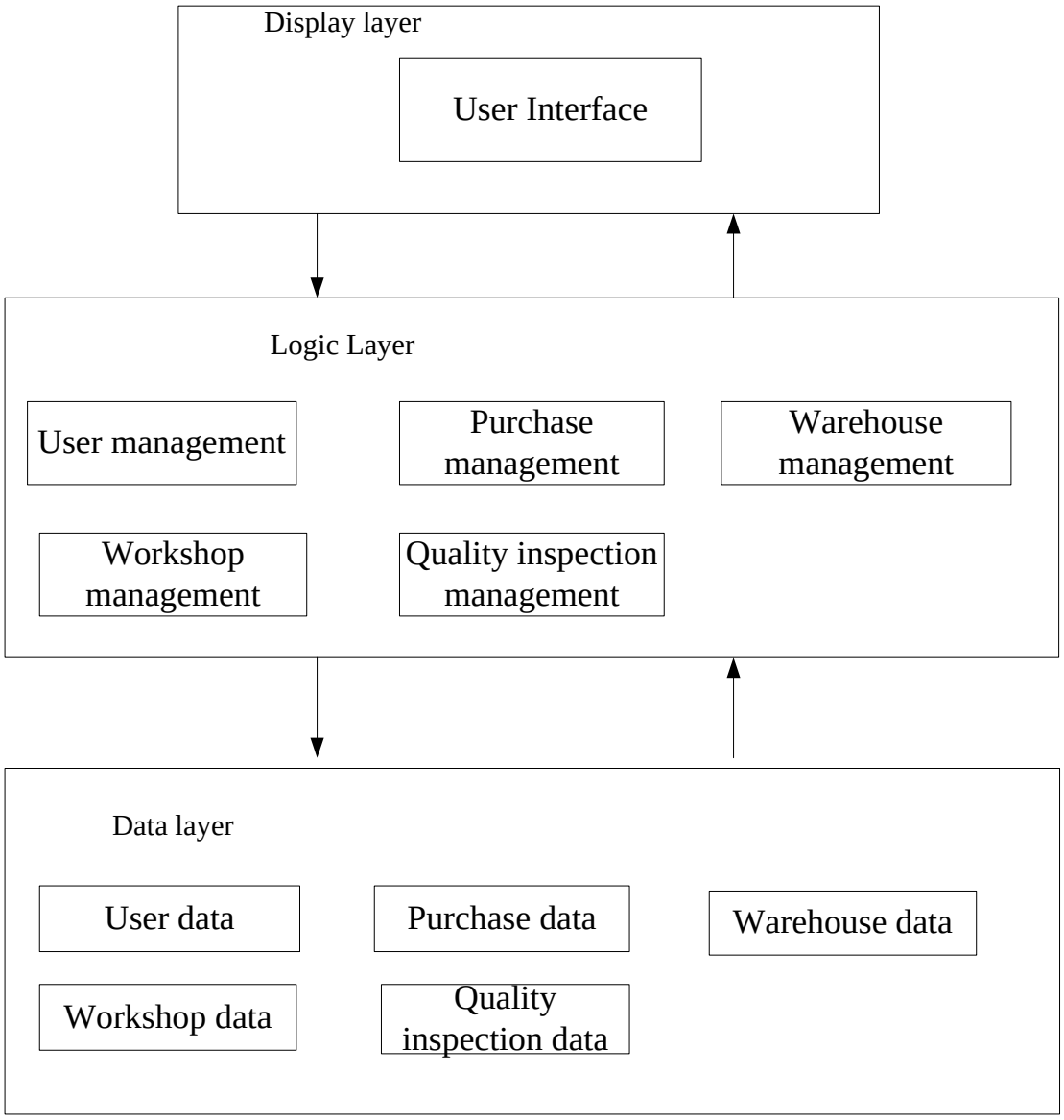

Figure 23. The System Structure of IMS Based on B/S architecture

The functions of each layer are discussed in the following:

1) Display layer

"Display layer is user interface to display the content that users want to access. It also accepts the data users input and response to users' request from browser. The user interface can be realized by HTML code" (Li & Guan 2009.).

2) Logic layer

In the logic sections, there are five modules are which are user management module, purchase management module, warehouse management module, workshop management module, and quality inspection module. The modules in logic layer can be implemented with ASP.net, JSP and other technologies.

The user management module is in charge of managing and saving the information about users. The specific contents have been mentioned in Figure 18. This module has the following functions as creating a new user, deleting a user, modifying the data and permission of a user and checking user data.

The purchase management module is responsible for managing information of the purchase department. It includes the department manager, purchasers, and activities for purchasing. The module can realize the functions as follows: making and managing the purchase plan, supplier information, purchase orders, material received note, and returned materials.

The workshop management module is used to organize and complete the production targets, manage manufacturing processes and production technologies. The module can manage and save the production plans, annual and monthly production plans, product ingredient, record the progress of manufacturing, make picking list, manage equipments, allocate worker and working time, record the output and quality of the production and check the delivery date.

The warehouse management module realizes the functions as following creating new materials and products, checking the information of materials and products, checking the shipments date, recording the name, quality and quantity of the material and the finished products, the notes of storage and delivery of the materials and the finished products, and checking the bills.

The quality inspection management module can realize the functions as following managing the quality inspection plan, quality inspection files and quality problem reports.

3) Data layer

The data layer is database server used to store data. It includes the user database, purchase database, warehouse database, workshop database, and quality inspection database.

4.3 IMS for Tiansuo Company

The first two sections of this chapter described the system structure and functional requirements and needs of IMS system which are the basic knowledge to develop this section. Therefore, in the third section of this chapter, the main work focuses on building the system model rather than considering the details of codes and programming. I use Microsoft Visio as the development tool for building the UML diagram, including the user case diagram, sequence diagram, activity diagram and deployment diagram. These diagrams will be made to describe and organize the workflow of the planned IMS of Tiansuo Company.

4.3.1 System Use Case Diagrams

The use case diagram usually is used to define the key elements and the processes that form the system. The key elements are termed as “actor”, and processes are referred to as “use case”. The use case diagram is made up of actors, use case and system boundary. The use case diagram shows the interactions between the actors and their use cases, defines the requirements and needs of the system, and captures the business processes and functional aspects of the system. (Chitnis & Tiwari& Ananthamurthy 2003.)

Due to the large number of businesses among four departments, I use the one use case diagram to define all businesses of each department. Firstly, the activities of the use management module are below in Figure 24:

Actors: system administrator

Use cases: create use, delete use, update use and edit use.

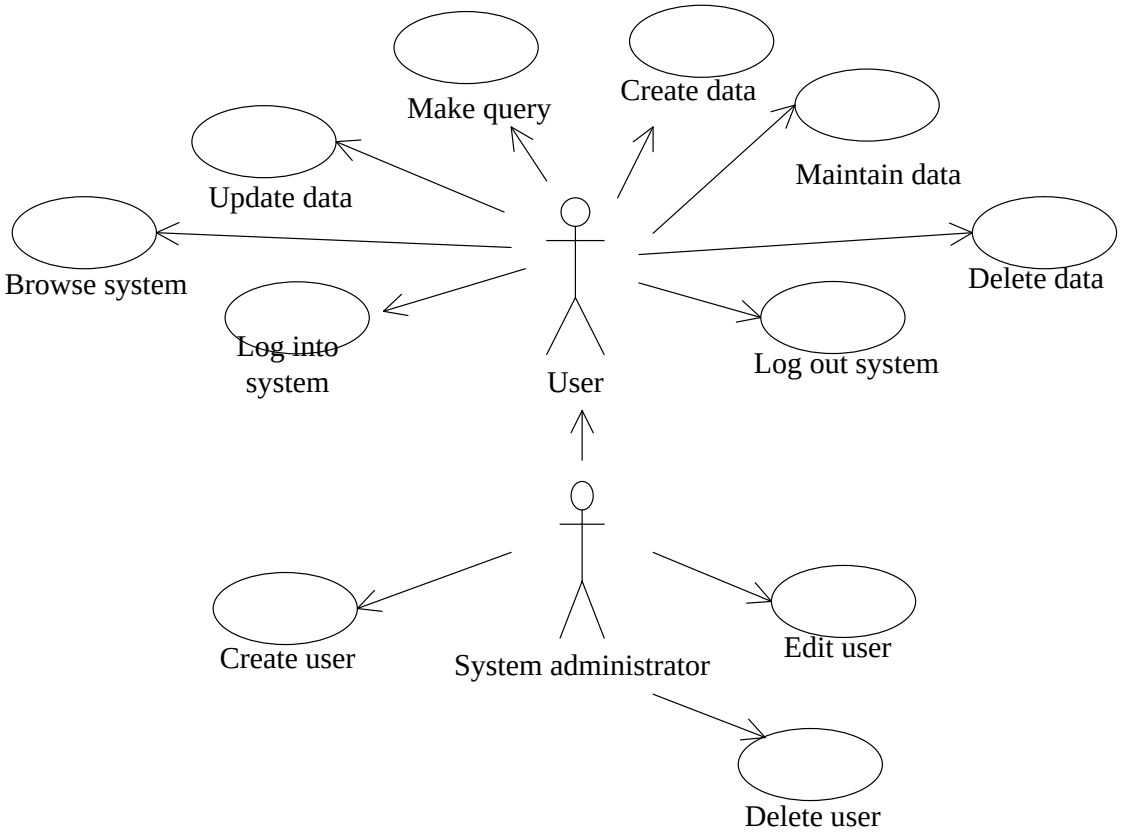

Figure 24. User Case Diagram of Use Management Module

Figure 25 shows the interactions between the actors and their use cases of the purchase management module.

Actors: purchase manager, purchaser

Use cases: manage purchase plan, view purchase reports, generate purchase order, manage supplier information, manage material received note, and manage returned material note.

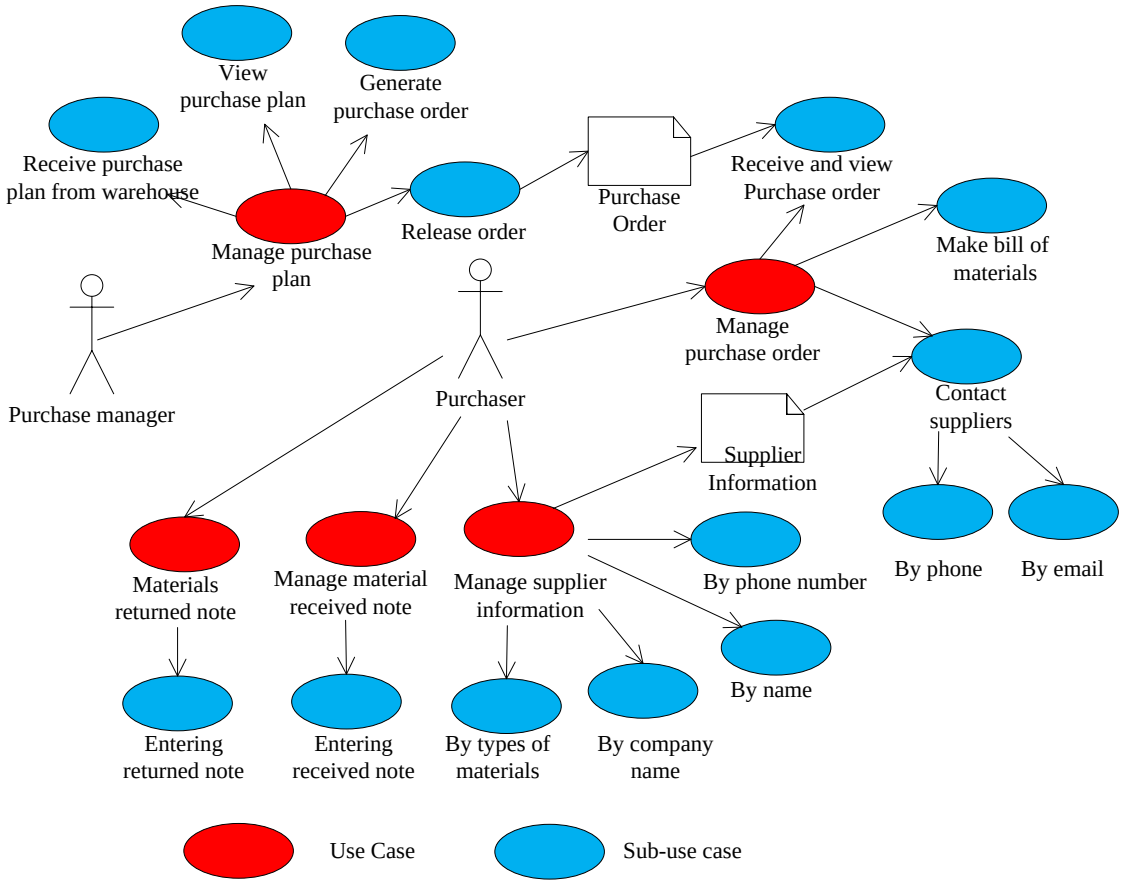

Figure 25. Use Case Diagram of Purchase Management Module

Figure 26 shows the actors and their use cases of the workshop management module.

Actors: workshop manager, designer

Use cases: manage production plan, generate production order, make picking list, make reports of production, make bill of materials, allocate works, allocate working time, and design technologies of producing products.

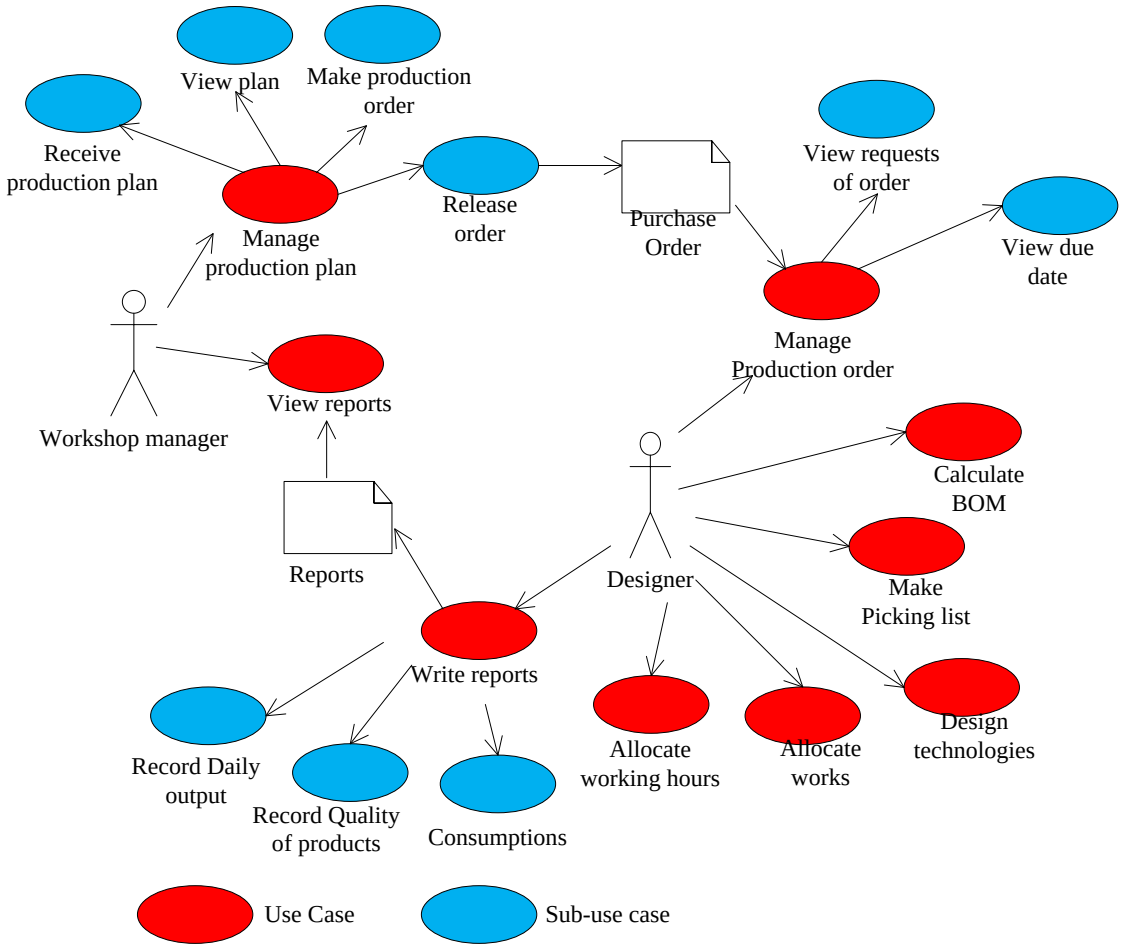

Figure 26. Use Case Diagram of Workshop Management Module

Figure 27 shows actors and their use cases of the warehouse management module

Actors: warehouse manager, book-keeper

Use cases: query information of materials and products, check inventory, manage warehousing entry note, manage warehouse outbound note, generate material and product table, and manage information of materials and finished products.

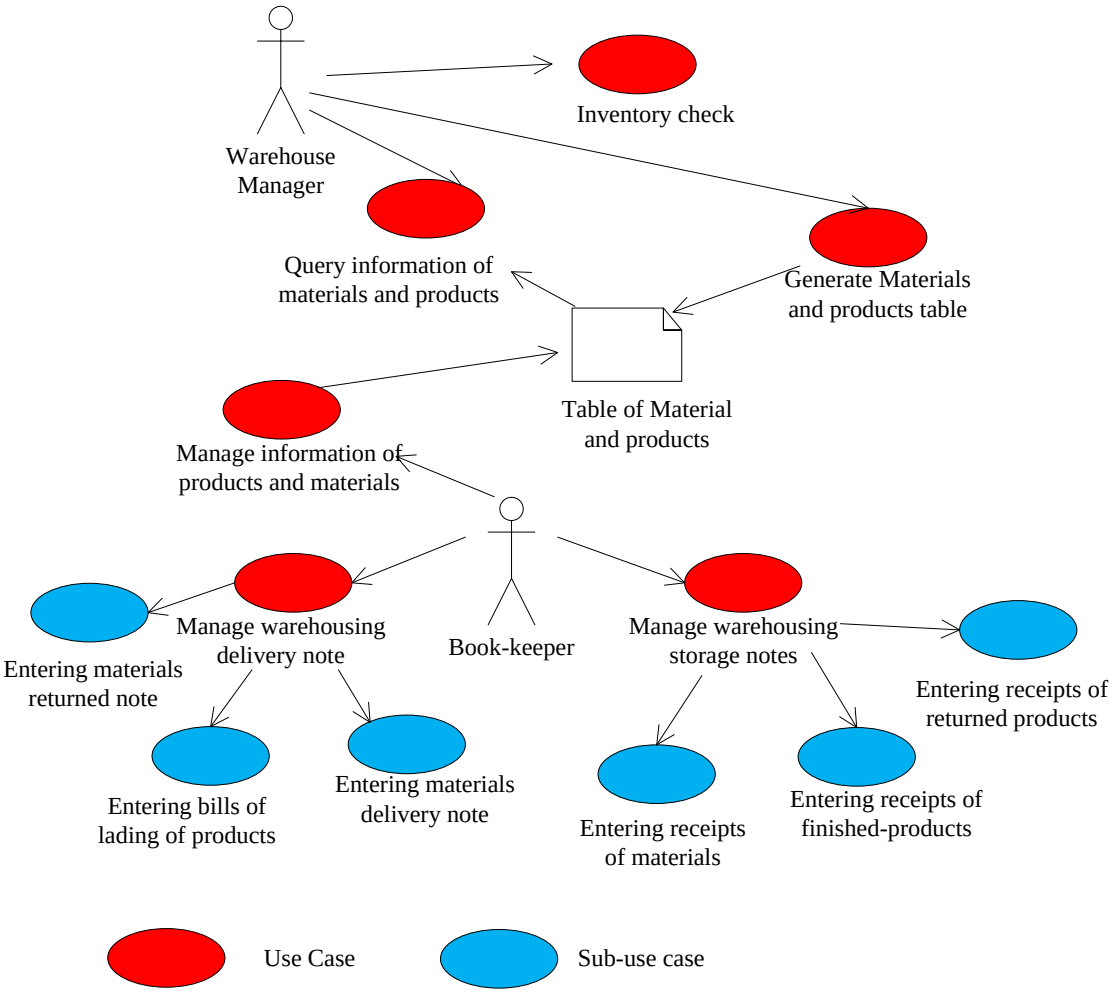

Figure 27. Use Case Diagram of Warehouse Management Module

Figure 28 shows actors and their use cases of the quality inspection management module.

Actors: inspection manager, inspector

Use cases: manage inspection plan, view application of quality inspection, generate inspection list, and make reports of inspection.

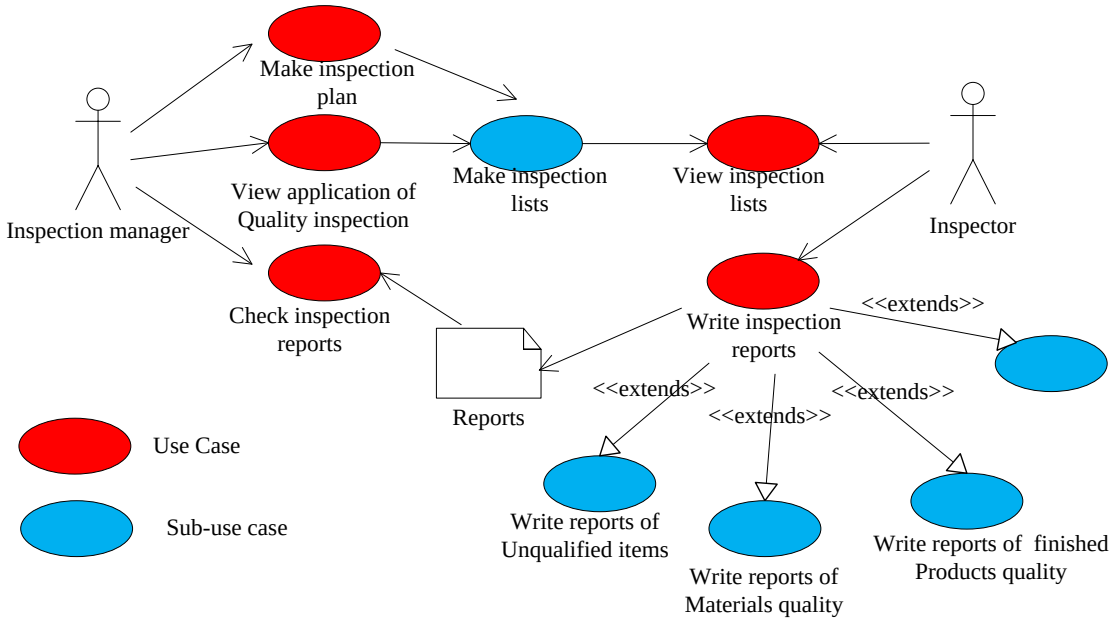

Figure 28. Use Case Diagram of Quality Inspection Management Module

4.3.2 System Sequence Diagram

"The sequence diagram can be used to primarily to show the interactions between objects in the sequential order that those interactions occur". For the business of organization, sequence diagram is suitable for communicating how the business works through indicating the interaction among the largely number of objects. Sequence diagram can be used as requirements documents for the implementation of IMS. "One of the primary uses of sequence diagram is transforming the requirements expressed as use case to the more high and formal level of refinement". The sequence diagrams were built by the requirements of use case. (Bell 2004.)

The sequence diagram of the users log in to the suggested IMS is shown below in Figure 29.

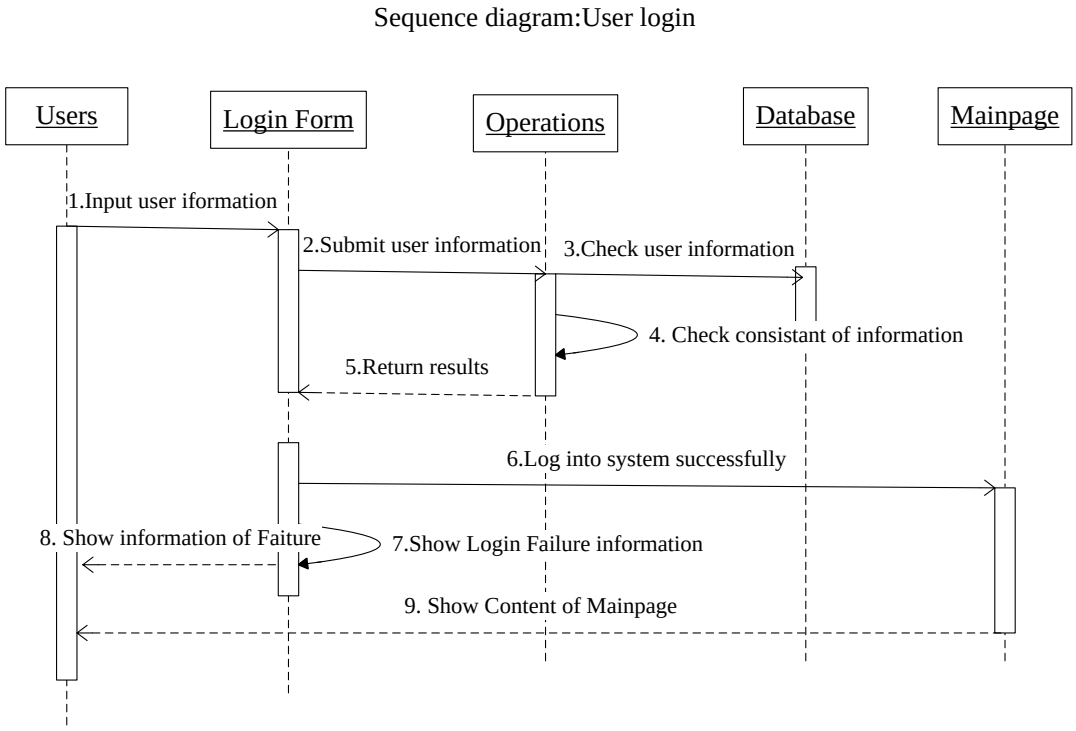

Figure 29. Sequence Diagram of Login System

The sequence diagrams of users make query the information of the materials and the finished product is shown in Figure 30.

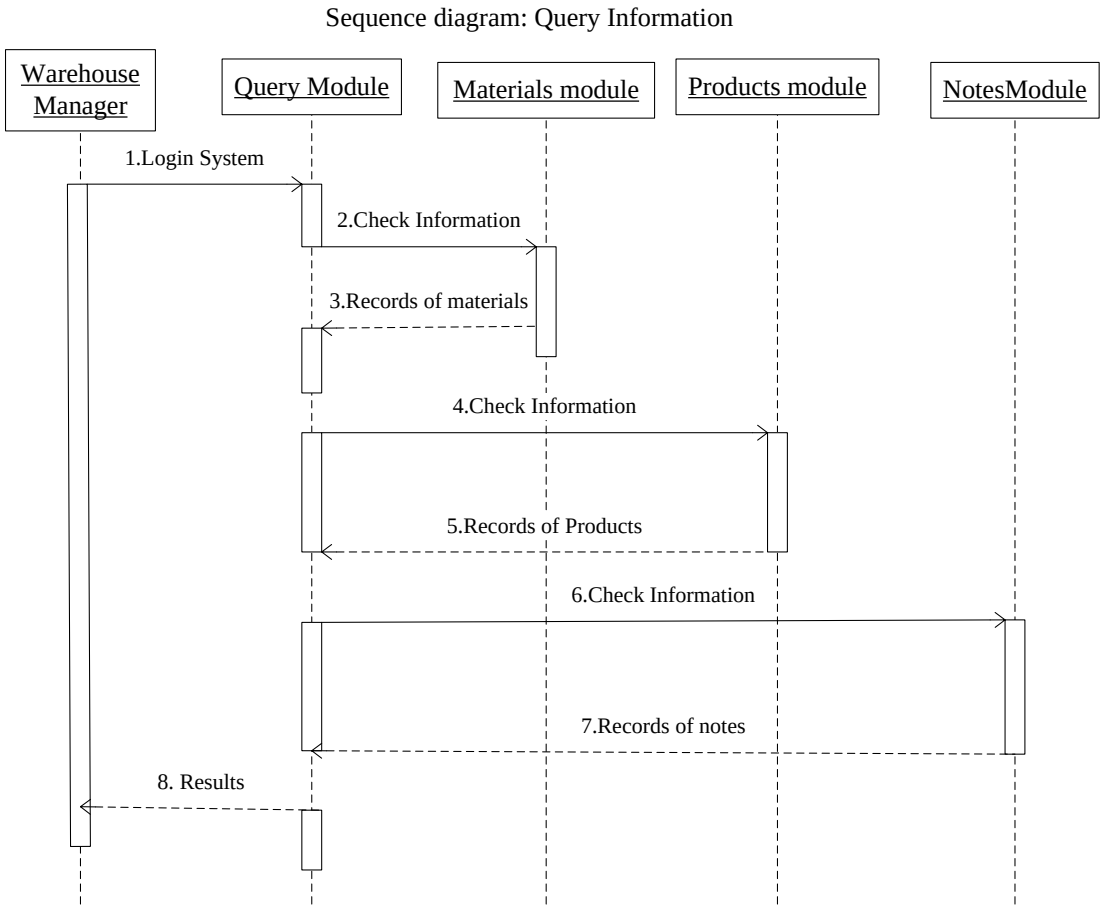

Figure 30. Sequence Diagram of Query Information

4.3.3 System Activity Diagram

"The activity diagram is used to display the sequence of activities. It shows the workflow from a start point to the finish point, and details the many decision paths that exist in the progression of events contained in the activity. Activity diagrams are useful for business modeling where they are used for detailing the processes involved in business activities". (Sparx System Pty Ltd 2012).

The first activity diagram describes the workflow through three departments. The whole sequence of activities is as Figure 31.

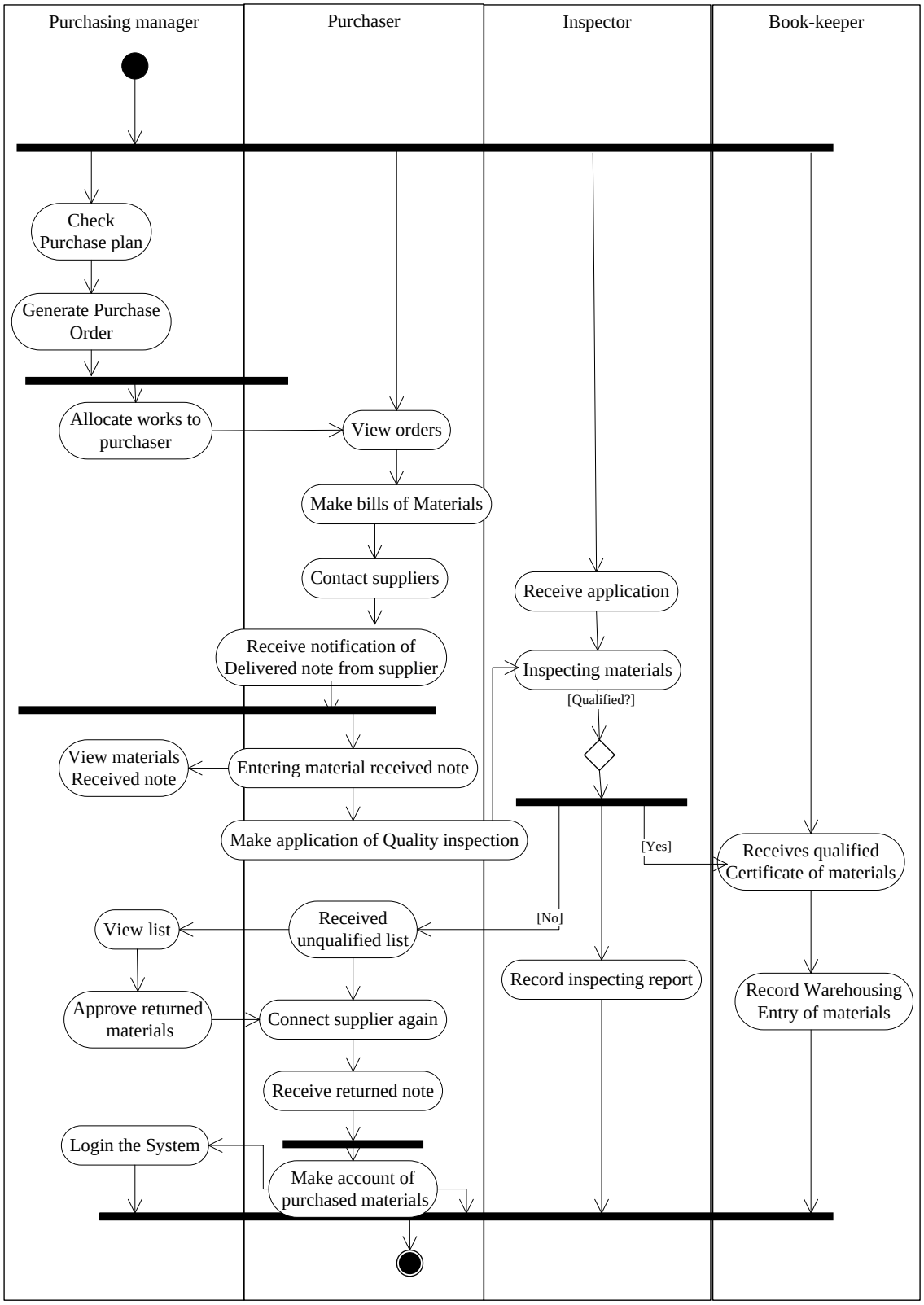

Figure 31. Activity Diagrams of Purchasing, Inspecting, Returning and Storing

Figure 21 activity diagram is made by connecting the use cases of the actors in above use case diagrams. There are four business activities are included in this figure.

1. Purchasing materials from suppliers
2. Quality inspection of purchased materials
3. Returned unqualified materials to supplier
4. Storing qualified materials into warehouse.

Figure 32 below displays the whole activities from preparation for manufacturing products to storing finished products into the warehouse. There are also three departments that are attended in this activity diagram. The business activities in this diagram are as following:

1. Picking the raw materials from warehouse
2. Inspecting the quality of equipment
3. Calculating and recording cost of the production
4. Inspecting the quality of the finished products
5. Storing the finished products into warehouse

The detailed processes of each business are displayed in Figure 32.

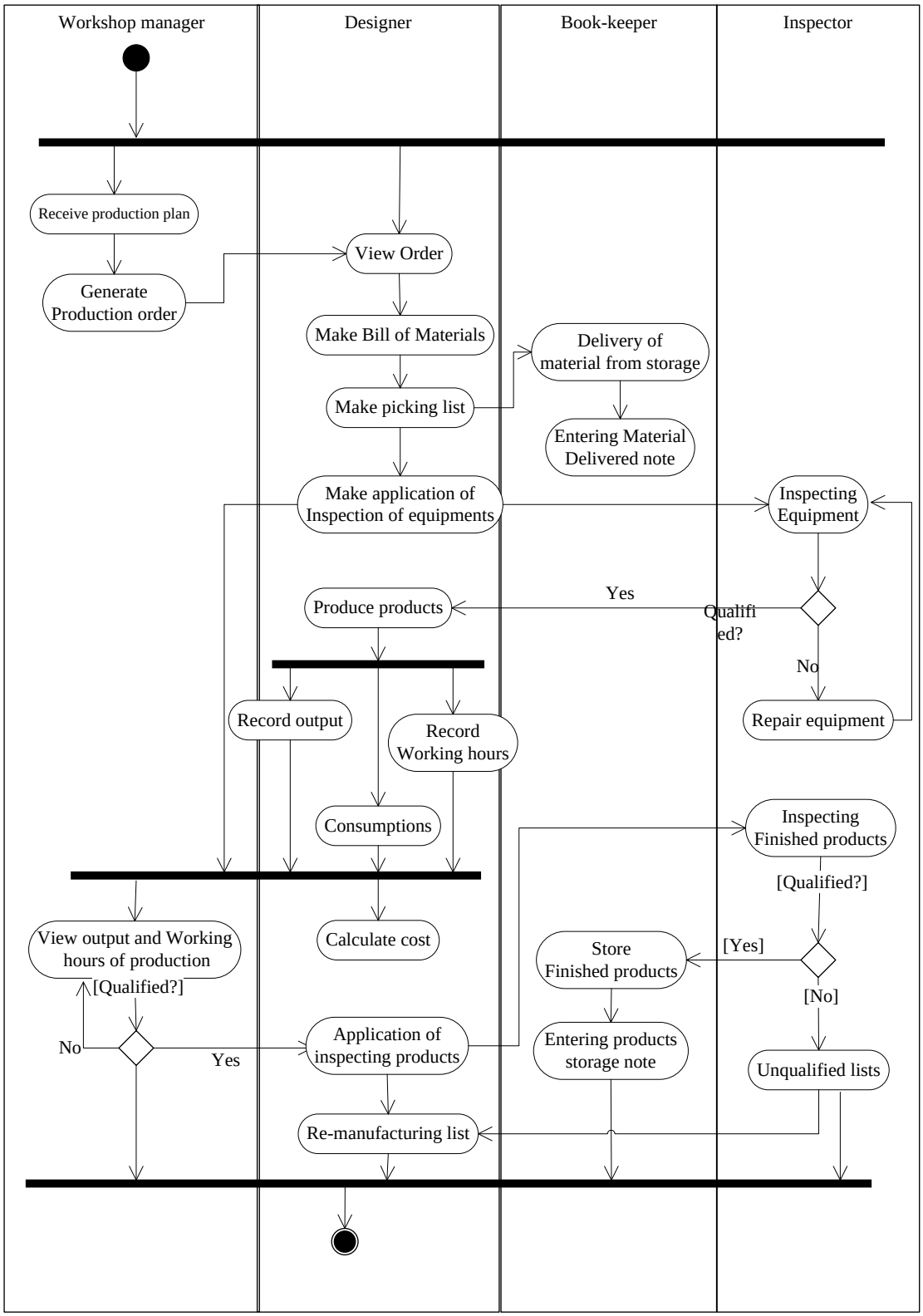

Figure 32. Activity Diagram from Preparation to Storage of Finished Products

4.3.4 Deployment Diagram

Deployment diagram is used to display the physical relationships among the components of software and hardware. Deployment diagram is suitable to indicate how components and objects are routed and moved in a distributed system. (eTuorials.org 2012) Figure 33 shows the relationships among the components of the B/S three layers.

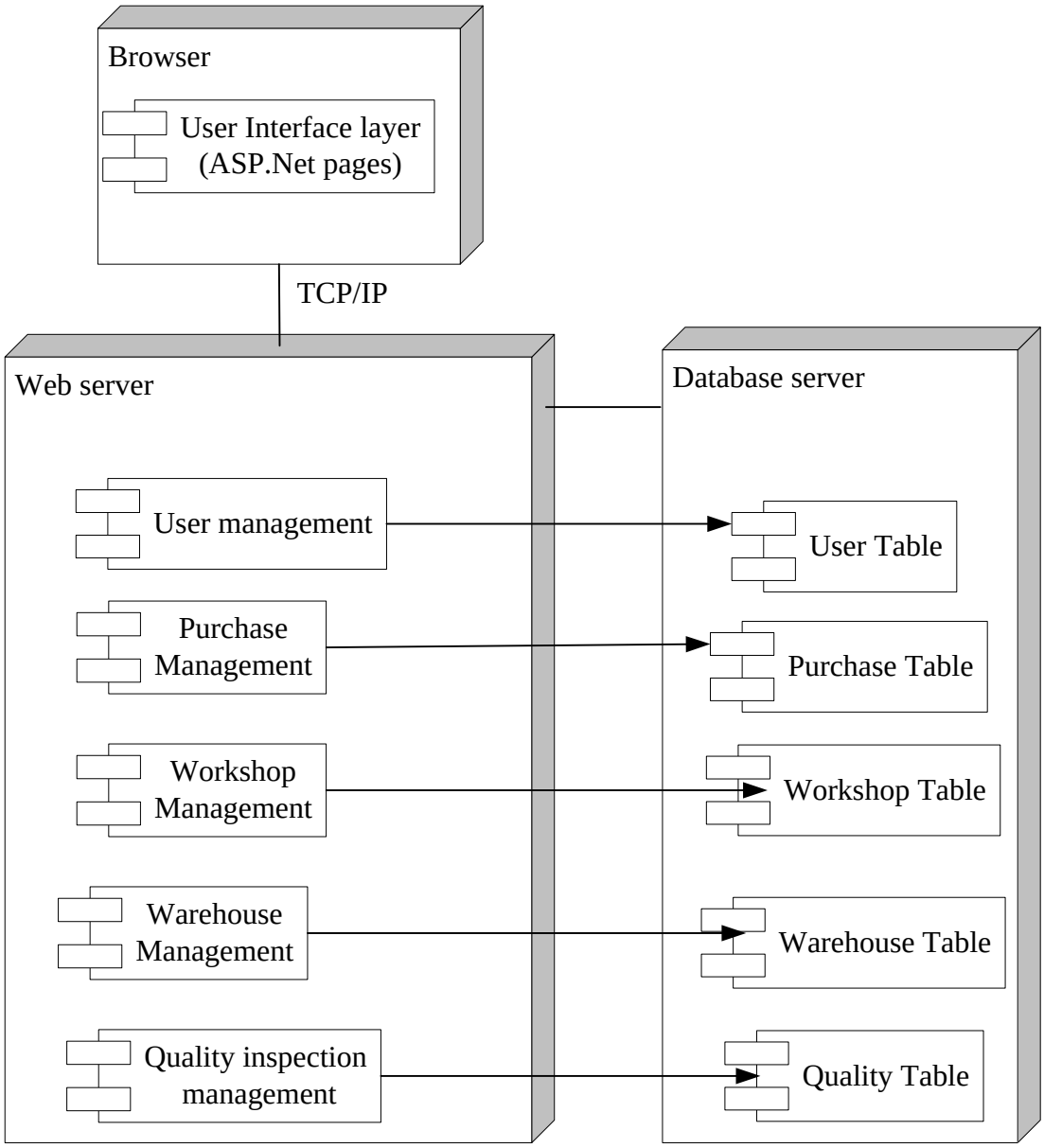

Figure33. Deployment Diagram of Planned IMS

5 RESULT OF THE STUDY

In the system design chapter, all the system functions have been described in detail by UML diagrams. This chapter is used to answer the second research question. One of the main aspects of this chapter is giving suggestions which will help the case company in the implementation stage of the planned IMS. Another aspect of this chapter is evaluating the planned IMS through SWOT analysis.

5.1 Suggestions for the implementation of the IMS

This section describes the suggestions which are necessary to be followed during the implementation stage. There are two alternative methods to implement this system.

The first method is to use programming and database technologies to implement this system. There are some suggestions for developing this system, including operation system, development tools, development platform, and database technology. The system operation environment of this information management system includes the software operation platform and hardware operation platform. This IMS can be operated under the system environment of Windows XP, Vista, and 7. The advantages of the Windows operating system are listed below with short descriptions of each.

First, there are a large number of hardware supports. The Windows operating system is designed to be compatible with the largest combination of PC hardware. Secondly, Windows provides a huge user base to any manufacturer software. Large numbers of software are designed to run primarily with Windows. The last advantage of Windows is user familiarity. With the appearance of the Internet and email, Windows has become the brand associated with home and office computing. “Windows remains the most popular and recognizable by virtue of its earlier successes and the work done by each release of the operating system to maintain this user familiarity”. (Cawley 2010.)

The hardware operation platform is detailed in Table 2.

Table 2. Hardware Operation Platform

Hardware	Configurations
Processor:	Pentium II300 above
Internal Memory:	More than 500M
Disk Space:	More than 3G
Video card:	VGA
Monitor:	Normal color monitor

ASP.NET is a new technology and unified web platform for building websites and enterprise-class applications. ASP.NET helps the programmer or developer to build web applications faster than other platforms due to the rich class libraries of Microsoft .net framework. ASP.NET is the next version of ASP, and remedies the lacks of ASP. ASP.NET generally is built on .NET framework for building web applications. ASP.NET is a part of .NET framework, so it has the capability to utilize the rich class libraries of .NET framework. ASP.NET has some features that make the developers use "ASP.NET as the best application technology rather than ASP or any other web programming technologies". The features of ASP.NET are as follows: HTML controls, HTML server controls, web server controls, and caching. Microsoft has introduced Visual Studio 2010 as the development tool for building ASP.NET applications in less time. (Exforsys Inc. 2010.)

The database server of IMS can be built by MySQL. MySQL is a free and open source database. It is used across all the major operation systems from UNIX to Windows. "It provides ease of installation, simplicity and fast data access to an array of clients from Java based system to .NET application." Some advantages to use MySQL on Windows operating system are as follows: free use, fast access data, stable and used by large number of organization, popular among developers, and cross platform. (Khan 2012.)

The second method is to use software package as the base to develop this system. The system structure and functional structure of each module of IMS have been planed and designed. According to the results of system functions, there are some software packages that can be used to support this system. They are presented in Figure 34.

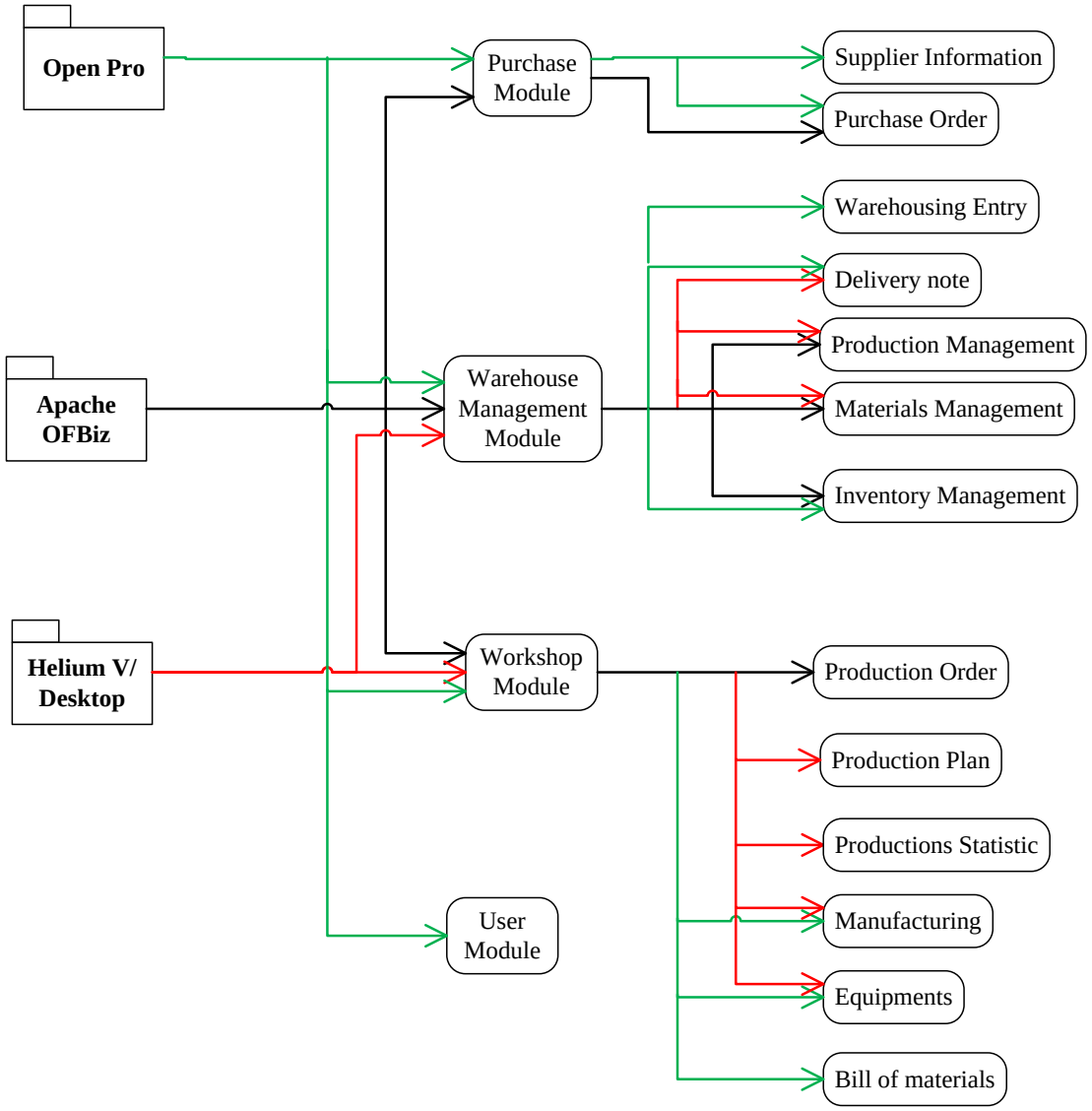

Figure 34. Software Packages for Implementing IMS

Figure 34 presents three open source software packages, and the interactions between software packages and the modules of IMS. Helium V is available as open source ERP suite since October 2010. The key customers are small and medium-sized company. It

provides some modules that are useful to implement the suggested IMS. (The Green House 2007). “OpenPro software is a complete end-to-end solution that includes financials, supply chain, e-commerce, manufacturing and customer relationship management. OpenPro incorporates a suite of integrated products that enables to move seamlessly between all facets of business, from order management to the plant floor” (OpenPro, Inc 2011). Apache OFBiz is also an open source. The features of Apache OFBiz are described in http://ofbiz.apache.org/. This package can be downloaded from http://ofbiz.apache.org/download.html.

5.2 Evaluation of the Quality of the suggested IMS: SWOT analysis

This section will evaluate the quality of the suggested IMS by SWOT analysis. SWOT analysis will help the case company to understand their situation and the value of IMS. Table 3 presents the results of SWOT analysis about this suggested IMS.

Table 3. SWOT analysis of recommended IMS

Strengths:	Weaknesses:
1. Current business processes are analyzed 2. The working efficiency increases 3. Resources are fully used and managed 4. The capacity of the supply and demand of the materials and products improves	1. Do not cover yet all the business functions 2. Planned supportive functions not tested in practice 3. Implementing the suggestions require some accommodating

Opportunities:	Threats:
1. Cooperation with other companies is now possible 2. The new business opportunities are increasing 3. Responding market change can happen quickly 4. Good relationships with suppliers and customers	1. System security threats 2. Change between the new business environment and the original environment 3. Lack of computer technique workers

6 CONCLUSIONS

Information management is playing an important role in the management of modern enterprises. Most enterprises prefer computer technology as tools to manage the information and data of their enterprise, human resource, products and service etc. With the current situation of Tiansuo Company, the capacity of information is growing larger than before. Therefore, it will be increasingly difficult to manage the information and data in an effective way, and to protect information in a security environment.

The objectives of this thesis are to make a designing scheme of information management system for Tiansuo Company, and to offer suggestions for implementing the suggested system. The objectives were achieved by indicating the requirements of Tiansuo Company which were gained through analyzing the current processes of the each business of the case company. This thesis presents the processes figure and descriptions of each business, and business requirements were marked by red symbols in each business process figure depicted previously in this text. There are large numbers of businesses among the six departments of the case company, and with the time limitation, this thesis was expanded by analyzing the businesses processes in production management.

During the designing process, the system structure of information management system was built by using the theoretical knowledge and the working principles of the three layered B/S structure firstly. The working principles of the three layered B/S structure was divided into three different layers as follows: the display layer, business logic layer and data layer. The system structure of the planned IMS was also designed by these three layers. After that, the requirements of each business of the case company were used as the base for making the overall structure of the IMS and the requirements and needs of each module of IMS. These also represent the requirements and needs of the display layer and business logic layer of the system structure.

UML modeling is an imperative part in the designing processes in order to expand and refine the requirements and needs of user and IMS which are created in the analysis phase. The main works of UML modeling were presenting the requirements of businesses and functional structures by the use case diagrams, sequence diagrams, activity diagrams and deployment diagram. The use case diagrams describe the requirements and functions of system. Sequence diagrams are used to refine the requirements in the use case diagrams, and how the objects interact. The activity diagrams show the detailed processes of each business activity. In addition, the deployment diagram presents the relationships among the components and objects of the three layers.

Based on the output of the designing process, there are two suggestions suggested for the case company for implementing this planned IMS. The first suggestion is the programmer can use Visual Studio 2010 as the tool to support ASP.NET platform, and the programming language will be decided by the programmer. MySQL was the suggested database system. The second suggestion is focused on the software package. The main work is to find the suitable packages which can be interact with the module of the IMS. Besides, the SWOT analysis was used to evaluate the quality of the suggested IMS.

Further research could focus on making this research scheme into an entity. The scope of businesses will be expanded into the entire businesses of the case company. This research will not stop until the case company uses IMS as an information management tool.

REFERENCES

Printed

Lukka, K. 2003. The constructive research approach. In L. Ojala & O-P. Hilmola (eds.) Case study research in logistics. Publications of the Turku School of Economics and Business Administration, Series B 1: 2003, 83-101.

Tiansuo Company 2011. Enterprise Production Management Handbook.

Not printed

Akrani, Gaurav 2011. What is Production Management? Meaning Definition Importance. KALYAN CITY LIFE. Downloaded 1 April, 2012. <http://kalyan-city.blogspot.com/2011/12/what-is-production-management-meaning.html>

Banks, Linda & Media, Demand 2012. Importance of the Management Information System. Downloaded 1 May, 2012. <http://smallbusiness.chron.com/importance-management-information-system-5256.html>

Bell, Donald 2004. UML basics: The sequence diagram. Downloaded 19 April, 2012. <http://www.ibm.com/developerworks/rational/library/3101.html>

Caplinskas, Albertas & Vasilecas, Olegas 2004. Information systems research methodologies and models. International Conference on Computer Systems and Technologies- CompSysTech' 2004. Downloaded 12 February, 2012. < http://ecet.ecs.ru.acad.bg/cst04/Docs/sIV/44.pdf>

Cawley, Christian 2010. Advantages of the Windows Operating System. Downloaded 21 April, 2012. <http://www.brighthub.com/computing/windows-platform/articles/62925.aspx#>

Chitnis, Mandar & Tiwari, Pravin & Ananthamurthy, Lakshmi 2003. Creating UML Use Case Diagrams. Developer.com. Downloaded 11 April, 2012. <http://www.developer.com/design/article.php/2109801/Creating-Use-Case-Diagrams.htm>

Collegiate Project Services 2009. Benefits of Implementing an ERP. Downloaded 13 April, 2012. <http://www.collegiateproject.com/articles/ERP%20Benefits.pdf>

Conjecture Corporation 2012. What is the difference between MRP and MPS? Downloaded 6 April, 2012. <http://www.wisegeek.com/what-is-the-difference-between-mrp-and-mps.htm>

Cortwell, Neoko 2009. Important of Technology in Business. Downloaded in 1 May, 2012. <http://ezinearticles.com/?Importance-of-Technology-in-Business&id=2237597>

eTuorials.org 2012. Deployment Diagram. Downloaded 19 April, 2012. <http://etutorials.org/Programming/UML/Chapter+10.+Physical+Diagrams/Deployment+Diagrams/>

Exforsys Inc 2010. Introduction to ASP.NET with C#. Downloaded 21 April, 2012. <http://www.exforsys.com/tutorials/asp.net/introduction-to-asp.net-with-csharp.html>

Java and J2EE Reference 2012. What is the C/S and B/S. Downloaded 2 April, 2012. < http://www.anyang-window.com.cn/what-is-the-c-s-and-b-s/>

Khan, Faisal 2012. Accessing MySQL Database with ASP.NET. Downloaded 21 April, 2012. <http://www.stardeveloper.com/articles/display.html?article=2003052201&page=1>

Li, Hongxin & Guan Keqing 2009. RBAC modeling based on B/S architecture and the application in SET payment system. Dongbei University of Financial and Economics, Dalian, China. Downloaded 9 April, 2012. <http://www.academypublisher.com/proc/isip09/papers/isip09p387.pdf>

Logisitik.com 2012. The Master Production Schedule (MPS). Downloaded 6 April, 2012.
<http://www.logisitik.com/learning-center/the-master-production-schedule.html>

Maguire, Martin & Bevan, Nigel 2002. User requirements analysis. Kluwer Academic Publishers. Downloaded 7 April, 2012.
<http://nigelbevan.com/papers/WCC_UserRequirements.pdf>

Management-Hub.com 2012. General Perspective of Information Management. Download 2 February, 2012.
< http://www.management-hub.com/information-management.html >

OpenPro, Inc 2011. OpenPro and IBM Information Page. Downloaded 25 April, 2012.
<http://www.openpro.com/company_erpibm.html>

Robertson, James 2005. 10 principles of effective information management. Step Two Designs. Downloaded 28 March, 2012.
< http://www.steptwo.com.au/papers/kmc_effectiveim/index.html >

Reed, Anita 2002. The constructive approach in management accounting. Program in Accounting University of South Florida. Downloaded 3 February, 2012.
<http://maaw.info/ArticleSummaries/ArtSumKasanenetal93.htm>

Sparx System Pty Ltd 2012. UML2 Activity Diagram. Downloaded 19 April, 2012.
<http://www.sparxsystems.com.au/resources/uml2_tutorial/uml2_activitydiagram.html>

The University of Texas at Austin 2011. Document analysis. Lastupdated 21 September, 2011
<http://www.utexas.edu/academic/ctl/assessment/iar/teaching/plan/method/doc-analysis.php>

The Green House 2007. Helium V. Downloaded April 25, 2012.
<http://www.kloxo.webminos.eu/st-HeliumV#Features>

Yang, Bensheng & Wang, Qiaoyun & Zhang, Fangming 2009. Security Architecture Design of Bidding MIS Based on B/S. School of Information & Electronic

Engineering, Hebei University of Engineering, Handan, China. School of Economics & Management, Tang Shan Teacher's College, Tangshan, China. Download February 3, 2012.
<http://www.academypublisher.com/proc/iwisa09/papers/iwisa09p74.pdf