SUPPLIER EVALUATION SYSTEM
FOR PACKAING INDUSTRY

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering in Engineering Management
The Regional Centre for Manufacturing Systems Engineering
Faculty of Engineering
Chulalongkorn University
Academic Year 2004

ISBN 974-17-6429-4

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ระบบการประเมินผู้ขาย
สำหรับอุตสาหกรรมบรรจุภัณฑ์

นางสาว สุภาภรณ์ สงวนศักดิ์ภักดี

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

วิทยานิพนธ์ฉบับนี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
สาขาการจัดการทางวิศวกรรม ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2547

ISBN 974-17-6429-4

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

Thesis Title	Supplier Evaluation System for Packaging Industry
By	Ms. Supaporn Sa-nguansakphakdee
Field of Study	Engineering Management
Thesis Advisor	Assistant Professor Rein Boondiskulchok, D.Eng.

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สุภาภรณ์ สงวนศักดิ์ภักดี: ระบบการประเมินผู้ขาย สำหรับอุตสาหกรรมบรรจุภัณฑ์ (SUPPLIER EVALUATION SYSTEM FOR PACKAGING INDUSTRY) อ.ที่ปรึกษา: ผศ.ดร. เหรียญ บุญดีสกุลโชค, 97 หน้า, ISBN 974-17-6429-4.

วิทยานิพนธ์ฉบับนี้เป็นการศึกษาเกี่ยวกับ การประเมินผู้ขายและการจัดการข้อมูลของฝ่ายจัดซื้อสำหรับอุตสาหกรรมบรรจุภัณฑ์ จุดประสงค์ในการศึกษาเพื่อจัดการข้อมูลพัฒนาระบบการประเมินผู้ขาย จากการศึกษาบริษัทตัวอย่างพบว่า มีปัญหาหลายประการเกี่ยวกับการประเมินผู้ขาย ในด้านการประเมินผู้ขายปัจจุบันนั้น ขึ้นอยู่กับประสบการณ์ และ ความเห็นของผู้ประเมิน ดังนั้นผลของการประเมิน จึงไม่มีมาตรฐาน นอกจากนี้การประเมินนั้นใช้เวลานาน ในการรวบรวม ข้อมูลต่างๆ ที่จำเป็นในการประเมินผู้ขาย และในด้านการจัดเก็บข้อมูลยังไม่สนับสนุนการระบบประเมินผลผู้ขาย และมีข้อผิดพลาดหลายอย่างเช่น ข้อมูลซ้ำซ้อน และการพิมพ์ข้อมูลผิดพลาด ได้มีการจัดตั้งทีมงานซึ่งประกอบไปด้วยตัวแทนจากฝ่ายที่เกี่ยวข้องเพื่อ ร่วมกันกำหนดวิธีการประเมิน และเกณฑ์การประเมินขึ้นมาใหม่สำหรับประเมินผู้ขายในบริษัท

งานวิจัยนี้เริ่มจากการวิเคราะห์ และออกแบบวิธีการทำงาน และความต้องการสารสนเทศของผู้ใช้งานสำหรับการประเมินผู้ขายของบริษัทที่เข้าไปศึกษา ระบบการประเมินผู้ขายใหม่ได้ใช้วิธีถ่วงน้ำหนัก วัดการดำเนินงานของผู้ขายในด้านคุณภาพของสินค้า การจัดส่ง การบริการ ราคา และ ความน่าเชื่อถือ ขั้นตอนต่อไปคือออกแบบโครงสร้างฐานข้อมูลและโครงสร้างการใช้งานโปรแกรม และนำระบบที่ออกแบบนั้นไปพัฒนาเป็นโปรแกรมต้นแบบสำหรับการประเมินผู้ขาย ระบบประเมินผู้ขายที่ออกแบบนั้นพัฒนาจาก Visual Basic 6.0 Microsoft Access version 2000 เป็นระบบจัดการฐานข้อมูล และ Crystal Report เป็นการออกรายงาน

โปรแกรมที่พัฒนาขึ้นนี้ได้ถูกนำไปใช้กับบริษัทต้นแบบ ทำให้เกิดประโยชน์ ในด้านการประเมินผู้ขาย กล่าวคือมีความรวดเร็วและมีมาตรฐานเดียวกัน และสารสนเทศมีความถูกต้องมากขึ้น

ภาควิชา …….-…… ลายมือชื่อนิสิต ……..

สาขาวิชา …..…การจัดการทางวิศวกรรม…..…… ลายมือชื่ออาจารย์ที่ปรึกษา …….....

ปีการศึกษา ……2547……..

46716279 21: MAJOR ENGINEERING MANAGEMENT
KEYWORD: SUPPLIER EVALUATION SYSTEM

SUPAPORN SA-NGUANSAKPHAKDEE: SUPPLIER EVALUATION SYSTEM FOR PACKAGING INDUSTRY. THESIS ADVISOR: ASSISTANT PROFESSOR REIN BUNDISKULCHOK, D. ENG., 97, ISBN 974-17-6429-4.

This thesis studied supplier evaluation system and database management system of purchasing department for packaging industry. The purpose of the thesis was to manage data originated in purchasing department and develop system for evaluating suppliers. The current rating supplier system was not standardized because it was dependent on buyer's experiences, judgments and satisfactions. The process of evaluation was considerably time-consuming starting from gathering data that are essential for assessing the supplier performance. Also the data-collecting process produced lots of errors such as data duplication and misspelling. A Supplier Evaluation Team from relevant departments involving with in making evaluation was appointed to establish a formalized supplier evaluation system and set performance criteria in assessment.

The research started with the analysis and design of the work procedures, following with the information requirement forms that the users. The supplier evaluation system applied the weight-point method for making assessment, which are based on major supplier's performance criteria, covering quality, delivery, price, service and reliability. After forming data, the structures of database and program application are designed. Finally the designed system is developed to be prototype software for supplier evaluation. The proposed system was developed on the base of Microsoft Visual Basic 6.0 program, used Microsoft Access version 2000 as the database management system and Crystal report 9.0 as the reports.

The expected results of the proposed program, after implementing in the firm during the observation period are time reduction and standardization in evaluating process. Additionally, the information is likely to be more correct and complete.

Department ……..…..-…….. Student's signature…….....
Field of Study....Engineering Management….. Advisor's signature ……...
Academic Year …2004….

ACKNOWLEDGEMENTS

I wish to express my profound appreciation and gratitude to my thesis advisor, Assistant Professor Rein Boondiskulchok for his invaluable and helpful suggestion throughout the course of the thesis. Grateful thank are also extended to Professor Sirichan Thongprasert and Dr. Paveena Chaovalitwongse for giving helpful comments and suggestions.

Special thanks must give to the case study company: Ms. Sureerat Wasuthapithak and Mr. Kittisak Noonsed and the other staff members for their support and assistance.

Finally, I wish to express my deep appreciation and thanks to my beloved parents and my family. All of them have given me greatly with their strong support and care.

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CHAPTER 1
INTRODUCTION

1.1 Background of the Thesis

Today, the intense of competitive environment has forced many firms to focus on supply chain management to cope with highly increasing competition. A basic part of supply chain management is the purchasing function. The purchasing function has been receiving increasing importance as a critical supply chain management component. The main reason is due to the significant impact of material costs on profits, increased investments in advanced manufacturing and information technologies, and a growing emphasis on Just-In-Time (JIT) production. The vital goals of purchasing departments consist of obtaining the product at the right cost in the right quantity with the right quality at the right time from the right source. In the past, the aims of purchasing department emphasized only on buying goods at low cost and high quality. However, recently building long-term supplier relationships has become more important.

With the current focus on supply base reduction and long-term supplier relationships, supplier selection and evaluation process has gained importance recently, since most of the firms have been spending considerable amount of their revenues on purchasing. Supplier selection is widely considered to be one of the most important responsibilities of the purchasing function of management. Closely related to supplier selection is the ongoing management and evaluation of the supply base once the supplier has been chosen.

Supplier selection and evaluation are directly related to purchasing performance measurement and purchasing reporting because they provide the essential information of suppliers, including price, delivery reliability, quality and availability of their products. As a result, the above information should be managed in order to facilitate suppliers selecting decision-making in time.

1.2 Background of the company

ABC, established in 1964, is a leading manufacturer of high quality presentation boxes for such luxurious things as jewelry, pens, spectacles, coins & medals, watches, and perfumes. Other product lines are watch dials, watch cases and bracelets. Over 40 years of experience, the company is recognized such the world's leading and most notable brand names. At the outset of business, the company had started with ten workers as a family-owned business. Have been rapidly growing in terms of capacity and sales volume, the company has more than 5,000 employees, which includes three factories and has monthly sales exceeding 1 million units. However, now the company still manages as family-owned business. The ABC Company's philosophy is to manufacture the highest quality at reasonable prices and to focus on service excellent to its customers. Most of products are exported because almost eighty percent of customers are the well-known and prestigious companies such as watches categories: Rolex, TAG-HEUER, Perfumes: Channel, Christian Dior, and so on. Thus, quality is the most important element of the company's reputation.

1.3 Statement of the Problems

Each factory has its own key functions such as design, production line and store. However, the company organizes purchasing system in centralization. On the other words, the purchasing department is responsible for purchasing everything for all the company's departments and three factories. As a result, there are a wide variety of data that are essential to evaluate suppliers. Supplier performance criteria include objective (quantitative) measures and subjective (qualitative) measures. Most of objective variables lie within the following three categories:

Delivery performance - quantity, lead-time, and due-date
Quality performance - inbound shipment quality, quality improvement
Cost competitiveness - cost comparison, cost reduction

While subjective (qualitative) measures are in service areas assessing supplier performance such as problem resolution ability, ongoing progress reporting and corrective action response. The supplier performance measurement of the company is a manual operation including the method and systems to collect and provide information of the basic records (e.g. price, delivery, quality, and services) and making evaluation. With the

highly increasing internal demands, purchasing department needs a computerized system to measure, rate or rank supplier performance on a continuous basis. Recently, the purchasing department has kept the important records of supplier performance with Microsoft Excel and paper. This method leads to many problems of purchasing processes, which can be summarized as follows:

1. The process is very time-consuming and slow to find the record of supplier performance from Microsoft Excel because it continues bigger and bigger. Such doing so, it is also risk to disappear.
2. Slow purchasing processes (i.e. tracking such data of the historical price, reliability of delivery and quality in order to inform other departments) results from that purchasing staffs can not able to use the program altogether.
3. Lack of the purchasing reports that are necessary for supplier selections and evaluation.

1.4 Objectives of study

To develop supplier evaluation system for packaging industry.

1.5 Scope of the study

This study will cover the development of a program that can serve the current purchasing department's requirements as follows:

1. Management information system and Database system based on the current process and documents.
2. Generating reports that are essential for supplier selection / evaluation.
3. Making evaluation supplier following to the supplier measurement or Key Performance Indicators (KPIs) of supplier performance.

1.6 Methodologies

1. Study related journals, literature and information from the Internet.
2. Interview with the concerned authorization to realize the current situation and problems of the existing purchasing process and documents.
3. Data collection of the related information.
4. Design measurement / KPIs for evaluating.
5. Design the database system and other functions.
6. Develop a program (including database system, supplier evaluation, and some essential reports).
7. Implementing the proposed program.
8. Summarized result and formulate suggestions.
9. Prepare for presentation and final report.

1.7 Expected Results

1. To facilitate process of supplier evaluation by using a computerized system.
2. To give some figures and statistical information about suppliers' performance.
3. To use the evaluation as a tool for managing the supply base and ensure that suppliers continue to meet the acceptable standard
4. To gain first-hand knowledge of suppliers' strengths or weakness

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CHAPTER 2
LITERATURE REVIEW

This chapter studies and explores knowledge from textbooks and publications related to the topics of Purchasing, Information Technology, Analysis and Design Database and Vendor Evaluation. This information is applied to develop Supplier Evaluation System, which can work in optimal.

2.1 The Role of Purchasing

Weele (1994) mentioned the basic function of purchasing, viewed as supportive activities, is able to meet the material requirement related to inbound and outbound logistics, more importantly, and related to operations. The most popular definition of purchasing function will probably be some variation of "Getting the right item to the right place at the right time in the right quantity for the right price". Messner (1982) considered the heart of what purchasing department's real objective should be – profits. Traditionally, the purchasing function encompasses determining the need, selecting supplier, arriving at a proper price, specifying terms and conditions, issuing the contract or order as well as following up to ensure proper delivery. The main areas, for which purchasing should be fully responsibilities are as follows; not necessary in order of importance:

- Determine the specification (in terms of required quality and quantities) of the materials and services that need to be bought
- Select the most suitable supplier
- Prepare and conduct negotiations with supplier in order to establish an agreement
- Place the order with the selected supplier
- Monitor and control of the order (expediting)
- After-care and evaluate (settling, claims, keeping product and supplier files up-to-date in terms of documentation and ranking).

Among the primary purchasing functions, one of the major responsibilities is the evaluation and selection of supplier. In today's highly competitive environment, it is impossible to successfully produce low cost, high quality product without supporting

from suppliers (Weber et al., 1991). The supplier selection has been recognized as one of the most important functions to be performed by purchasing department. The cost of raw materials, component parts and services purchased from external suppliers makes a large contribution to manufacturing cost, accounting for 40-70% of total manufacturing costs (Buffa and Ittner, 1987). Moreover, on average, manufacturer's purchases of goods and services amount to 55 per cent of revenues, whereas labor costs and overhead expenses are around 6 per cent and 3 per cent, respectively (Tully, 1995 cited in Vokurka et al., 1996). Choosing the wrong supplier can create several problems that directly affect to business, including quality of products, increase in overhead expense and reputation.

Lee and Dobler (1971) described that a firm should allocate its purchasing power wisely and choose its suppliers carefully. Both buying and selling firm can be motivated to strengthen and continue relationship in order to increase the profitability. A good vendor will provide every possible assistance and guidance to valuable customers - financial aids (prices and terms of payment), technical aids (design and manufacturing), and service (on- time deliveries, general cooperatives). Thus, the vendor must understand the customer's material requirements and the manufacturing process in order to offer suggestions that may lead to improvement materials specification or to economical substitution.

2.2 Supplier Evaluation

Supplier evaluation is the method to assess supplier performance on a set of selected criteria over a period of time. Many buyers just rely on their judgment and attitude to evaluate suppliers. Although, this way makes evaluation easier, it does not present the economic value to the company – that can leads to slow and undetected, drained on profits. Therefore, many companies have initiated formal supplier performance evaluation system to provide buyers with the analytical tools they need to make a good decision.

2.2.1 The Objectives of Evaluation

The classification and rating of suppliers is a significant feature of a total quality management. The overall objectives of the supplier evaluation process are: to reduce purchase risk, to ensure that suppliers who doing business with firm can meet the firm's requirement (Humphreys et al., 1998); to open communication between consumer and

supplier, and to identify opportunities for long term relationship and improvement (Singerpurwalla, 1999). Additionally, the purposes of evaluation are stated by Buffa and Ittner (1987) and Weele (1984) as follows:

- **Better decision making**

  Use the previous performance of supplier as prescreening tools in rating. For example, if the supplier's quote is low but his habitually delivers late, its rating may indicate that the supplier does not offer the best value.
- **Motivating suppliers**

  An outcome of supplier's rating is often used for encouraging supplier to improve its performance. It also can be used effectively for constructive goal setting.
- **Initiating corrective action**

  Sometimes the supplier rating will indicate deficient performance in one or more areas. This information can used to guide the corrective action or stop employing the supplier.

Gordon (1994) compared some aspect of the advantages and disadvantages of conducting supplier evaluations, particularly manual evaluations as follows.

<u>Advantages of evaluation</u>

- It is a professional way to approach the business of supply.
- Statistical information about suppliers' performances can be collected in order to support policy decisions.
- It makes the acceptable standard for supply and ensures that suppliers continue to meet these.
- It provides the first-hand knowledge of suppliers' strengths or weaknesses.

<u>Disadvantage of evaluation</u>

- It is very labor intensive.
- The process is very time-consuming and slow.
- Displacement of records can be inconvenient while other staffs access to the record.
- Sample size may not be truly represented, especially if your resources are limited.

To obtain maximum benefits for the buyer firms, before commencing the evaluation, it is essential to have clear goals and objectives concerning who, and/ or what are exactly needed to measure.

2.2.2 The Characteristic of Supplier Evaluation

Monczka et al. (2002) identified that an effective supplier evaluation process should have certain characteristics as follows:

- **Comprehensive:** The users can understand exactly the meaning of scales and items.
- **Objective:** Using a scoring system is required to clearly define the different meaning of each value on a measurement scale. Objective means making a quantitative scale to evaluate performance attributes.
- **Reliability:** Reliable supplier evaluations should have well-defined measures and well-understood items and scales. Different people or groups review the same items and the same measurement scales will reach the same conclusion.
- **Flexibility:** The evaluation process should provide some flexibility in adjusting the performance categories and weights assigned to each category, regarding to their importance. The most important categories will get a higher weight.
- **Mathematically straightforward:** The application of weights and scales should be simple so that each individual using the evaluation is able to understand the mechanics of the scoring and selection process.

2.2.3 Method of Evaluation Techniques

Some organizations evaluate suppliers by means of complicated formulas containing a large number of factors such as costs, late delivery, production breaks, and poor quality of delivered goods. A number of alternative approaches have been suggested to take these other factors into account, call rating models, summarizing several performance indicators into one score. There are typical three supplier measurement systems that were developed to assist in evaluating (Leenders et al., 1997; Monczka et al., 2002; Zenz, 1994; Roodhooft and Konings, 1995). These approaches differ in their ease of use, level of decision subjectivity, required resources to use the system, and

implementation costs (Monczka et al., 2002). Figure 2.4 illustrated the comparison of the advantages and disadvantages of these three systems.

The easiest and most simple one is **Categorical method.** The method places different vendor characteristics as "preferred, neutral, or unsatisfactory according to each supplier's attributes. The supplier with maximum score is then selected. For example, a supplier with a rating score of two preferred, one unsatisfactory, and two neutral would obtain a score of one positive. This approach is common for smaller organization because it is easy and relatively inexpensive to implement. However, one problem of this method is that the attributes are given equal weightings which are not clearly the case in practical. Also, it is the most subjective as far as determining supplier performance. Thus, the reliability of the categorical method is the lowest due to relying on attitude and personal judgment of the evaluator.

The most frequently used approach of evaluation is **Weight-Point method**. Linear weighting models appoint a weight on each criterion according to relative importance (typical subjectively determined; depending on the buying firm's emphasis) and assign score of supplier performance in each area. Each weight is then multiplied by the assigned scores. The total score for each supplier provides by summing up the suppliers' performance over the period of assessment. Then the supplier with the highest weighted total score is selected. The method provides a higher level of objective than categorical approach because of combining both of quantitative and qualitative variables. This measurement has key drawbacks that must convert into standardized units to avoid an unfair evaluation score (Humphreys et al., 1998) and limitation of scaling techniques (Thompson, 1991, cited in Youssef et al., 1996).

Cost ratio method is the least subjective and most complicated technique to evaluating supplier. This approach required standard cost analysis to calculate the total purchase cost and cost ratios such as late delivery, return to supplier, scrape labor costs, and material rework. The cost ratio provides a measure of the cost of each factor as a percentage of total purchases for each potential supplier. These factors are used in calculating a net adjusted cost for each vendor. All cost ratios are summed to an overall cost ratio and then applied to obtain the net adjusted cost (Humphreys et al., 1998; Roodhooft and Konings, 1995). The lowest purchased price is not always the lowest total

cost for an item or service. The supplier who minimized the net adjusted cost would then be the preferred supplier. It is clearly that this method is complex and requiring a comprehensive cost –accounting system.

System	Advantages	Disadvantages	Users
Categorial	Easy to implement Requires minimal data Different personnel contribute Good for firms with limited resources Low-cost system	Least reliable Less frequent generation of evaluations Most subjective Usually manual	Smaller firms Firms in the process of developing an evaluation system
Weighted-Point	Flexible system Supplier ranking allowed Moderate implementation costs Quantitative and qualitative factors combined into a single system	Tends to focus on unit price Requires some computer support	Most firms can use this approach
Cost-Based	Total cost approach Specific areas of supplier nonperformance identified Objective supplier ranking Greatest potential for long-range improvement	Cost accounting system required Most complex so implementation costs high Computer resources requires	Larger firms Firms with a large supply base

Figure 2.1 Comparison of Supplier Measurement of Evaluation Systems

2.2.4 The Framework of Supplier Evaluation and Selection

Monczka (et al., 2002) proposed the framework in the detail of supplier evaluation, divided into seven steps, as illustrated in Figure 2.2.

<u>Step 1: Identify key supplier evaluation criteria</u>

Many researchers identified the critical performance of suppliers considered to be evaluated are quality, delivery, cost and service performance (Dickson 1966, Humphreys, 1998; Weele, 1999; and Kriangkrai, 2002). Technological and process capability, quality systems, and management capability are the additional criteria of evaluation for current and future manufacturing facilities and the supplier's speed in development (Ellram 1990 cited in Toni and Nassimbeni, 2001). These categories are considered the most important performance areas.

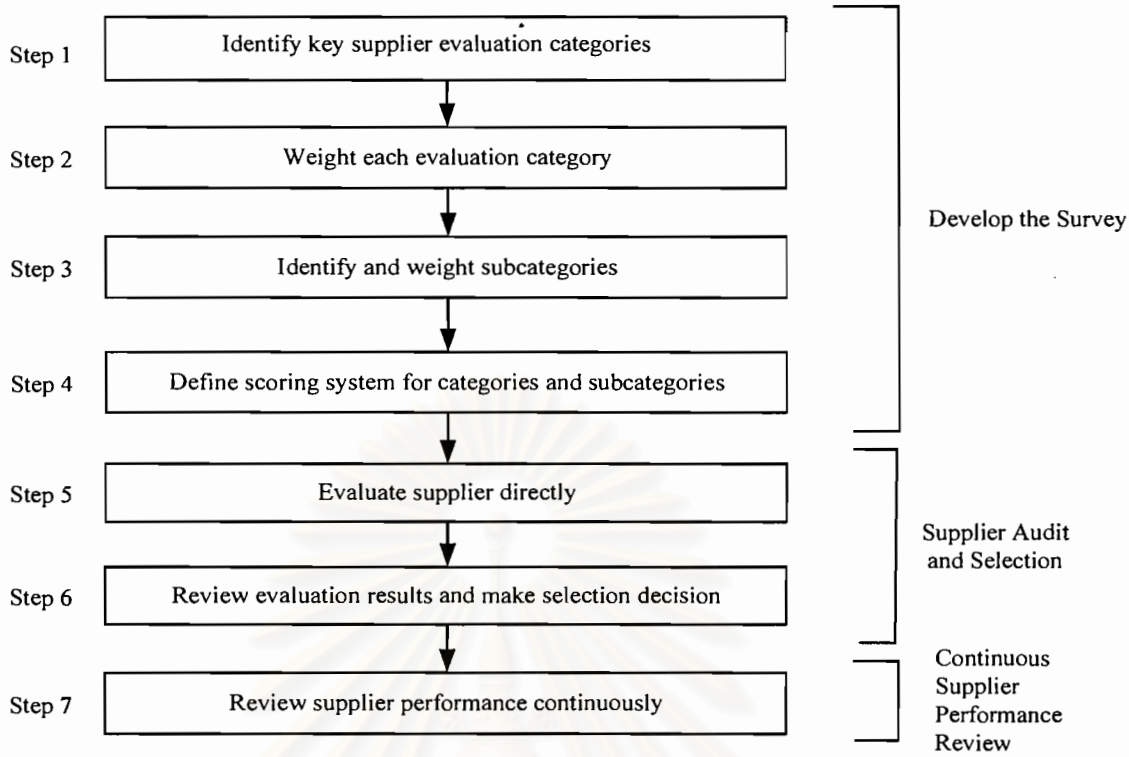

Figure 2.2 Initial Supplier Evaluation and Selection Audit Development

Step 2: Weigh each evaluation category

The assigned weights reflect the relative importance of each category, considering the proportion. The weighting scales consist of percentage per criterion and numerical values (Stueland, 2004). For example, if quality performance was the factor received the most weight of the evaluation categories overall, 30%, while service performance received 20%, this shows the difference in relative importance of the two categories.

Step 3: Identify and weigh subcategories

If a category is separated into many subcategories, the purchaser has to identify and give weight to subcategories. For example, the quality systems categories consider suppliers' process control systems, total quality commitment and parts per million defect performance. The sum of the subcategory weights must equal the total weight of the performance category.

Step 4: Define scoring system for categories and subcategories

Each scoring value should be clarified its definition and interpretation. For instance, an evaluation use a 5-point scale to assess a performance category where 1 = unsatisfactory, 2 = marginal, 3 = fair, 4 = good, 5 = excellent. A clear definition of scoring system helps translate subjective criteria and develops a quantitative measurement. Although the evaluations are made by different individuals, interpretations and conclusions are still the same meanings due to the effective scoring metric.

Step 5: Evaluate supplier directly

This step requires the reviewer to know a supplier's information and performance (i.e. process control system and delivery performance) through records, documentation of performance capacity or even visiting a supplier's plant.

Step 6: Review evaluation results and make selection decision

The objective of the evaluation is to qualify potential suppliers for current or expected future purchase contracts. The reviewers have to determine the seriousness of any supplier shortcoming and assess the degree of the weaknesses and strengths of suppliers. Then they will decide whether to reject or accept a supplier as a source. The initial evaluation provides an objective way to compare suppliers according to the same criteria before making a final selection decision by the authority.

Step 7: Review supplier performance continuously

This step is the last step of initial evaluation, not the last process of the selection of the suppliers. Some meaningful conclusion involving average supply time, price per item, percent of commitment compared to expenditure and the strengths and weaknesses of suppliers in various areas should be arrived at this step. The results of finding should be shared with individual suppliers so they can use to improve their performances. The main point is that buyers have a responsibility to measure supplier performance, to ensure the establishment and maintenance of continuing high standards in the acquisition process."

Apart from the above steps, Gordon (1994) pinpointed that to obtain a true reflection of the supplier's performance, it is essential to consider the sample size and timing. Too small a sample could distort the results. If 1,000 orders were processed in one month, 100 orders would be reasonable figure in evaluation. Moreover, it is wise to choose a time that is most representative of the normal throughput.

2.2.5 Identification of the key criteria

The supplier evaluation criteria often differ widely from item to item, from organization to organization, or industry to industry because of the variety of factors in making such a buying decision. The traditional approach to the evaluation and selection of potential suppliers is to consider a variety of variables and then to weigh up the factors based on either a formal system or an informal system based on the buyer's experiences and judgment. As a result, the evaluation can be misleading and quite often improperly influenced by personal consideration. Thus, it is essential to find a good objective means of evaluating vendors.

Generally, criteria can be classified into two types, including subjective and objectives methods. Subjective methods are used in evaluating suppliers through personal judgments; objectives methods aim to quantify the suppliers' performance (Weele, 1994). In general, the variables of quality, price, delivery, and service were always rated as important in almost every product category/buying situation (Lambert and Stock, 1993). Based on a comprehensive studies of supplier evaluation criteria, Dickson (1966) identified the three criteria of assessment of supplier are quality, cost, delivery performance (cited in Narasimhan et al, 2001). Weber et al. (1991) concluded that quality was the highest ranked factor followed by delivery and cost, respectively. Furthermore, Willis et al. (1993) and Zenz (1994) described more details of common evaluation criteria, which no formula exists for measuring every aspect of purchasing performance as follows:

- **Quality Criteria**

Quality may be measured in terms of the number of rejections of incoming shipments (or the percentage acceptable) and defects found during the production process. Also, Paisit (1998) identified additional attributes in terms of quality; the percentage of Lot Acceptance Rate (%LAR) and Defect per Million.

- **Quantity Criteria**

Quantity performance can be evaluated in different ways. The simple one is the amount of downtime outcome of a shortage of materials. The second one is the amount of rescheduling of production caused by lack of materials. Another quantitative factor is the relation between inventory and usage, as known as the turnover rate, calculated by dividing the value of purchased materials or supplies by the average investment during a certain time period. This measures inventory losses occurring through spoilage or obsolescence. The final method considers the number of new vendors used and the number of new quotations solicited during a specific time period. This measure shows efforts to maintain a strong competitive environment.

- **Time and Place Criteria**

Some quantity performance can be applied to measure time and place performance. It is to compare suppliers' delivery dates with promised shipping dates (expressing the percentage of on-time) and to measure the amount of goods delivered and required.

- **Price Criteria**

There are several measures in appraising price performance. The first one is a comparison of the price index of company purchases with one of the standard price indexes. Next measure is a comparison of the market price at the time of use with the purchased price. Another evaluating price performance is discounts obtaining.

Monczka et al. (2002) described an organization should decide objective (quantitative) measures and subjective (qualitative) measures. Most of objective variables are in the three groups – delivery, quality, and cost reduction. For subjective factors, he conducted the possible qualitative service factors as shown in Figure 2.2.

Factors	Description
Problem resolution ability	Supplier's attentiveness to problem resolution
Technical ability	Supplier's manufacturing ability compared with other industry suppliers
Ongoing progress reporting	Supplier's ongoing reporting of existing problems or recognizing and communicating a potential problem
Corrective action response	Supplier's solution and timely response to requests for corrective actions, including a supplier's response to engineering change requests
Supplier cost-reduction ideas	Supplier's willingness to help a buyer find ways to reduce purchase cost
Supplier new-product support	Supplier's ability to help a buying firm reduce new-product development cycle time or to help with product design
Buyer/seller compatibility	Subjective rating concerning how well a buying firm and a supplier work together

Figure 2.3 Qualitative Service Factors

Based on the study of Ellram (1987), he provided a number of factors as important in selecting suppliers which to establish partnership relations (cited in Vokurka et al., 1996). The factors were classified as shown in Figure 2.3

Furthermore, Farmer and Weele (1995) also stated that the analysis of financial viability of supplier is increasingly significant because it becomes an important factor to establish a long-term partner or a supply critical goods and services. The financial indicators consist of profitability, liquidity and leverage ratios.

Factors	Criteria
Financial issues	Economic performance Financial stability
Organizational culture and strategy issues	Feeling of trust Management attitude/outlook for the future Strategic fit Top management compatibility Compatibility across levels and functions of buyers and supplier firms Supplier's organizational structure and personnel
Technology issues	Assessment of current manufacturing facilities / capabilities Assessment of the future manufacturing capabilities Supplier's design capabilities Supplier's speed in development
Other factors	Safety record of the supplier Business references Supplier's customer base

Figure 2.4 Ellrams's supplier partnership selection

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2.3 ABC analysis

ABC analysis is also known as Pareto analysis or the 80/20 rule. This analysis was originated by a nineteenth-century Italian economist. Zenz (1994) described the inventory control that is applicable of the ABC analysis. It is divided into three priority categories- A, B, and C. The A items, high-value items, may account for 65 to 80 percent of the dollar tied up in inventory or the material expenditure, while representing only 10 or 20 percent of the quantity volume. Ordering quantities of the A items, should be carefully determined.

The B items, the moderate value items, are in 10 to 15 percent of total inventory. Typically, they tied up 20 to 25 percent of the dollars invested in inventory. The B items deserve in the right quantity to buy and hold in stock. The C items, the low-value items, make up 65 percent of all items inventory, while representing only 10 percent of the entire investment in inventory. Most firms find that a small number of purchased items account for the major portion of the purchased value, it is advisable to classify purchased items according to value. A typical classification of dollar usage is illustrated in Figure 2.5

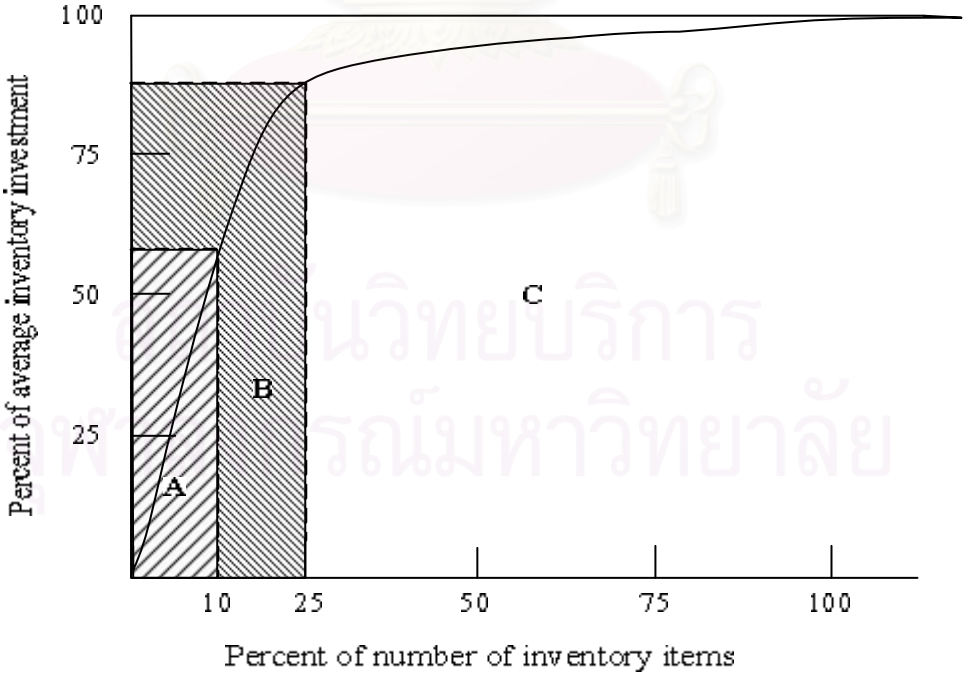

Figure 2.5 ABC analysis of inventory control

CHAPTER 3
EXISTING SYSTEM AND REQUIREMENT SYSTEM

3.1. General Information

ABC, a selected company, is a leading manufacturer of high quality presentation boxes for such luxurious things as jewelry, pens, spectacles, coins & medals, watches, and perfumes. Other product lines are watch dials, watch cases and bracelets. It was established in 1964. The ABC's highlight information is summarized as follows:

1. Most of products are exported. Almost eighty percent of customers are the well-known and prestigious companies such as watches categories: Rolex, TAG-HEUER, Perfumes: Channel, Christian Dior, and so on.
2. The company has more than 5,000 employees.
3. Purchase volume is around 300 million bath per year.
4. Purchasing policies apply the concept of centralization.
5. The number of staffs in purchasing department is 9 people.
6. The current number of suppliers is approximately 1,500 suppliers.

The amount of purchase volume between January and November in 2004 is shown in Table 3.1.

Month	Purchasing volume (Baht x 1,000)
January	17,080.70
February	38,096.94
March	31,164.71
April	32,193.25
May	27,346.91
June	30,128.70
July	33,490.73
August	22,418.81
September	82,322.40
October	17,163.30
November	18,161.99

Table 3.1 Purchasing volume between January and November in Year 2004

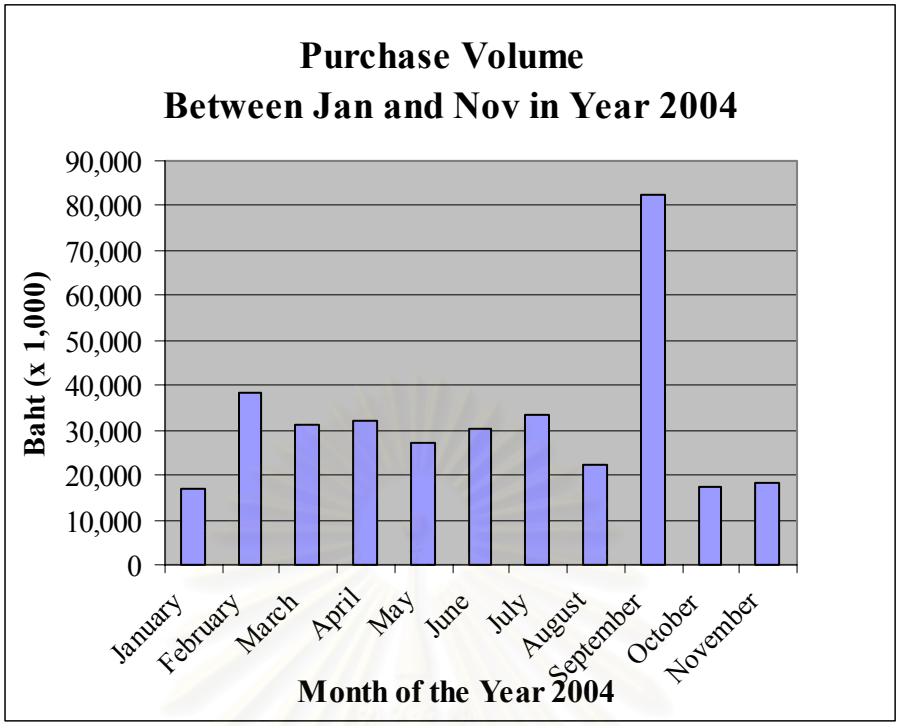

Figure 3.1 Purchasing volumes between January and November in Year 2004

3.2. Existing System

The ABC Company has applied the concept of centralized purchasing, although it has five plants. The primary reason of operating this concept is the similarity of purchased items and service in each factory. The key materials for production are sources of paper, plastic, and other chemicals. There are several advantages of centralization as follows:

- The company can reduce the duplication of orders and unplanned purchasing practices by coordinating all purchases.
- The company can sustain its competitive advantages through total economic power, particularly quantity discounts.
- Suppliers are able to offer more competitive prices and better service as their expenses are reduced by means of, for example, fewer orders to prepare, fewer shipments to make, , and fewer financial records to keep.
- Fewer orders are processed for the same quantity of purchased goods, thus reducing expenses in purchasing, goods receiving and inspecting, other than prices quoted in term of account payables.

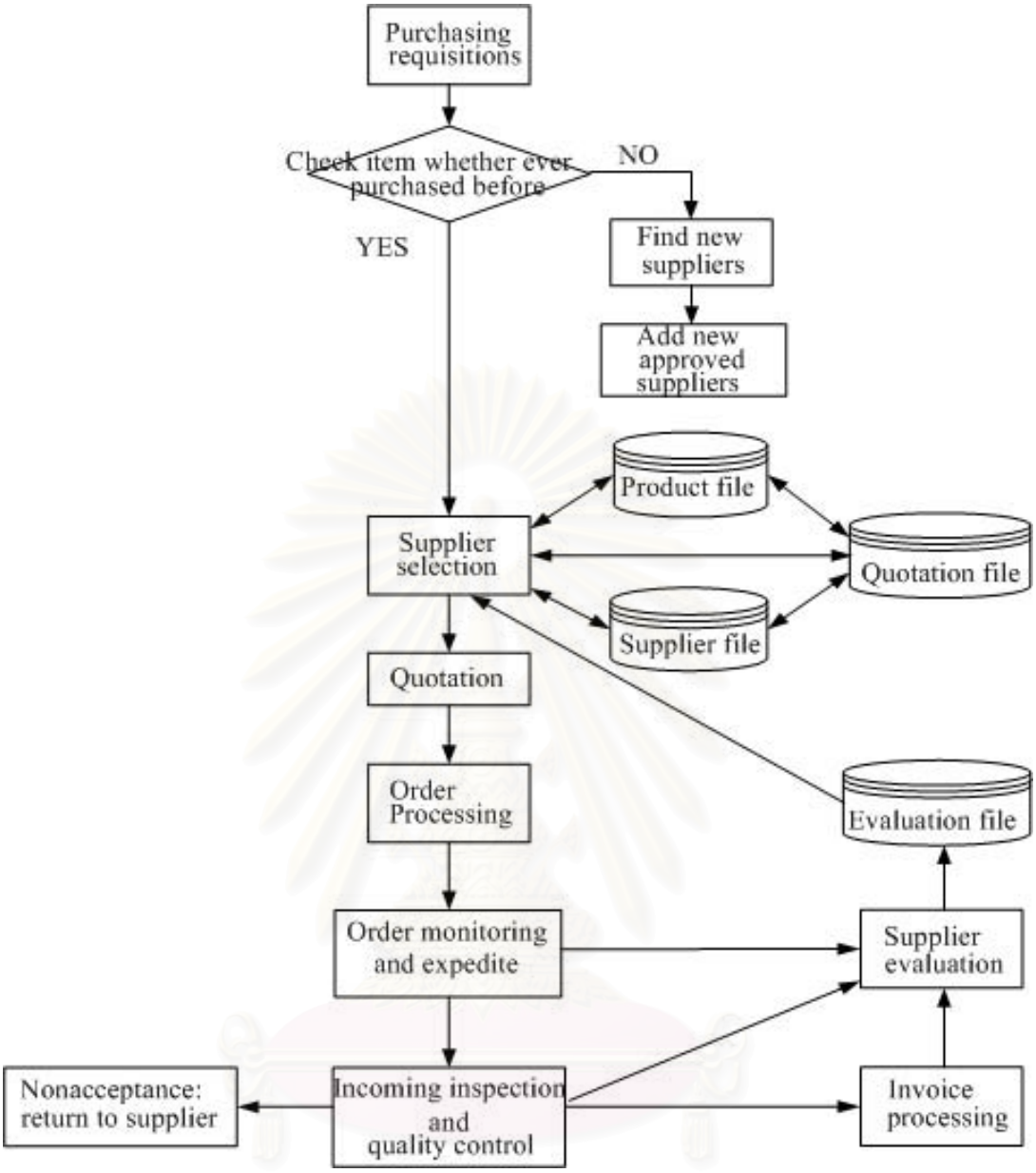

Figure 3.2 The procedures and information flows of purchasing system

3.2.1. Current process of purchasing and evaluating supplier

1. After receiving Purchase Requisition (PR) from staffs in the organization, each buyer keys-in data to Microsoft Excel File such as Date, Originating department, Quantity required, Unit, Product description, and Need date.
2. The buyer considers items requested whether they have buying records from the existing supply base. If not, the buyer has to look for the new supplier and asks for a sample so as to approve that new supplier. When qualified, the company will further to ask for price quotation.

3. After considering the price quotes, the buyer prepares and places an order via inputting relevant data to Purchase Orders (PO) in the same file as above.
4. After a PO has been issued to a supplier, the buyer follows up and/or expedites the order to ensure that the supplier could make delivery to meet the company's requirement.
5. When products were delivered, the store of each factory is accountable for receiving and inspecting the incoming shipment with evidences of receipt and inspection reports. The data on receipts and inspection reports are accordingly fed into the order status record.
6. To assess suppliers' performance, the results of receiving and inspection of reports will be reviewed by the buyers for the period of six months. After that, the buyers classified the selected suppliers by the company's criteria and their judgments.

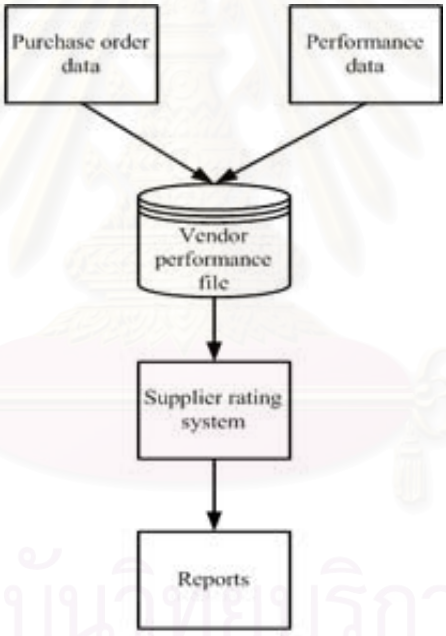

Figure 3.3 The step of evaluation process of ABC Company

The current system in evaluating the performance of suppliers is in manual operation including the method to collect information of the basic records (e.g. price, delivery, quality, and services) and to evaluate. With a high increase on the number of suppliers and the amount of ordering demands, purchasing department requires a computerized system to measure, rate or rank supplier performance on a continuous basis. Recently, the company has kept the important records of suppliers' performances with Microsoft Excel. This method creates lots of tasks in the process of evaluating. To

evaluating effectively, the buyers have to review every order one-by-one to get the actual records. With the ever-increasing amount of orders in every day, the buyers often ignore to gather supplier performance before evaluating. Consequently, supplier performance measurement is dependent on the buyers' judgement.

3.2.2. Current problems

As mentioned earlier, the current system causes the difficulties in rating the suppliers, which can be summarized as follows:

1. The existing data were collected separately in each month in the form of Microsoft Excel. Thus, multi-users are impossible to use the same file at the same time.
2. The current purchasing records have errors in data, such as the duplication of data and various name of the same supplier, which are dependent on each user's satisfaction. This leads to considerable confusion.
3. Lack of the purchasing reports that are essential to report to the management, particularly supplier selections and evaluation including the historical price, cost saving, delivery reliability, reject-rates as well as lead time reduction.
4. Some existing records of suppliers' performance are kept in the form of documents and buyers' recollection. Thus, the process of rating supplier is very time-consuming due to a manual system.
5. The current supplier evaluation measurement is too subjective which is dependent on the buyers' opinion. There is no standard to control the results of evaluation.

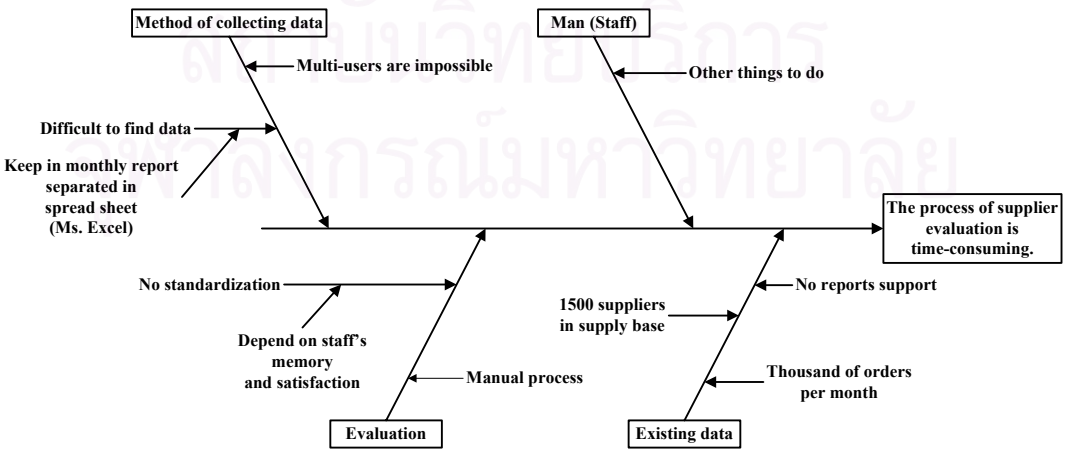

Figure 3.4 Cause & Effect Diagram of causes for evaluation problem

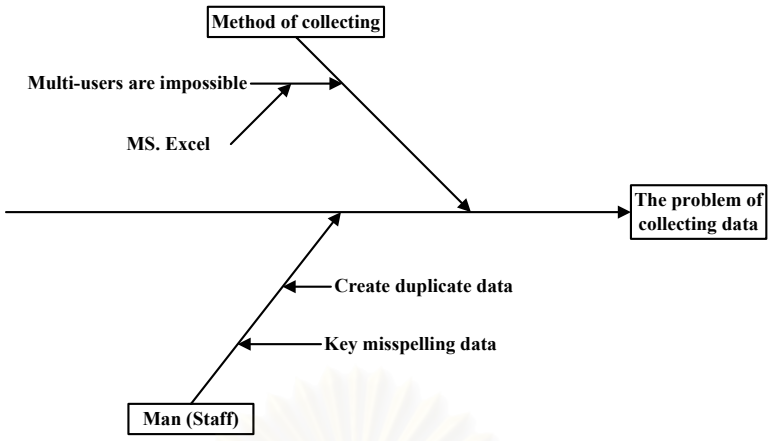

Figure 3.5 Cause & Effect Diagram of causes for data- collection problem

3.3 Determining System Requirements

Before designing the new system, it is important to study the current system to find out how it works and where the improvement should be made. The requirements are significant features that must be included in a new system. The determination of requirement entails studying the existing system and collecting details about it to find out what these requirements are. After interviewing the requirement of purchasing information management, the researcher classified the degree of requirements into two groups.

3.3.1 The requirements from purchasing staff

1. The system can provide the historical data of suppliers such as products' price, term of payment in order to use in negotiation.
2. The new system should be allowed the using of several users to access information and the involved people for the security of information.
3. The users can view the status of purchasing activities easily.
4. The system should provide auto-checking to prevent errors from the user's mistakes.

3.3.2 The requirements from purchasing manager

1. The system can carry out the different interesting aspects for the following
   (1) Price movement
   (2) Summary of purchase volume sorted by product group
   (3) Summary of purchase volume sorted by suppliers

(4) The historical data of defective items

(5) Cost of products

2. The system can detect the status of the process of purchasing.
3. The system support evaluating supplier in timely.
4. The system should develop from the existing resources and technology within the company.

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CHAPTER 4
PROPOSED SUPPLIER EVALUATION SYSTEM

With the current process of purchasing and problems in evaluating suppliers, the new system is designed to improve evaluation system within the specified scopes as discussed in Chapter 3.3. The objectives of the thesis are described in the following

1. To make an evaluation system that is standardized and reflects supplier's performance.
2. To create a computerized evaluation system through a new program based on the principle and condition of current supplier evaluation.
3. To develop database management system that supports evaluation system.

The proposed system can be classified into three modules– (1) Designing the standard criteria module, which is the most important process of supplier evaluation; (2) The computation module of Supplier Evaluation System Program that describes the method of rating supplier performance; (3) Designing database management system related to the steps of data structure in the system.

4.1. Studying the data flow of process

The data flow diagram of evaluating as illustrated in Figure 4.1 shows the data generating from each relevant department as follows:

- **Centralized Planning:** Working as the centre of originating product codes and scheduling production plan based on customers' requirement date.
- **Stores:** Each factory has its own store. Store is functioned of supervising in-out inventory movement.
- **Quality Assurance:** Quality assurance section is responsible for inspecting the quality of purchased items before imputing to production process.
- **Production department:** If production line is interrupted as a result of defective products, Production will report the purchasing department on causal problems to inform the supplier for corrective actions.

Figure 4.1 The data flow diagram of supplier evaluation system

- **Purchasing department:** Gathering purchasing data such as Purchase requisition, Purchase order, including with all information which related to the material purchase such as the report of goods receipt and product quality, production line interruption, and making claim in order to follow up the suppliers' corrective actions.

4.2. The Supplier Evaluation System Team

Evaluating supplier performance is relevant not only to the purchasing department, but also to other related departments. It is evidenced by the fact that the evaluation in quality aspect, the company will assess by means of initial inspection and defects found in the production line. This then shows the participation of stores and production. Accordingly, the standards of supplier evaluation criteria are determined through the consensus of the evaluating team, consisting of people from purchasing, quality assurance, planning, production and stores. The team members are assigned to the following people.

1. Purchasing Manager and supervisors, who take full responsibility of collecting data in evaluating suppliers, are considered the direct user of this system.

2. QA Manger and key supervisors who are responsible for checking goods-in as the first step of receiving material.
3. Production Manager and key supervisors who are accountable for reporting to purchasing and suppliers about the cause of defective items found in production.

4.3. The determination of supplier evaluation criteria

Determining evaluation attributes, weights and form of measurement will require considerable thought to ensure congruence between the organization's priorities for product class and rating scheme's ability to classify superior suppliers accurately. In deriving a list of supplier performance, the team employed two main approaches. Firstly, they considered list of measures developed by other researches. The other was a brainstorm to select attributes in each criterion. Many researches identifies the main criteria for selection and evaluation consisting of quality improvement, delivery reliability, price, lead time reduction and technology (Weele, 1994; Humphreys, et al, 1998), quantity, carriage, location, flexibility, maintenance and after sales service, method of payment, and terms of payment (Farmer and Weele, 1995). As a result, the team established standard criteria of quality, delivery, pricing, service and reliability. Lists of attributes of each category are mentioned below.

4.3.1 Quality performance

Quality is the most important factor of assessing supplier performance because it mainly contributes to the company's product quality. QA division is responsible for inspecting on the basis of Assurance Quality List (AQL) of each material whether the purchasing items are defective before putting into the production process. Incoming Material Inspection Report (IQC) presents the results of inspection including total accepted quantity, total rejected quantity and defect details. The IQC data is used for controlling the defects and feeding back to the supplier in order to improve the next product shipment. The chosen attributes of quality area are

- % Rejection rate
- % LAR

4.3.2 Delivery performance

Delivery is also the most significant factor of supplier performance because of affecting critically to the production planning. Each store of the company is in charge of receiving and checking the punctuality of goods deliveries and the amount of products delivered. Consequently, the major measures of this category are

- Timeliness of delivery
- Fulfillment of order (Quantity over- or under-supplied)

4.3.3 Price performance

Price is another factor in evaluating supplier. Price competitiveness is expressed by the concept of price index, which is the comparison of purchased price with lowest price (or market price) from other suppliers, who offer the same merchandise. Cost-reduction and payment terms are also used as the price attributes for appraising supplier. Purchasing is responsible for gathering pricing data. Therefore, the measures of this category are

- Price Index
- Cost reduction efforts (discounts obtaining)
- Payment terms

4.3.4 Reliability performance

This category records the supplier's profile to facilitate a purchasing decision and provides the buyer with supplier's reliability in terms of management capacity, finance, and reputation. The following lists are the measures of reliability:

- Management Capability
- Financial Situation
- Registered Capital
- Duration of Business
- ISO Certificate

4.4. Weighing the importance of categories and subcategories

The evaluating team chose the Weighted-Point approach to measure supplier performance due to its flexible system and moderate implementation cost. As mentioned above, there are five criteria selected in the supplier evaluation: quality, delivery, pricing, service and reliability. Assigning weight for each criterion, the team considered the significance of each factor on the company's business.

At the moment, the company is primarily concerned with quality and delivery. Quality has extremely affected the company's products, so it is the most weight of the supplier evaluation attributes overall, which is 40. Delivery performance has also been an influence for production, but it is assigned less weighed than quality, receiving 30. Service category is the third important area for evaluating supplier, accounting for 20. Price is not as important as quality and delivery; it is given 10% of the weight rating, the lowest importance rating. Reliability in service category is assigned nil; it is implied that it is not important to the firm but it is used as a support in making purchasing decision.

In the initial stage of setting evaluation criteria, the sub-weights of each criterion were given equally weighting. For example, reject rate and lot acceptance have equal importance, weighing 20. Indicators of pricing including price competitiveness, cost reduction, and payment term are equally given 16.67. The weight assigned could be changed appropriately depending on type of business and purchasing policies in the future. After identifying the standard of supplier evaluation criteria, the evaluating team concluded the weight assigned in each category as shown in Table 4.1.

Criteria	Performance Indicators	Details	Weight
Quality	• Rejection rate • Lot acceptance rate	• 100% lot accept rate • The number of lot accepted 100%	20 20
Total weight for quality category			**40**
Delivery	• Timeliness of delivery •?Fulfillment of orders	• Percent of on-time deliveries • Percent of quantity delivered on-time compare to quantity ordered	15 15
Total weight for delivery category			**30**
Pricing	• Price Competitiveness • Cost Reduction • Payment Term	• Pricing compared to the lowest price • Supplier offer discount to reduce purchase cost • Extended dating programs (supplier allows for payment)	10/3 10/3 10/3
Total weight for price category			**10**
Service	• Responsiveness • Technical /Product Ability • Corrective Action Response • Advanced for Purchasing Information • Assistance in emergency orders	• Responsiveness (Performance to promise) • Supplier' assistance on technical or product knowledge • Solution and timely response to request for corrective actions. • Informing customers such data of price change and ship delays • Supplier's attentiveness to meet emergency orders	4 4 4 4 4
Total weight for service category			**20**
Reliability	• Management capacity • Financial stability • Registered capital • Duration of business • ISO certificate	• No points for this criteria but these factors help to make a purchasing decision	0
Summary of total weight for supplier rating			**100**

Table 4.1 Summary of performance measures in supplier evaluation system

4.5. Total Rating Score

According to internal meeting of the supplier evaluation team, they used the Likert-type scale. The low end represents a negative response while the high end represents a positive. The team determined a five-point scale to assign score for each attribute (1= Poor, 2 = Below Average, 3 = Average, 4 = Above Average, 5 = Excellent). Once the factors, weight and rating scale have been determined, a

summation of rating score of evaluation are totaling to 500 points as shown in Table 4.2

Criteria	Performance Measures	Weigh	Score	Weight rating
Quality	• Lot Acceptance Rate	20	5	100
	• Rejection Rate	20	5	100
Delivery	• Timeliness of Delivery	15	5	75
	• Fulfillment of Orders	15	5	75
Pricing	• Price Competitiveness	10/3	5	16.67
	• Cost Reduction	10/3	5	16.67
	• Payment Term	10/3	5	16.67
Service	• Responsiveness	4	5	20
	• Technical /Product Ability	4	5	20
	• Corrective Action Response	4	5	20
	• Advance Notice of Purchasing Information	4	5	20
	• Assistance in Emergency Orders	4	5	20
Reliability	• Management Capacity	0	-	-
	• Financial Stability	0	-	-
	• Registered Capital	0	-	-
	• Duration of Business	0	-	-
	• ISO Certificate	0	-	-
Total Rating Score				500

Table 4.2 Total Rating Score of Supplier Evaluation System

4.6. Supplier Evaluation System Program

4.6.1 The method for calculating in the proposed system

The Weighted-Point approach is used for measuring supplier performance and rating scale is the five-point scale. The proposed performance measures are combined both objective and subjective criteria; however, each evaluation attribute is calculated separately as follows.

4.6.1.1 The objective criteria

The objective criteria encompass quality, delivery, and price performance. Conducting an assessment of vendor performance is dividing the actual amount of shipment in each order by the amount of goods receipt. The result will provide the quantitative data on how well that vendor meets the company's requirement. Factors

in this objective criteria help to reduce the degree of judging suppliers on feeling and impression by rating them objectively.

Quality Performance

Percent of Rejection rate (Q1): The percentage of rejected items is calculated inversely through the accepted number in each item of each order. Then, we sum a percent of accepted items over the six-month period; find out the average of those percent of accepted items and translate the result into the score specified below.

$$\% \text{ Reject Rate} = \frac{\text{No. Accept Items} \times 100}{\text{No. Delivery Items}}$$

% Reject Rate	Score	Meaning
91<x≤ 100	5	Excellent
81<x≤ 90	4	Above average
71<x≤ 80	3	Average
61<x≤ 70	2	Below average
x≤ 60	1	Poor

Table 4.3 Percentage of Rejection Rate (or Acceptance Rate)

Lot Acceptance Rate (Q2): The definition of LAR is that delivered items is not rejected during the stage of incoming quality control inspection (IQC). The percentage of Lot Acceptance Rate (%LAR) is computed by dividing total of accepted lots by total of inspection lots; later on converting the result into the table below.

$$\% \text{ LAR} = \frac{\text{Sum of lot accepted} \times 100}{\text{Total of lot inspected}}$$

% LAR	Score	Meaning
95 <x ≤ 100	5	Excellent
90 <x ≤ 95	4	Above average
85 <x ≤ 90	3	Average
75 <x ≤ 80	2	Below average
x ≤ 75	1	Poor

Table 4.4 Percentage of LAR

Delivery Performance

Percent of on-time delivery (D1): The number of on-time deliveries is added up over the six-month period. Next, we compute the percentage of on-time deliveries, and change the figure into particular scale as follows.

$$\%\ \text{Ontime Delivery} = \frac{\text{Sum of ontime delivery} \times 100}{\text{Total of delivery}}$$

% Timeliness of order	Score	Meaning
$81<x\leq 100$	5	Excellent
$61<x\leq 80$	4	Above average
$41<x\leq 60$	3	Average
$21<x\leq 40$	2	Below average
$x\leq 20$	1	Poor

Table 4.5 Percentage of Timeliness of Order

Percent of quantity delivered on-time (D1): Each item is computed the percentage of fulfilled orders over the six-month period. After that, we calculate the average of the percentage of on-time deliveries, and change the figure into particular scale.

$$\%\ \text{Fulfillment of Order} = \frac{\text{Actual quantity delivered (ontime)} \times 100}{\text{Quantity ordered}}$$

% Fulfillment of order	Score	Meaning
$91<x\leq 100$	5	Excellent
$81<x\leq 90$	4	Above average
$71<x\leq 80$	3	Average
$61<x\leq 70$	2	Below average
$x\leq 60$	1	Poor

Table 4.6 Percentage of Fulfillment of Order

Price Performance

Price Competitiveness (P1): Total price index is the comparison of actual price and market price) in each item. After finding out the average of the percentage of price index during six months, we apply the result to the specific score.

$$\text{Price Index} = \frac{\text{Actual Price}}{\text{Market Price}}$$

$$\text{Average Price Index} = \frac{\text{Sum of Price Index}}{\text{Total of Orders}}$$

Price Index	Score	Meaning
x = 1.0	5	Excellent
1.0 <x≤ 1.2	4	Above average
1.2 <x≤ 1.5	3	Average
1.5 <x≤ 2.0	2	Below average
x> 2.0	1	Poor

Table 4.7 Percentage of Price Index

Cost reduction (P2): Summing the percentage of discount over the six-month period, finding out the average of percentage discount per unit, and converting into the particular score according to table below.

$$\%\,\text{Cost reduction} = \frac{\text{Sum of Cost reduction} \times 100}{\text{Total purchase volume}}$$

% Cost reduction	Score	Meaning
x≥ 10	5	Excellent
5 ≤x< 10	4	Above average
1 ≤x< 5	3	Average
0.1 ≤x< 1	2	Below average
x< 0.1	1	Poor (No discount)

Table 4.8 Percentage of Discounts offered

Term of Payment (P3): Converting the payment term offered to the score. If a supplier offers special discount for early payment, the program will calculate the average of Payment term before translate into the specific score.

$$\text{Average Payment Term} = \frac{\text{Sum of Payment Term}}{\text{Total of Orders}}$$

Average Payment Term (Days)	Score	Meaning
x> 90	5	Excellent
60<x≤ 90	4	Above average
30<x≤ 60	3	Average
1<x≤ 30	2	Below average
x = 0 (Cash)	1	Poor

Table 4.9 Payment Term offered

4.6.1.2 The Subjective criteria

The subjective criteria consist of services and reliability performance. These factors are dependent on the buyer's satisfaction on each supplier. The five-point scale is applied to rate suppliers according to measures of each criterion.

Score	Meaning
5	Excellent
4	Above average
3	Average
2	Below average
1	Poor

Table 4.10 Service and reliability performance

4.6.2 The Principle of Supplier Evaluation

The principle of supplier evaluation is related to the definition of supplier classification and frequency of rating. Total rating score obtained will use to place the suppliers in different classification according to our defined supplier classification.

4.6.2.1 Definition of supplier classification

The proposed supplier evaluation system classifies into three types of suppliers: 1) New suppliers, 2) Suppliers in AVL (Approved Vendor List), and 3) Suppliers out of AVL (Unapproved Vendor List).

4.6.2.1.1 New suppliers

The status of new supplier will depend on the number of orders and accepted lots in continual basis. The supplier will be evaluated under the same criteria aforesaid.

4.6.2.1.2 Suppliers in AVL

Approved Vendor List is subdivided into three groups, which are specified by the level of product quality. A supplier will be in AVL must have a minimum of 12-month historical records with ABC and meet the requirement of each level below.

1. Approved Supplier

Approved Supplier can achieve the overall rating score in between 350 and 400 (70%-80%). Typically, a new supplier will be added into the company's Approved Vendor List (AVL) must have five consecutive lots accepted.

2. Certified Supplier

A supplier becomes in a certified supplier, getting total rating score in between 400 and 450 (80%-90%). Certified suppliers, the second level of the classification, will be considered as a potential supplier in the future, if suppliers in this category are able to correct their problems of products or services.

3. Potential Supplier

This is the highest level of classification. Total rating score is more than 450 (more than 90%). Suppliers in this level show their efforts to seek cooperation and compliance to the company's quality standard, and commitments to provide ongoing quality improvement. Consequently, the company can develop long term relationships with all potential suppliers.

4.6.2.1.3 Suppliers out of AVL.

Suppliers in this category are Low volume suppliers or Disqualified suppliers. Low volume suppliers who are not new suppliers but they provides "one-time" service or products over the twelve-month periods.

4.6.2.2 Frequency of Rating Review

Frequency of rating supplier can be varied on the quality level of each supplier.

1. New suppliers

New suppliers will be evaluated, specifically for the first five consecutive lots accepted.

2. Suppliers in AVL

Suppliers in AVL include Approved Supplier, Certified Supplier, and Potential Supplier. Typically, rating reviews are made twice a year in April and October. If there is performance deterioration during six months, the supplier evaluation team informs suppliers the evaluation results.

3. Suppliers are out of AVL

Suppliers in this category are Low volume suppliers or Disqualified suppliers. Low volume suppliers are the suppliers who do business with the company "one-time" service or products only once a year. Meanwhile, Disqualified suppliers fail to improve their quality products or services within six-months. The supplier shall be assessed on the judgment of the supplier evaluation team.

4.7 Designing database management

The supplier evaluation system is developed on **Microsoft Access Version 2000** for keeping transaction data and internal data, **Visual Basic 6.0** for creating user interface and form & module in order to access the system, and **Crystal Report version 9.0** for issuing the related reports. Purchasing.MDB is database file of purchasing including all information used in the system.

The purposes of the input and output design computer based programs for supplier evaluation are to track actual performance over time throughout Purchase requisition, Purchase order, Goods Receipt and to compute each supplier performance. The flow diagram of the program design is illustrated in Figure 4.2. The database system of supplier evaluation system was developed by consisting of the following data input and data output. (Note: * = Primary key)

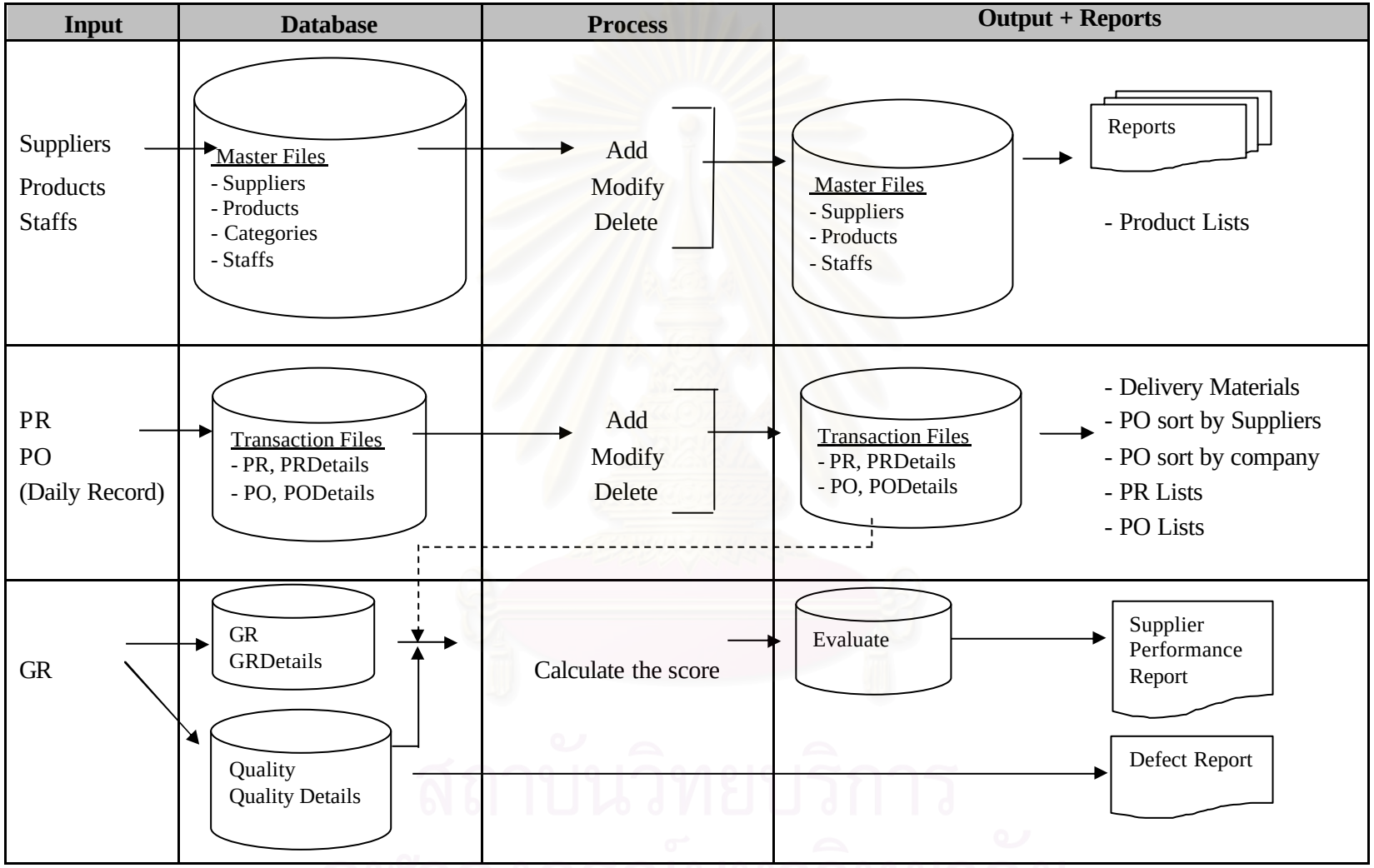

Figure 4.2 The diagram of system input/output design

i) Database of Input

Table 4.11 Database of Products and Category

Products		
Field	**Type**	**Description**
ProductID *	Text	Product ID
SupplierID *	Text	Supplier ID
ProductCatID	Text	Category ID
ProductName	Text	Product Name
Unit	Text	Unit
UnitPrice	Number	Unit Price
LastUpdate	Date	Date of Update Price
ProductStatus	Text	Status of Product
Rec	Text	Recorder Name

Table 4.12 Database of Product Categories Table

Products Category Table		
Field	**Type**	**Description**
ProductsCatID *	Text	Category ID
ProductsCatName	Text	Category Name

Table 4.13 Database of Suppliers

Suppliers Table		
Field	**Type**	**Description**
SupplierID *	Text	Supplier ID
SupplierName	Text	Supplier Name
ContactName	Text	Contact Name
Address	Text	Address
Phone	Text	Phone
Mobile	Text	Mobile
Email	Text	E-mail address
PaymentTerm	Text	Condition of Payment
SupplierType	Text	New /Approved/ Certified/ Potential

Table 4.14 Database of Staffs

Staffs Table		
Field	**Type**	**Description**
StaffID *	AutoNumber	Staff ID
StaffName	Text	Staff Name
Surname	Text	Surname
Department	Text	Department
CompanyCode	Text	Company Code

Table 4.15 Database of Purchasing Staffs

Purchasing Staffs Table		
Field	**Type**	**Description**
PStaffID	AutoNumber	Purchasing Staff ID
PStaffName	Text	Purchasing Staff Name

Table 4.16 Database of PR and PR Details (Purchase Requisition)

PR		
Field	**Type**	**Description**
PRCode *	Text	PR Code
StaffID *	Text	Requirer Code
PRDate	Date	PR Date
NeedDate	Date	Need Date
IssueDate	Date	Issue Date
PRFlag	Text	Status of PR
Rec	Text	Recorder Name

PR Details		
Field	**Type**	**Description**
PRCode *	Text	PR Code
ProductID *	Text	Product ID
StaffID *	Text	Staff ID
Line	Text	Item number in order
Site	Text	Company Code
Quantity	Number	Quantity request

Table 4.17 Database of PO and PO Details (Purchase Order)

PO Table		
Field	**Type**	**Description**
POCode *	Text	PO Code
SupplierID	Text	Supplier ID
PaymentTerm	Text	Payment Term
PStaffID	Number	Purchasing Staff ID
PRCode	Text	PR Code
PODate	Date	PO Date
PrintDate	Date	Date Print PO
ApprovedDate	Date	Date Approved PO
DueDate	Date	Due Date
Discount	Text	Discount rate
NetTotal	Number	Net Total of purchase order
NetVAT	Number	Net VAT
POFlag	Text	Status of PO
Rec	Text	Recorder Name

PO Details Table		
Field	**Type**	**Description**
POCode *	Text	PO Code
ProductID *	Text	Product ID
QtyOrder	Text	Actual quantity order
UnitPrice	Number	Price per unit
PriceDiscount	Number	Discount per unit
Net	Number	Net item after discount
IsReceived	Text	Status of Product received

Table 4.18 Database of GR and GR Details (Good Receipt)

GR Table		
Field	**Type**	**Description**
GRCode *	Text	GR Code
POCode	Text	PO Code
InvoiceNo	Text	Invoice Nunmer
Receipt Date	Date	Date Product delivered
Rec	Text	Recorder Name

GR Details Table		
Field	**Type**	**Description**
GRCode *	Text	GR Code
ProductID *	Text	Product ID
OnTime	Text	Status of timeliness delivery
Receipt Qty	Text	Number of quantity delivered
LackQty	Text	Number of quantity lack
PercentDelivery	Text	Percentage of Items delivered
Receipt Status	Text	Status of Items delivered

Table 4.19 Database of Quality and Quality Details

Quality Table		
Field	**Type**	**Description**
Qcode *	Text	Quality Code
POCode *	Text	PO Code
GRCode *	Text	GR Code
QDate	Date	Date of inspection
Rec	Text	Recorder Name

Quality Details Table		
Field	**Type**	**Description**
Qcode *	Text	Quality Code
ProductID *	Text	Product ID
AcceptQty	Text	Accept Quantity
DefectDesc	Text	Defect Description
PercentAccept	Text	Percentage of Items accepted
QualityStatus	Text	Status of Items accepted
TimeofShip	Text	Time of shipment

ii) Database Output

Table 4.20 Evaluation Table

Evaluation Table		
Field	**Type**	**Description**
SupplierID	Text	Supplier ID
EvaDate	Date	Date of Evaluating
Q1	Text	Score of Rejection rate
Q2	Text	Score of Lot acceptance rate
D1	Text	Score of On-time
D2	Text	Score of Fulfillment of orders
P1	Text	Score of Cost competitiveness
P2	Text	Score of Cost reduction
P3	Text	Score of Payment term
S1	Text	Score of Responsiveness
S2	Text	Score of Technical/ product knowledge
S3	Text	Score of Corrective action response
S4	Text	Score of Advance notice purchasing information
S5	Text	Score of Assistance in emergency orders
R1	Text	Score of Management capacity
R2	Text	Score of Financial stability
R3	Text	Score of Registered capital
R4	Text	Score of Duration of business
R5	Text	Score of ISO certificate
TotalScore	Text	Total Weight Score
SupClass	Text	Type of Supplier

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Table Relationship:

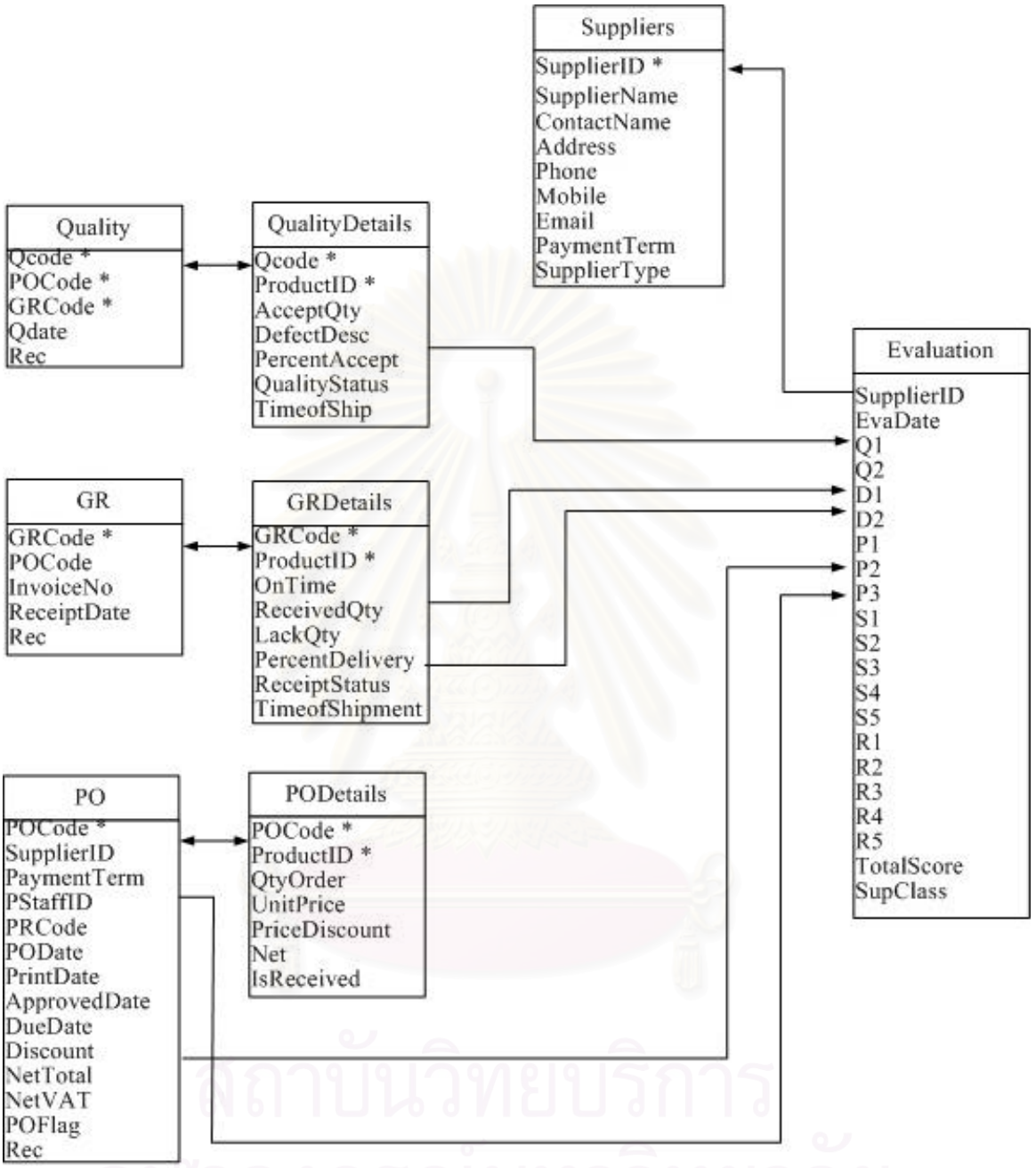

Figure 4.3 Table relationship of database of supplier evaluation system

Apart from the score computation and the supplier classification, issuing reports is the important function of the system through the application of Crystal Report version 9.0. The key reports include

1. Summary of Monthly Delivery Materials
2. Good Receipt List
3. Product list
4. Purchase Requisition List sort by Supplier
5. Purchase Order List sort by Supplier
6. Purchase Order sort by Product ID
7. Purchase Order sort by Product Name
8. Purchase Order List sort by Product Categories
9. Evaluation Report
10. Price Change of material

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CHAPTER 5
SYSTEM DEVELOPMENT AND IMPLEMENTATION

5.1. Survey the readiness

According to chapter 4.3, the proposed system was developed on Microsoft Access version 2000, Visual Basic 6.0, as well as Crystal Report version 9.0. Establishment of a computerized system for supplier evaluation is required a plan for implementing. The plan of the proposed system in the ABC Company was set into steps as follows

Step1: Hardware and software requirement

The proposed system is planned to specifically use in the purchasing department; we set the selected PC to be server and other PCs working as Clients.

Hardware and software requirement	Description
CPU	Pentium 166 MHz up
Hard disk	1.2 GB up
RAM	32 Megabyte up
Operation system	Windows 98, Window 2000, Window ME, Window XP
Database system	Microsoft Access 2000
Network	Intranet 10/100
Monitor	-
Keyboard	-
Mouse	-

Table 5.1 Hardware and software requirement

Step2: Preparing the master data

- Gathering the Master Data such as suppliers, products, employees from the existing information
- Determining the Products categories and Product code
- Entering primarily data through the user interface of the proposed system

Step3: Initiating the proposed program

After the equipment, initial data and staff are ready, the proposed program will be started in the following step:

- Installing the proposed program and additional software (i.e. Visual Basic and Crystal Report) in each PC.
- Testing the performance of the program in network
- Holding a meeting among the users
- Training relevant users on the program utilization
- Determining the duration for testing the program
- Verifying the performance of the program and the record of data
- Evaluating the performance of the program
- Authorizing the result of using the program by Supplier Evaluation Team approve

5.2. Testing the performance of Purchasing Evaluation System

Testing the performance of Purchasing Evaluation System is associated with 1) checking errors of the system during running an operation, 2) checking whether the system process work properly 3) ensuring the system designed can operate in real situation. To examine the above functions, we use the historical data of company to compare the system performance and its results.

The investigation of the system performance is separated into three parts: Database management system, Evaluating the user's satisfaction and Validation of evaluating.

5.2.1 Database Management System

The proposed system has capable of collecting all required data, namely Transaction Data and Master Data. Both data are stored in Purchasing.mdb. Due to the program's relationship property, when data are updated in some place, the linkage will automatically changed that data in other tables. This helps lessen the redundancy in entering the repeated data. It shows how easy the program is. In addition, generating summary reports is faster and more convenient than the previous system, in which the users have to collect

data and rekey-in to the spread sheet for reporting summary purpose. The comparative results are concluded in the table below.

Item	Database management of Purchasing.mdb	Database management of The old system (Excel File)
1. Collecting data	• Keeping in file of MS.Access	• Separating in MS.Excel files • Experience, Memory or Documents
2. Viewing data 3. Generating summary reports	• Viewing by using menu function on screen • Printing immediately by using menu on screen • Providing with graphs	• Searching in each spread sheet • Collecting information and retyping data in order to issue reports
4. Accessing data	• Use altogether	• One by one staff
5. Time of keying data into database	• Average 3 minutes per order	• Average 5 minutes per order
6. Amount of orders per day	• Approx. 20 orders per day	• Approx. 10 orders per day
7. Evaluating method	• Calculating by formula sorted supplier's name	• Experience, Memory, And Documents

Table 5.2 The comparison of the database management system of supplier evaluation system and the existing system

5.2.2 Evaluating the user's satisfaction on the system designed

In evaluating the result of using supplier evaluation system, the questionnaire is developed to assess the user's satisfaction on the program after using the program over a week period, after the users are familiar with the program. The major aspect of evaluating performance of program is focusing on convenience in each process such as updating data, searching product's price, evaluating supplier and issuing reports. Moreover, the program will be evaluated in terms of the correction of the evaluation results. Key evaluators of the supplier evaluation system are 5 buyers, 2 senior buyers and a purchasing manager.

The criteria of evaluating of users' satisfaction are emphasized on conveniences of the system that can be considered in details as follows:

1. Entering and/ or updating Data
2. Searching Product Cost

3. Searching History of Orders
4. Tracking Purchasing Orders
5. Rating Suppliers
6. Generating Summary Reports
7. Assessing Database

At the initial stage of implementing the program for a week period, the result of user's satisfaction on the program can be summarized as shown Table 5.2

Evaluating Items **Convenience in**	**Average score**
1. Keying Input Data	8.25
2. Editing Data	8
3. Tracking Purchasing Orders	9
4. Searching for Cost of Materials	9.25
5. Searching Historical Orders	8.5
6. Rating Suppliers	9
7. Generating Reports	8.5
8. Accessing Database	7.5

Table 5.3 Average score of user's satisfaction

It can be seen that the level of user's satisfaction was rated relatively high score, particularly in aspect of searching for cost of materials, tracking purchasing orders, and rating suppliers. Keying input data and editing data gained a slightly lower score because the users need more time to adapt themselves to the program usage. The lowest score in database assessment is at 7.5; however, it did not mean bad. It was reasoned that the users felt the program worked too slow to access, in particular generating the summary reports. The main cause of inferior score may be from the difference of operation system and free space of Hard disk in each PC, which affected to the performance of the system.

5.2.3 Validation of evaluating

After implementing the proposed system, there was a question whether the supplier's classification is appropriate to the actual supplier's performance. To check the validation of evaluating, the team selected ten sample suppliers of the appraisal result using the proposed system. The ten suppliers had 80% collective purchase volume of the total purchased value inputting to the database. The result of implementing the program grouped four suppliers into Potential level, four into Certificate level, and two into Approved level. However, some results of appraisal were not consistent with company's perception on these suppliers as show in the Table 5.3.

Supplier	Classification from the proposed system	Classification from the existing system
1	Potential	Potential
2	Certificate	Potential
3	Potential	Potential
4	Certificate	Certificate
5	Certificate	Certificate
6	Certificate	Certificate
7	Approved	Approved
8	Potential	Potential
9	Potential	Certificate
10	Approved	Approved

Table 5.4 The result of evaluation supplier based on the proposed system

The reasons of contrast result were the limitation of information in the database and determination of weight and rating scale. In real situation, the company placed numerous orders to Supplier No.2 and 9, but during the period of testing the program, only few orders were presented. Thus, the validation of result was not absolutely precise. After discussion, the team conclusively accepted the results of evaluation at the initial stage, even there were some differences. For the future, rating scale and weighing criteria can be adjusted to be more accurate after the company has sufficient supplier performance and has experienced in the proposed program for a while. In practice, the company may apply the statistic application (e.g. the average and

dispersion of the supplier's rating score) to modify the concept of categorization. For example, the company can recognize the number of optimal suppliers in each level of the supply base. Using of the statistic principle, the company can arrange suppliers the suitable rating score and the precise group.

5.3 Screen Design

The main screen of the program is illustrated in Figure 5.1 that there are 8 major menus, i.e. master files, PR menu, PO menu, GR menu, Evaluating menu, Summary report menu, Admin menu and Help menu. The below pictures present the sample screens of the program. For the full details of screen design are described in the manual of the program (Appendix A).

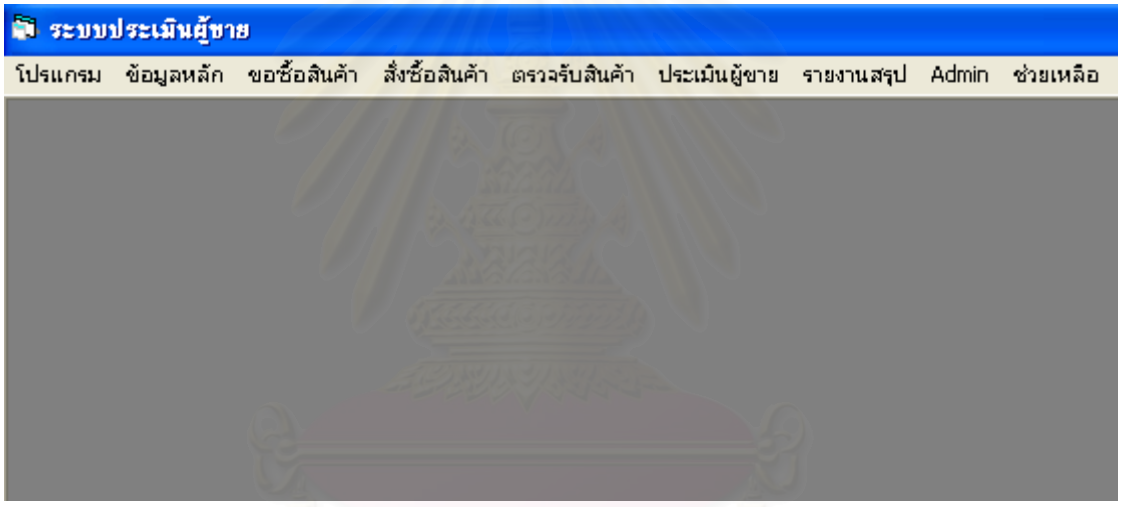

Figure 5.1 The main screen of the program

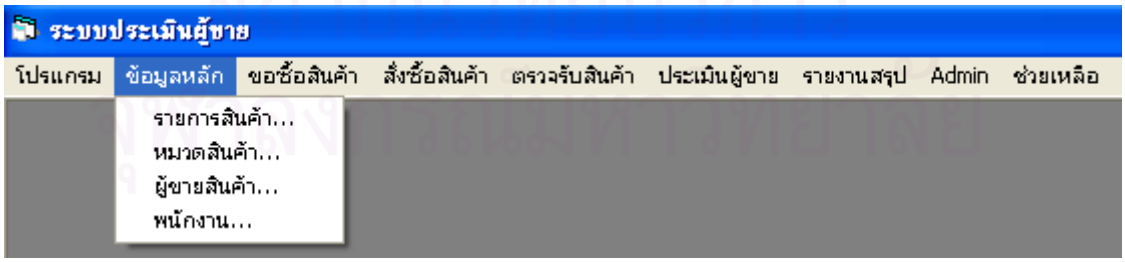

Figure 5.2 Menu of Master file

When selecting the product submenu, the users will jump into the screen of product as shown in Figure 5.3

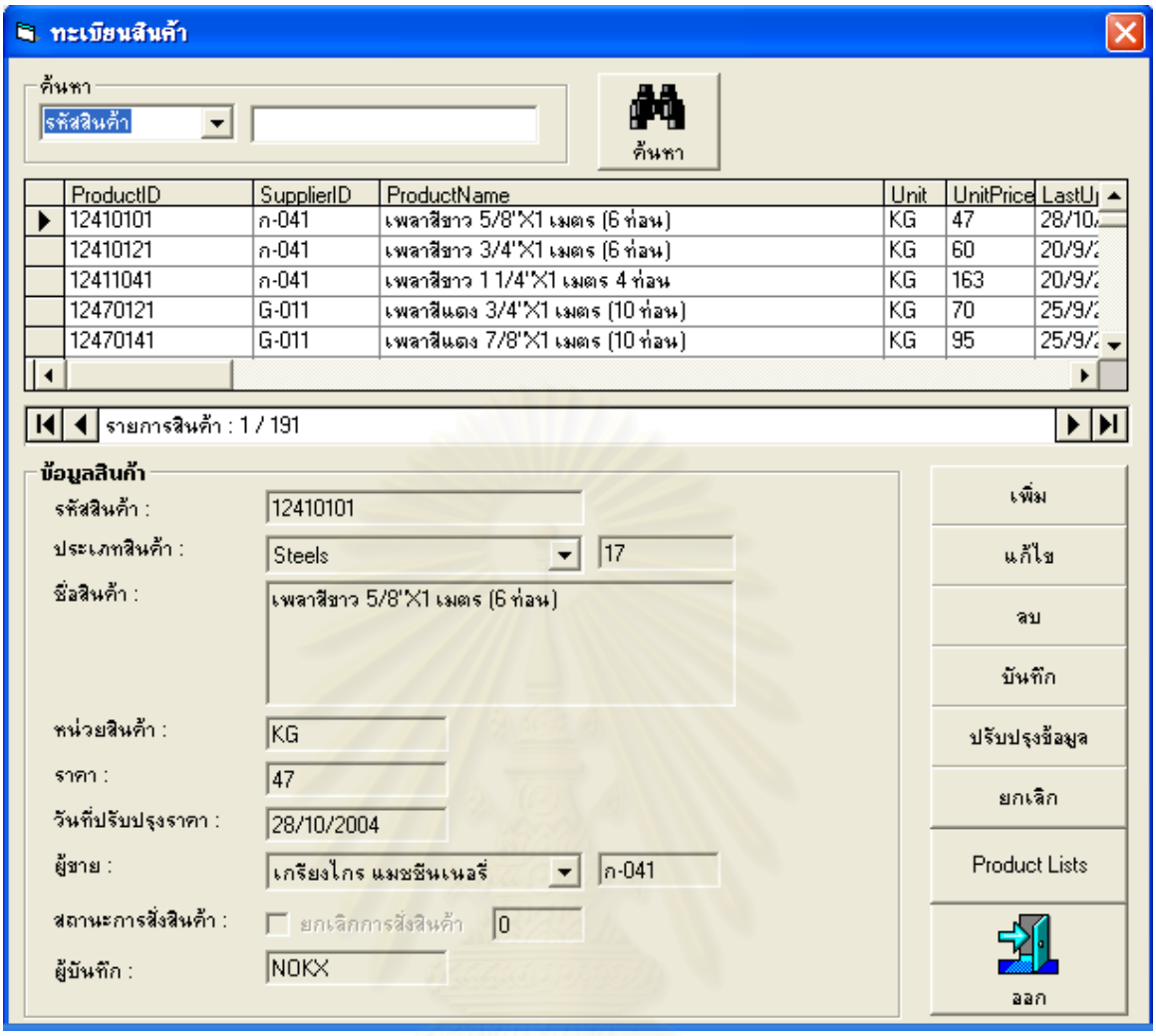

Figure 5.3 The screen of Products

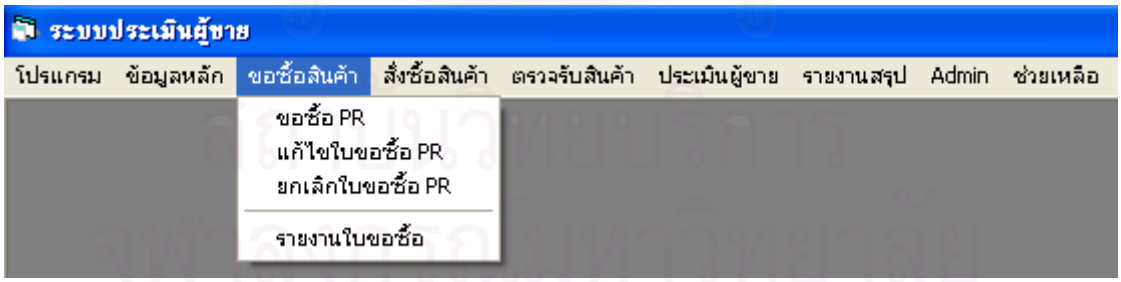

Figure 5.4 Menu of PR

Choosing PR submenu, the screen of PR will appear as shown in Figure 5.5

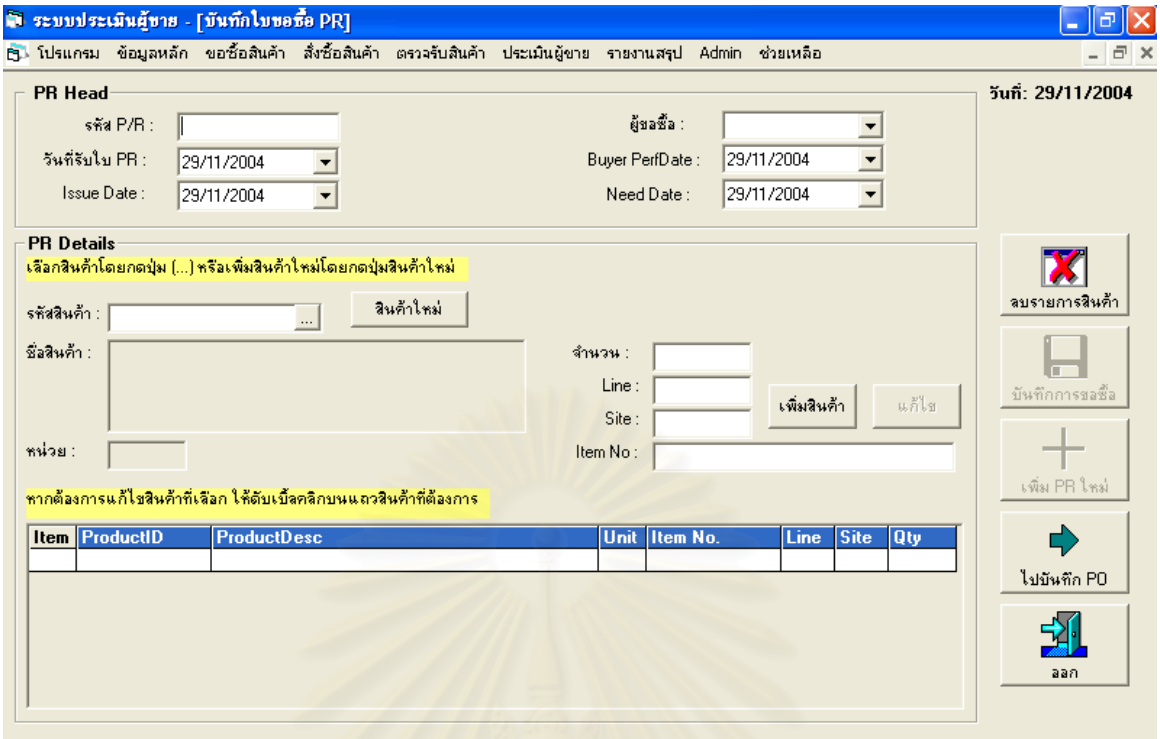

Figure 5.5 The screen of input PR data

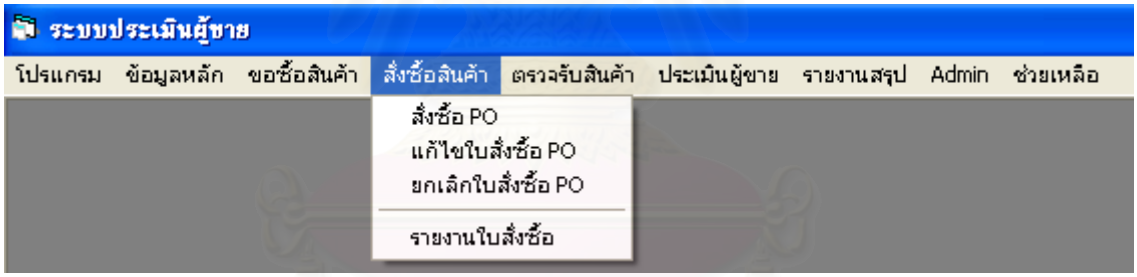

Figure 5.6 Menu of PO

The users can fill in the details of PO by selecting Menu of PO and the screen of PO as illustrated in Figure 5.7

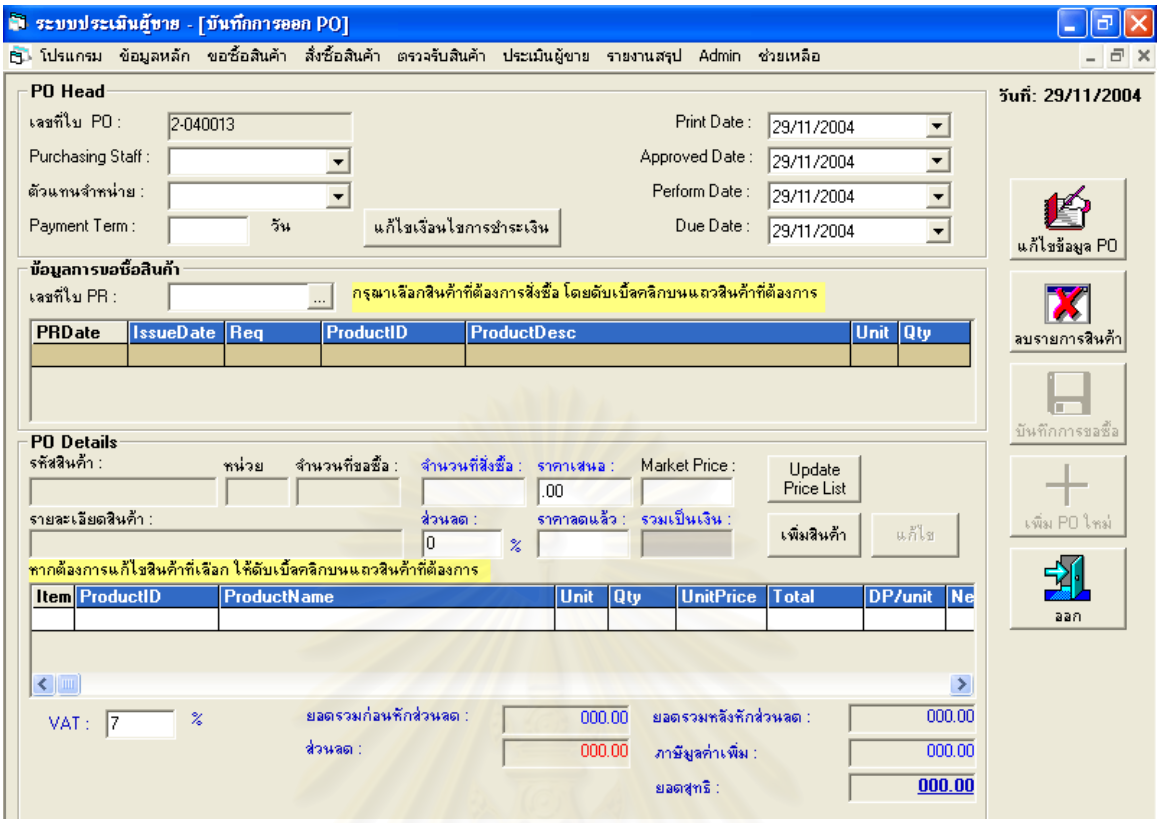

Figure 5.7 The screen of input PO data

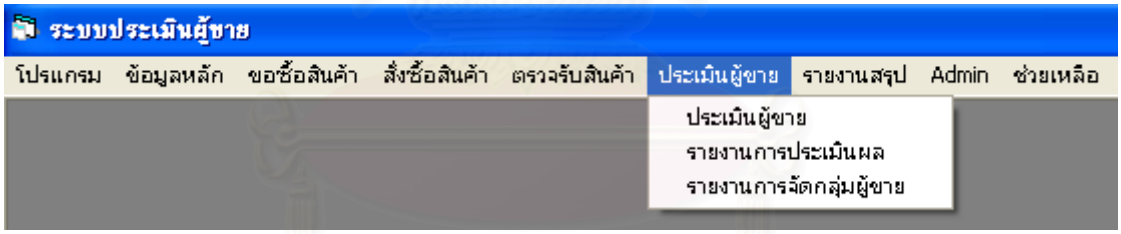

Figure 5.8 Menu of Evaluating

To rate supplier, the users have to choose Menu of Evaluating. After that the screen of Evaluating shows in the picture below.

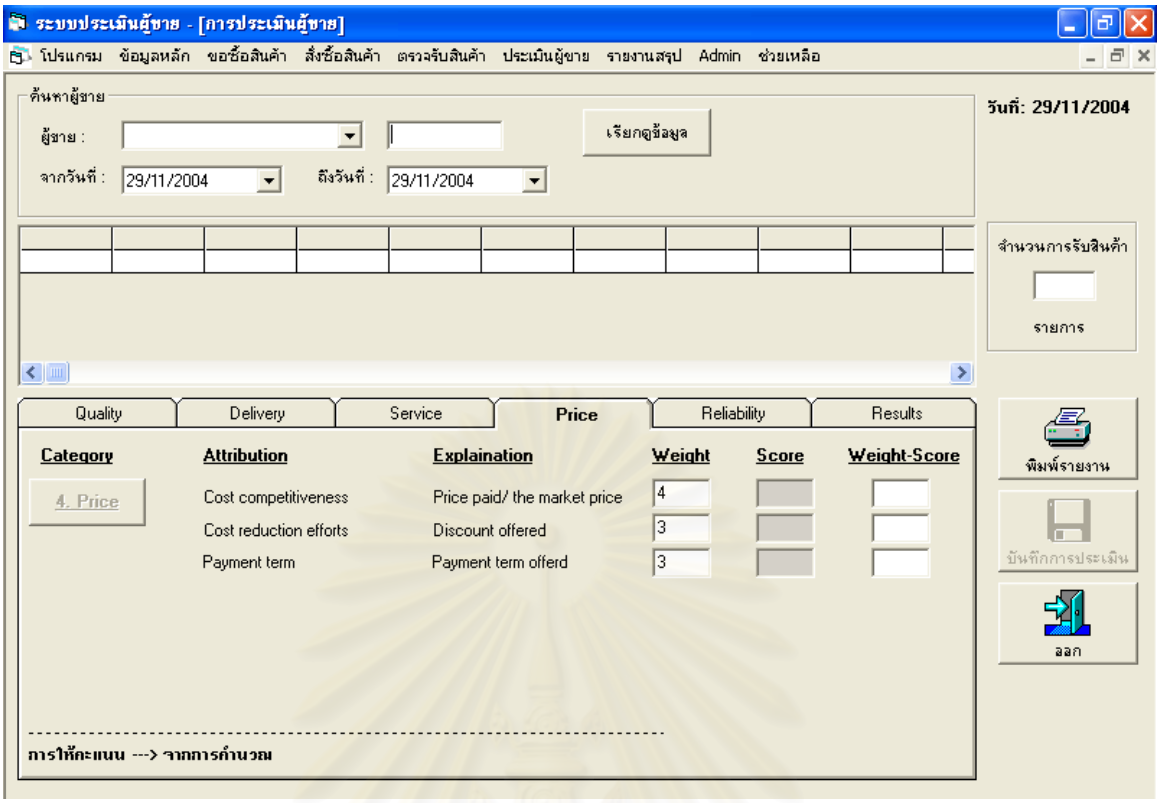

Figure 5.9 The scrren of Evaluating supplier

Generating summary reports is not complicated, the users just go to the menu of summary report and then choose type of report that they want.

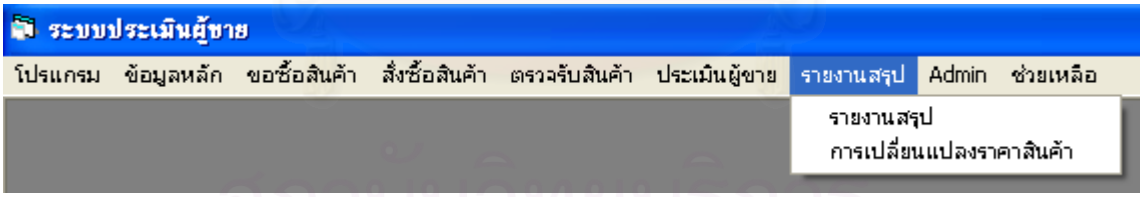

Figure 5.10 Menu of Summary Report

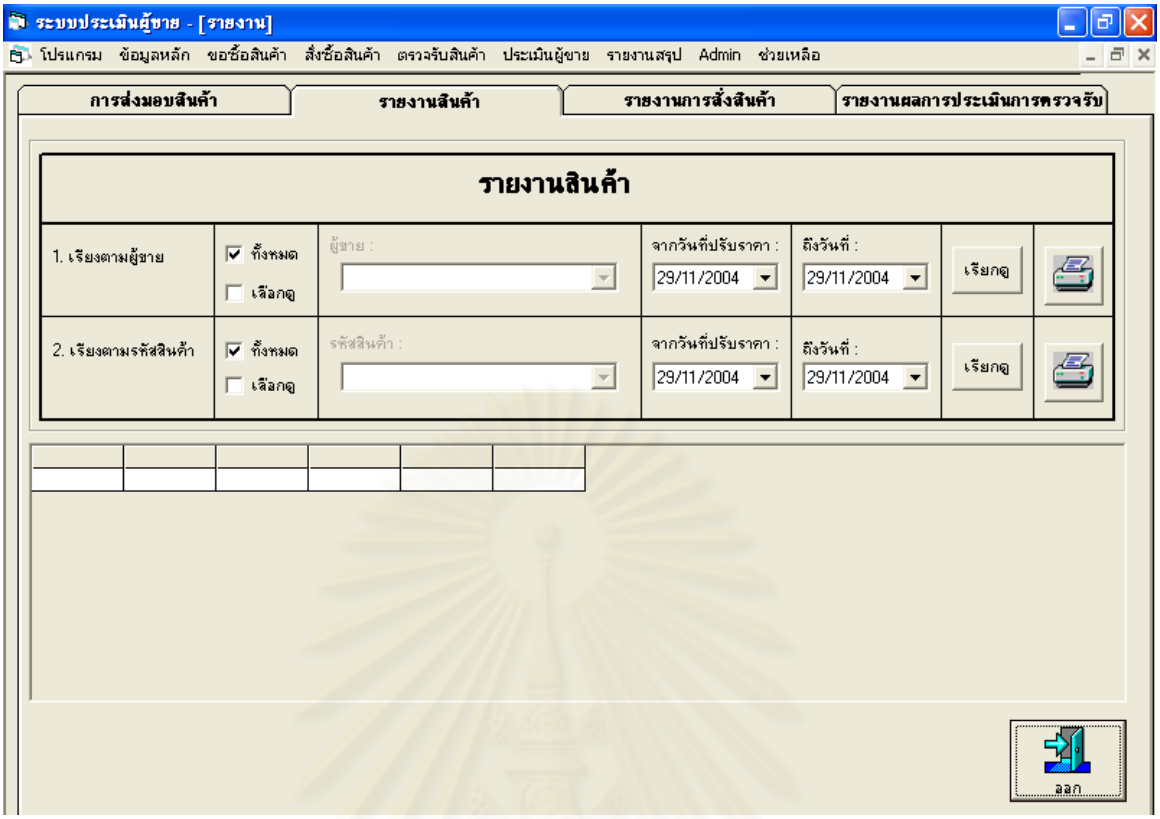

Figure 5.11 The screen of Summary Report

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This thesis focuses on developing the computerized supplier evaluation system and database management for a firm in the packaging industry. The research started with studying the existing evaluation system, a manual system, which is a lengthy time-consuming process in collecting data and making evaluation. A cause-effect diagram was used to find root causes of the problem, i.e. personnel, method of collecting data, the existing process in making evaluation, and the flaw of existing data. Therefore, the research aimed to develop the way to improve the procedure of supplier evaluation. The objectives of the study are to make the assessment of the supplier performance faster, to classify the suppliers according to their performances, and to generate the relevant reports.

The proposed system was developed through using Microsoft Visual Basic 6.0 program, Microsoft Access version 2000 as the database management system and Crystal report 9.0 as reporting tool. Major activities of the system are designed to collect relevant and significant data about the supplier's performance and to convert these data into the objective score and to categorize each supplier into the suitable group based on the supplier's score. The expected result of this system is providing the users with comfortable process, particularly in evaluating suppliers and updating the significant data. The complication and difficulty of the existing supplier evaluation is in the process of searching the required data of each supplier one-by-one and manually making the assessment. The shortcoming can be solved by the proposed system because what information needed in assessment is designed to present in only one screen. Moreover, updating data could be done automatically, for example if there is some changes in any data in one table, the information on the linked tables will be updated automatically.

According to the system for evaluating suppliers, the existing practice was not standardized, which may be biased by the evaluator's preferences. The existing result was rather dependent on the evaluators' experiences and judgment, specifically from purchasing staff. As a result, the new proposed system was established by the

collaboration of all members from the involved departments. The body of the supplier evaluation team encompassed the staffs from production, purchasing, QA, and store. The team is responsible entirely for determining the methodology and criteria including with attributes in each criterion of making evaluation, weighing each attribute and setting up rating levels. The calculating method of evaluation is multiplying the supplier's rating for any variable by its variable's importance. The suppliers who obtain the higher composite scores will be positioned in the hierarchy levels of AVL, following to the specified categories-- potential, certificate and approved level, respectively. The system emphasizes on not only the design of computer system itself but also the operational design for end-users. Therefore, it is prerequisite to provide training course for the involved people to know the concept and application of the system before using the proposed program.

The Weight-point approach is used as a method of evaluating supplier performance. Supplier performance rating process is based on purchasing record, incoming inspection report and goods receipt report to evaluate the quality of suppliers both its products and services upon five key criteria, i.e. quality, delivery, service, price, and reliability. The new established system was put into practice for a week. After implementing, the results showed that the users were somewhat satisfied especially in aspect of searching cost of materials, tracking purchasing orders, and rating suppliers. The validation of supplier classification using in the proposed system was not fully consistent with the company's perception. However, the team agreed to accept the outcome because the fallacy was probably resulted from the limitation of supplier data performing this project also encouraged the company to improve supplier evaluation system to be more objective and standardized.

6.2 Recommendations

1. The supplier evaluation system is designed to assess all suppliers under the same condition both criteria and weight-giving to each criterion, even in practice the different product would rather require the different criteria to measure. So, we suggest it seem more reasonable that each product should be grouped in the same product categories and applied the same criteria within its product group.
2. To accurately assess supplier performance in terms of quality, the amount of defective items found in the production process should be reported to purchasing department as soon as possible, as the additional reference in evaluating the supplier performance.
3. The company shall continually adjust the weights given to each performance to be more accurate and change the rating scale to reflect the accuracy of placing suppliers at the right classification levels.
4. There is no weighting given to the reliability performance because, the company at present has no plan to visit supplier's site. However, the proposed system is designed the screen for reliability area in response to the future need.
5. Since our sampling collection had been done within limited timeframe of only 1 week period, the result of using those samples in our analysis was deviated from the evaluators' estimations. It is expected that the result would be more accurate, if there were sufficient data processed in making evaluation.
6. The current system and proposed system are not informed to supplier about the performance results, just internally used. To improve suppliers' products and services, particularly suppliers' weaknesses, the company should have a regular meeting among buyers, users and suppliers to give feedback on supplier's performance on continuous and regular basis. In stepping further to install the supplier development programs, discussion and collaboration with suppliers is required.
7. The users have face difficulties in entering and transferring the existing data of master file to the database, thereby spending long time to putting data in the process. It so had better to automatically link the data with the new system.

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สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Appendices

สถาบันวิทยบริการ
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Appendix A

The Supplier Evaluation System User Guide

สถาบันวิทยบริการ
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The Supplier Evaluation System User Guide

General information

This document provides all information and instructions for using the program, effectively. This user guide covers four major areas:

1. Getting started with the software
2. Updating data (Add, Edit, Delete, View)
3. Generating reports
4. Evaluating suppliers

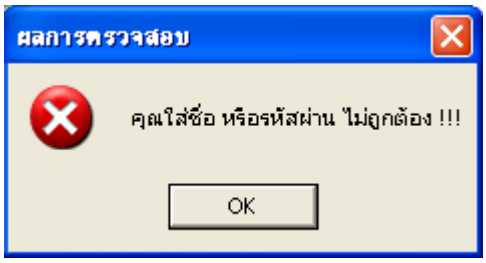
1. Getting started with the software

A valid account and password is required to access to the proposed program. The administrator is the only one who can add or change the users.

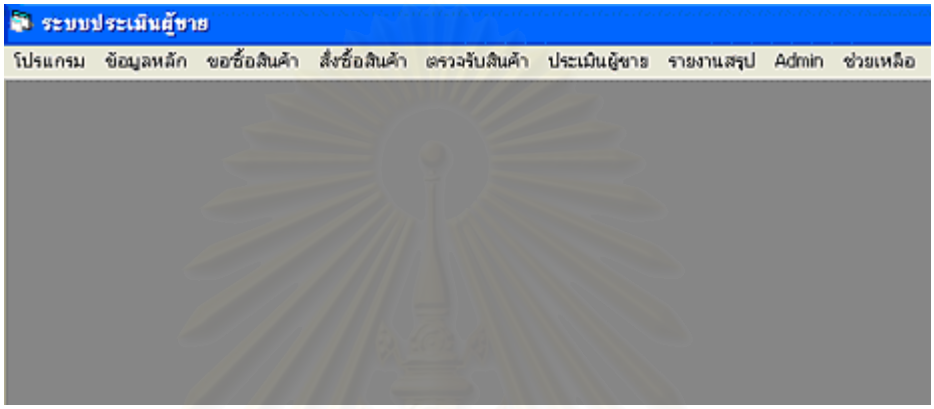
Logging in to the program

1. Enter your account ID in the username field.
2. Enter your password in the Password field.
3. Click OK

If the users type the wrong username or password incorrectly, he or she can not access the system and the below page shown ‘Your username or password is not correct’ illustrated as follows.



After typing the correct Username and Password, the following page appears.



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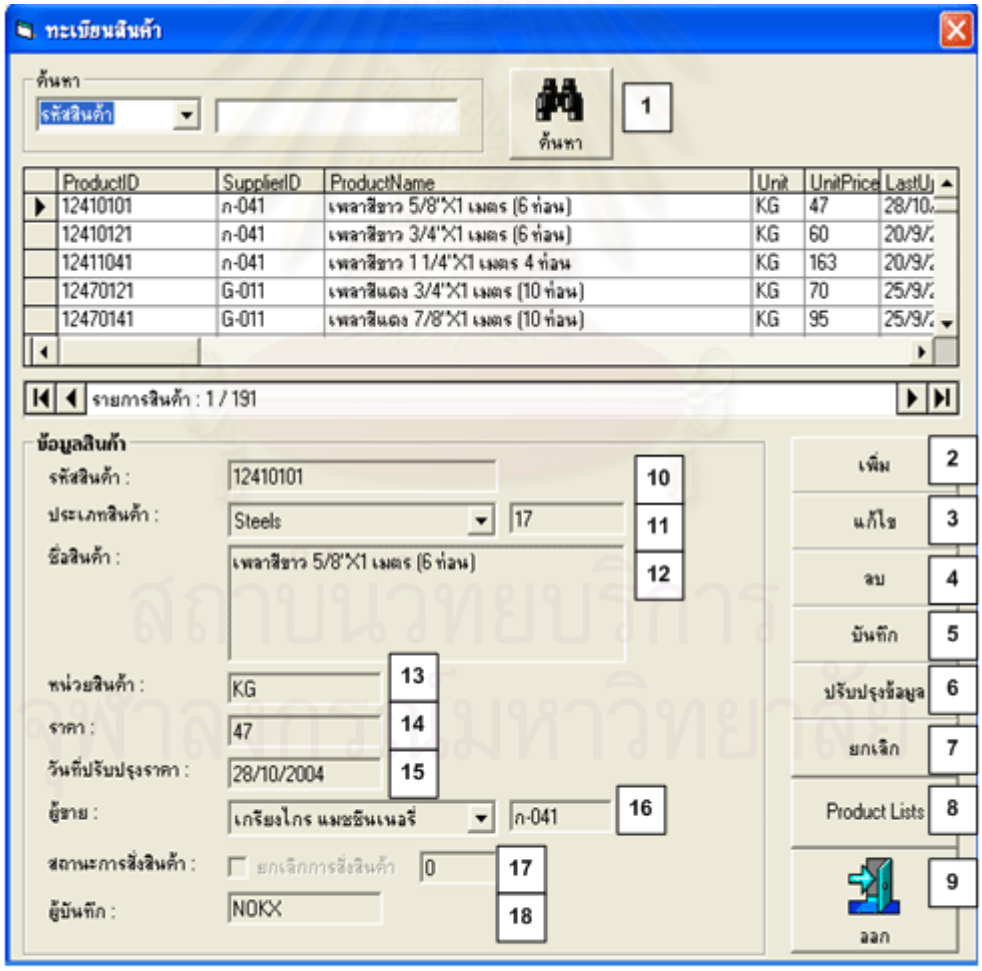
2. Updating data

This process is related to adding, editing, deleting as well as viewing in Master files and Transaction files. The master files are record of Products, Product categories, Suppliers and Staffs, whereas the transaction files are Purchase requisitions, Purchase order, and Goods receipt.

Mater files

The user can update data of records by using buttons (Add, Save, Edit, Delete, Update and Exit). The following pictures are the working screens of the master files in the proposed program.

- **Products**

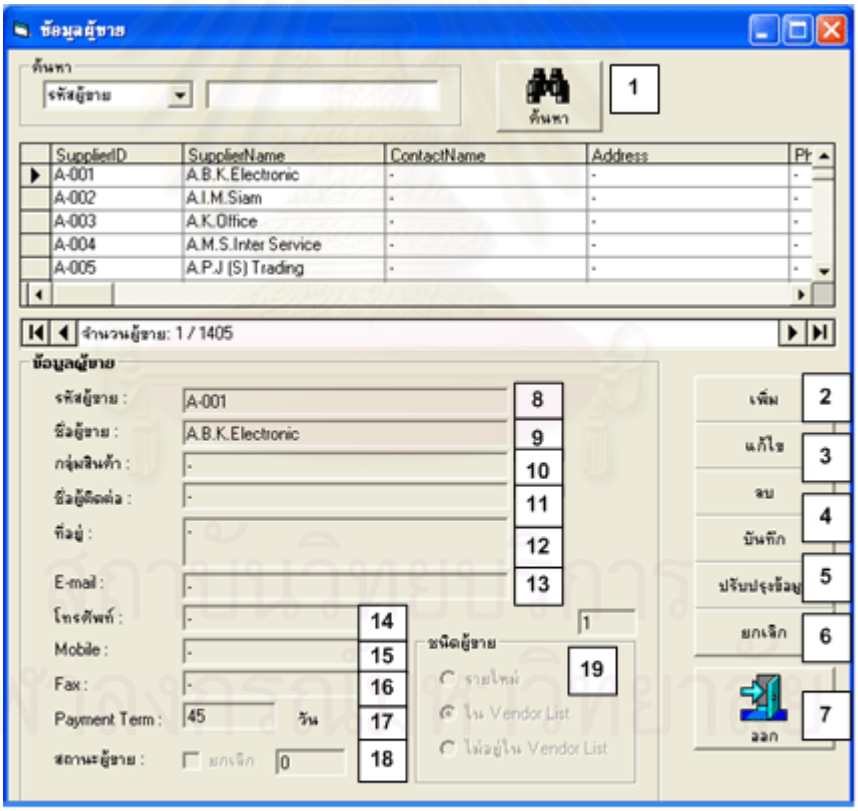


1= Search Item, 2 = Add, 3 = Edit, 4 = Delete, 5 = Save, 6 = Update, 7 = Cancel, 8 = Product List, 9 = Exit, 10 = Product ID, 11 = Category code, 12 = Product Name, 13 =Unit, 14 = Price, 15 = Date for update price, 16 = Supplier name, 17 = Product Status, 18 = Recorder's name

- **Product categories**

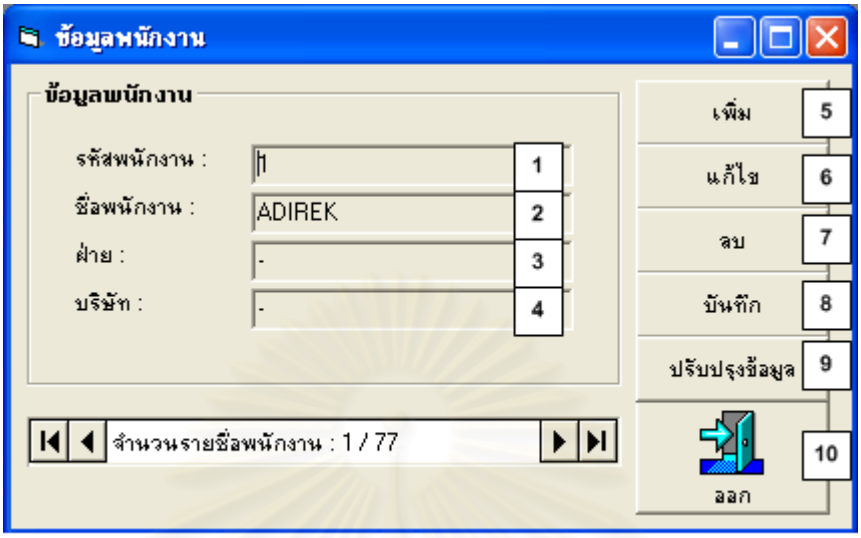
1 = Category code, 2 = Category name, 3 = Add, 4 = Save, 5 = Delete, 6 = Update, 7 = Exit

- **Suppliers**



1= Search Supplier, 2 = Add, 3 = Edit, 4 = Delete, 5 = Save, 6 = Update, 7 = Exit, 8 = Supplier ID, 9 = Supplier Name, 10 = Type of product, 11 = Contact Name, 12 = Address, 13 = E-mail, 14 = Phone, 15 = Mobile, 16 = Fax, 17 = Payment term, 18 = Supplier Status, 19 = Supplier Type

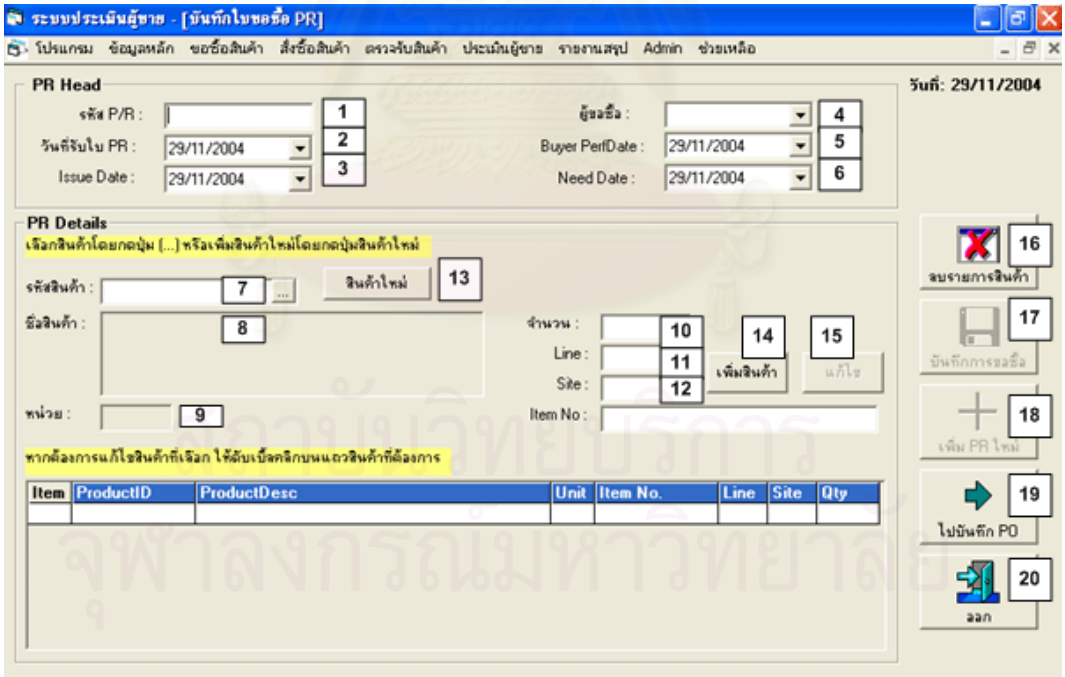
- **Staffs**



1 = Staff ID, 2 = Staff Name, 3 = Department, 4 =Company, 5 = Add, 6 = Edit, 7 = Delete, 8 = Save, 9 = Update, 10 = Exit

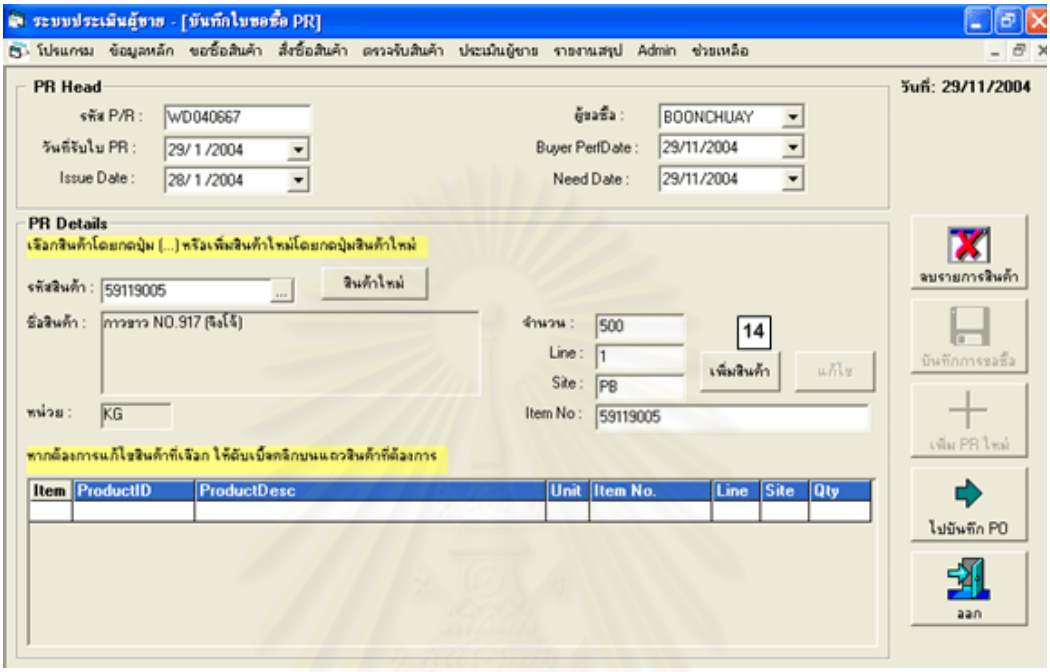
Transaction files

- **Purchase Requisition (PR)**

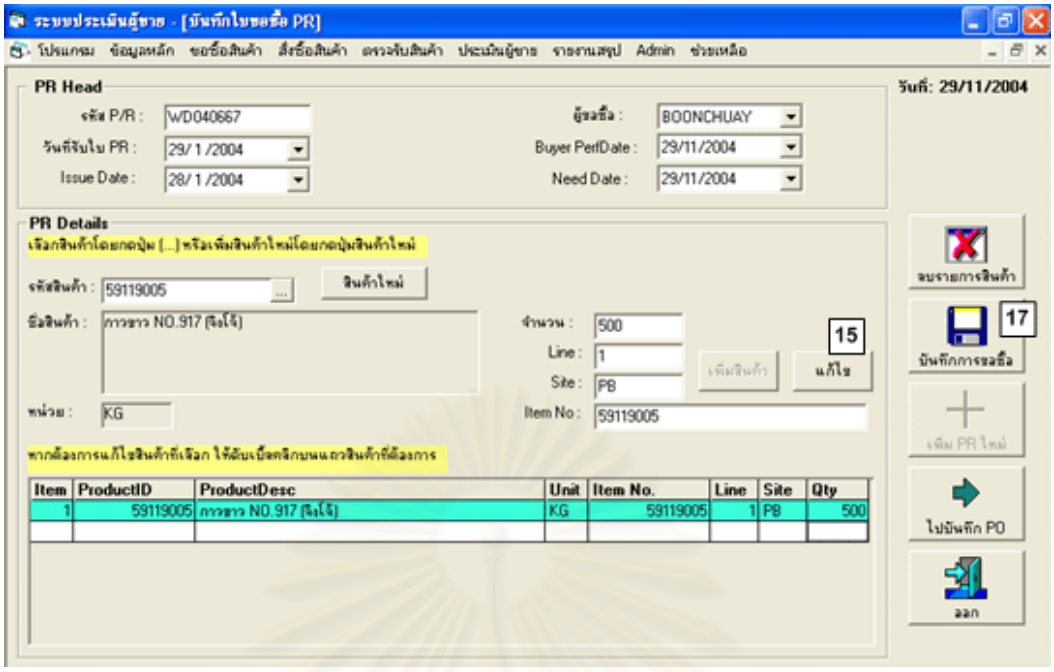


1= PR Code, 2 = Staff Name, 3 = Buyer Performance Date, 4 = PR Date, 5 = Issue Date, 6 = Need Date, 7 = Select Product, 8 = Product Name, 9 = Unit, 10 = Quantity, 11 = Line, 12 =Site, 13 = New Product, 14 = Add Product, 15 = Edit product, 16 = Delete, 17 = Save, 18 = Add new PR, 19 =GO to PO record, 20 = Exit

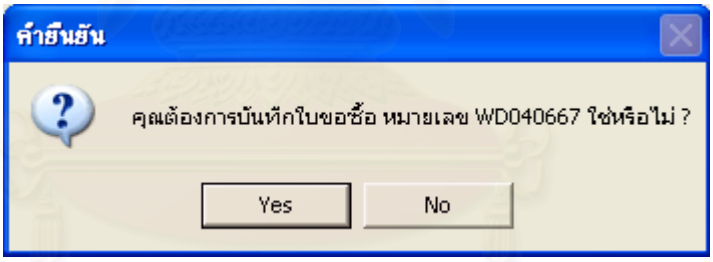
1. The user inputs data of PR Head in the screen of PR recorder, including PR Code, Staff Name (The person asked purchase product), PR Date, Issue Date, Buyer performance Date, and Need Date.



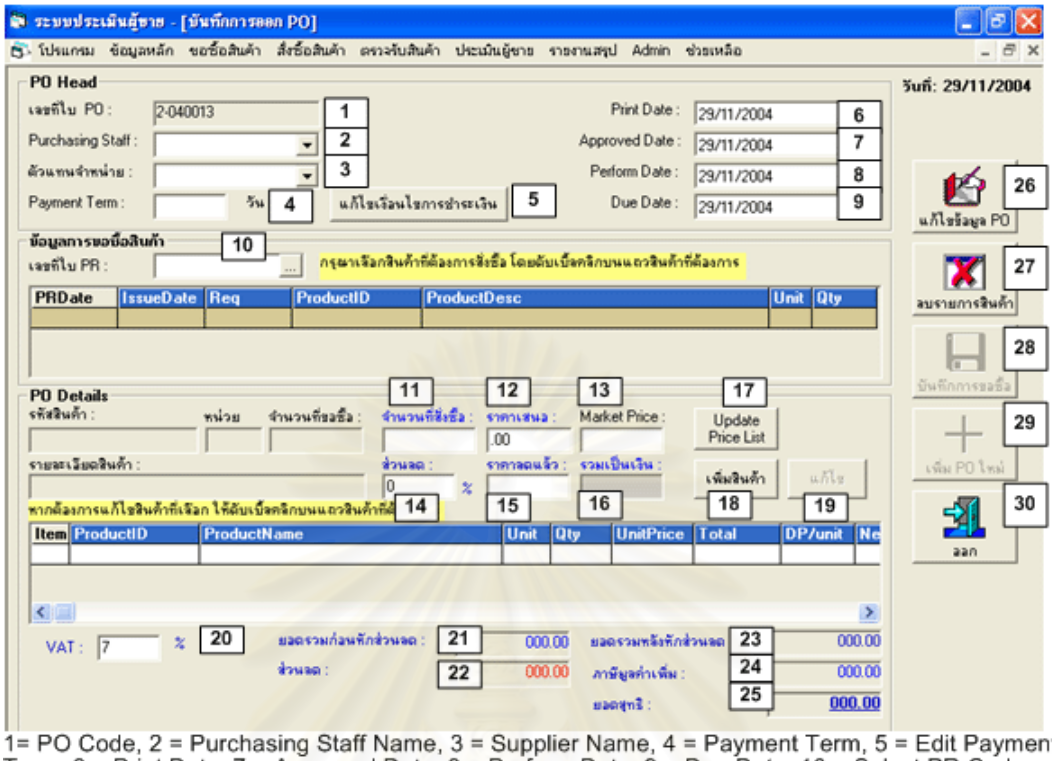
2. In PR Details, the user clicks button (…) in order to select product form the products screen and then add other data in the box. In case there is no product in the record, the user is able add new product by pressing new product button.
3. If there are some errors from keying in the PR Details, the user is able to change by double clicking on the row of table that required. All data will be retrieved in the text box and Add button disabled. After that press Edit button (No. 15) to enter data into the below table.



4. When everything is correct, press save button (No.17) to record data in the database. The Message box will appear to ask for the users' conform before saving.

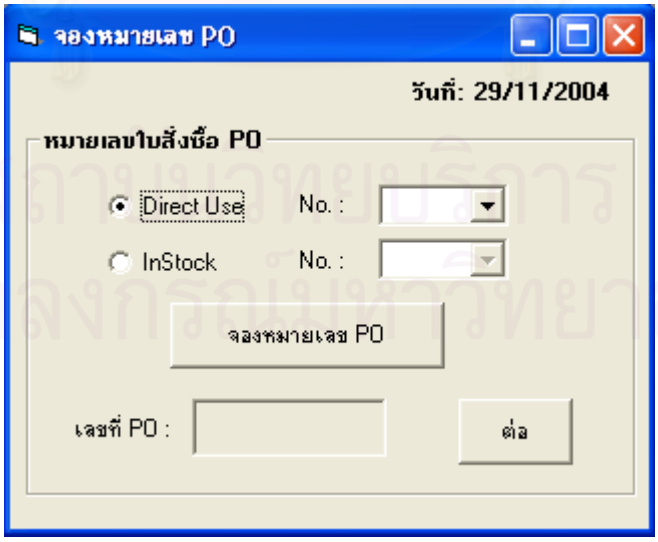


- **Purchase Order (PO)**

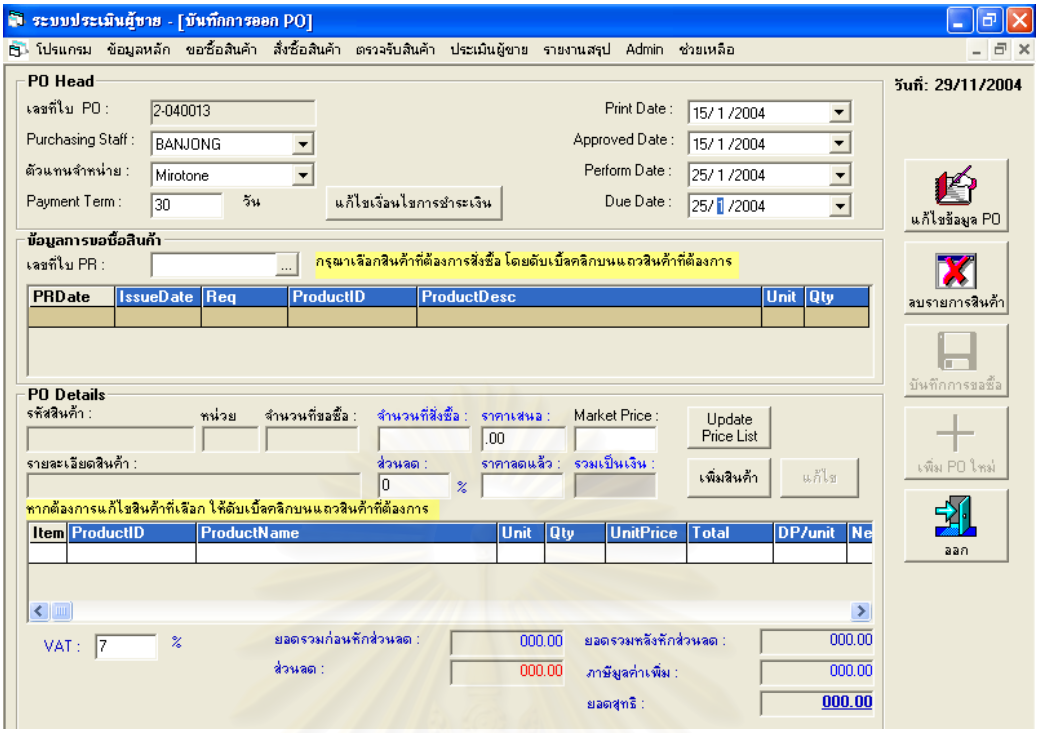


1= PO Code, 2 = Purchasing Staff Name, 3 = Supplier Name, 4 = Payment Term, 5 = Edit Payment Term, 6 = Print Date, 7 = Approved Date, 8 = Perform Date, 9 = Due Date, 10 = Select PR Code, 11 = Quantity Order, 12 = Quote Price, 13 = Market Price, 14 = Discount, 15 = Price After Discount, 16 = Net Price, 17 = Update Price, 18 = Add Product, 19 = Edit Product, 20 = Vat, 21 = Total Amount Before Discount, 22 = Discount Display, 23 = Total Amount After Discount, 24 = Vat Amount, 25 = Total Net, 26 = Edit PO, 27 = Delete Product, 28 = Save, 29 = Add New PO, 30 = Exit

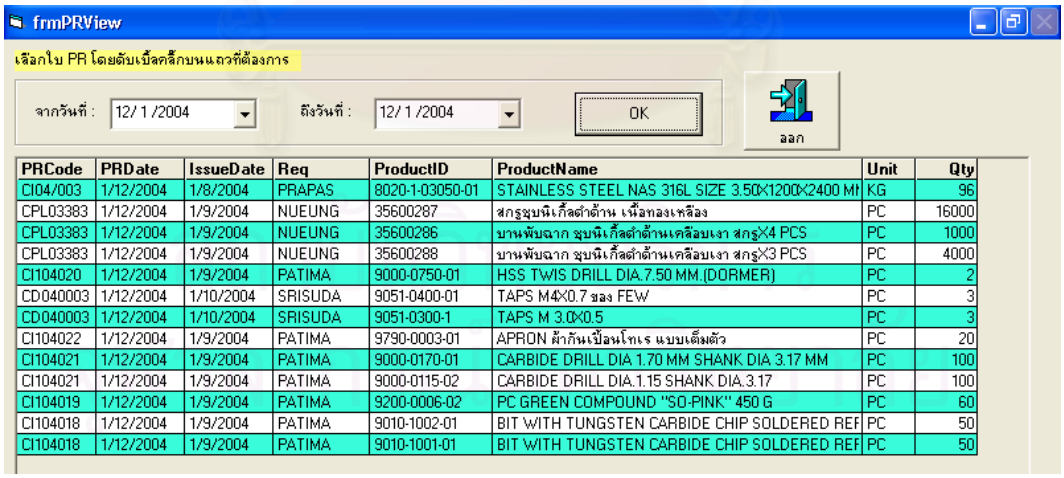
1. Before input data in the PO Record, the user has to book the PO Number as the following picture.



2. After booking the PO Number, the user comes in the screen of PO record and fills out the details of the PO Head.



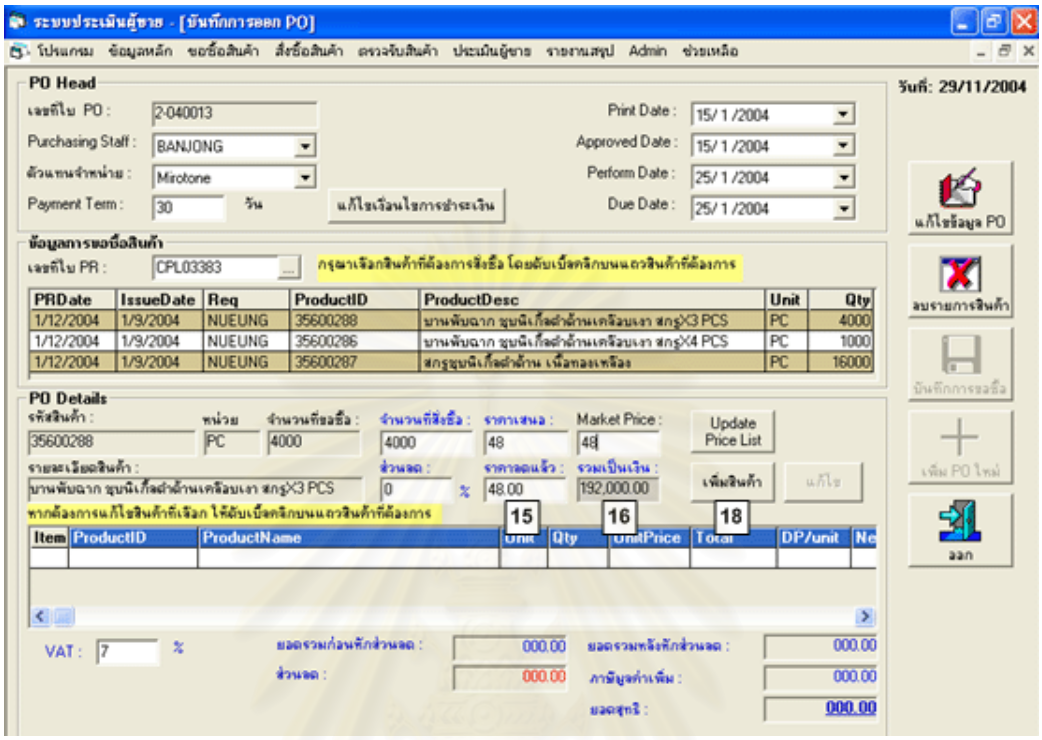
3. Press button (…) to choose the PR related, the following picture appears. The program will search PR Code and other details by entering the duration of PR Date. When find out the PR Code, select PR by double click on the row of table required.



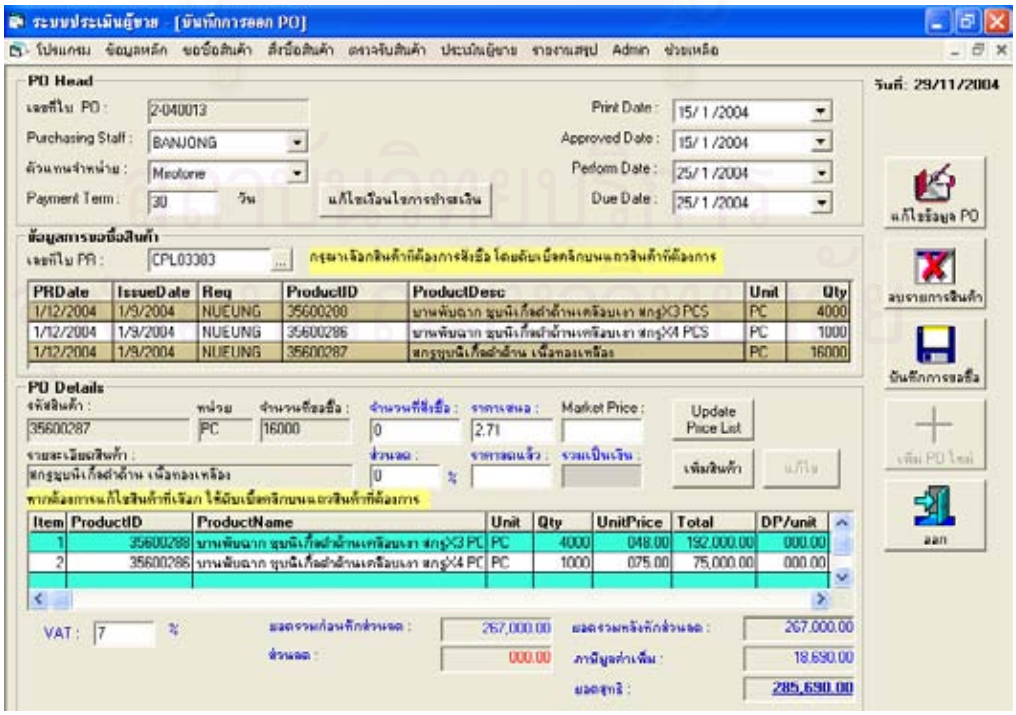
PRCode	PRDate	IssueDate	Req	ProductID	ProductName	Unit	Qty
CI04/003	1/12/2004	1/8/2004	PRAPAS	8020-1-03050-01	STAINLESS STEEL NAS 316L SIZE 3.50X1200X2400 MI	KG	96
CPL03383	1/12/2004	1/9/2004	NUEUNG	35600287	สกรูชุบนิเกิ้ลดำด้าน เนื้อทองเหลือง	PC	16000
CPL03383	1/12/2004	1/9/2004	NUEUNG	35600286	บานพับฉาก ชุบนิเกิ้ลดำด้านเคลือบเงา สกรูX4 PCS	PC	1000
CPL03383	1/12/2004	1/9/2004	NUEUNG	35600288	บานพับฉาก ชุบนิเกิ้ลดำด้านเคลือบเงา สกรูX3 PCS	PC	4000
CI104020	1/12/2004	1/9/2004	PATIMA	9000-0750-01	HSS TWIS DRILL DIA.7.50 MM.(DORMER)	PC	2
CD040003	1/12/2004	1/10/2004	SRISUDA	9051-0400-01	TAPS M4X0.7 ของ FEW	PC	3
CD040003	1/12/2004	1/10/2004	SRISUDA	9051-0300-1	TAPS M 3.0X0.5	PC	3
CI104022	1/12/2004	1/9/2004	PATIMA	9790-0003-01	APRON ผ้ากันเปื้อนโทเร แบบเต็มตัว	PC	20
CI104021	1/12/2004	1/9/2004	PATIMA	9000-0170-01	CARBIDE DRILL DIA 1.70 MM SHANK DIA 3.17 MM	PC	100
CI104021	1/12/2004	1/9/2004	PATIMA	9000-0115-02	CARBIDE DRILL DIA.1.15 SHANK DIA.3.17	PC	100
CI104019	1/12/2004	1/9/2004	PATIMA	9200-0006-02	PC GREEN COMPOUND "SO-PINK" 450 G	PC	60
CI104018	1/12/2004	1/9/2004	PATIMA	9010-1002-01	BIT WITH TUNGSTEN CARBIDE CHIP SOLDERED REF	PC	50
CI104018	1/12/2004	1/9/2004	PATIMA	9010-1001-01	BIT WITH TUNGSTEN CARBIDE CHIP SOLDERED REF	PC	50

4. The system will bring information of PR Details into the table as shown in the following picture. Then the user enters data of PO details, including Quantity Order, Quotation Price, Discount and Market Price. Price After Discount (No.

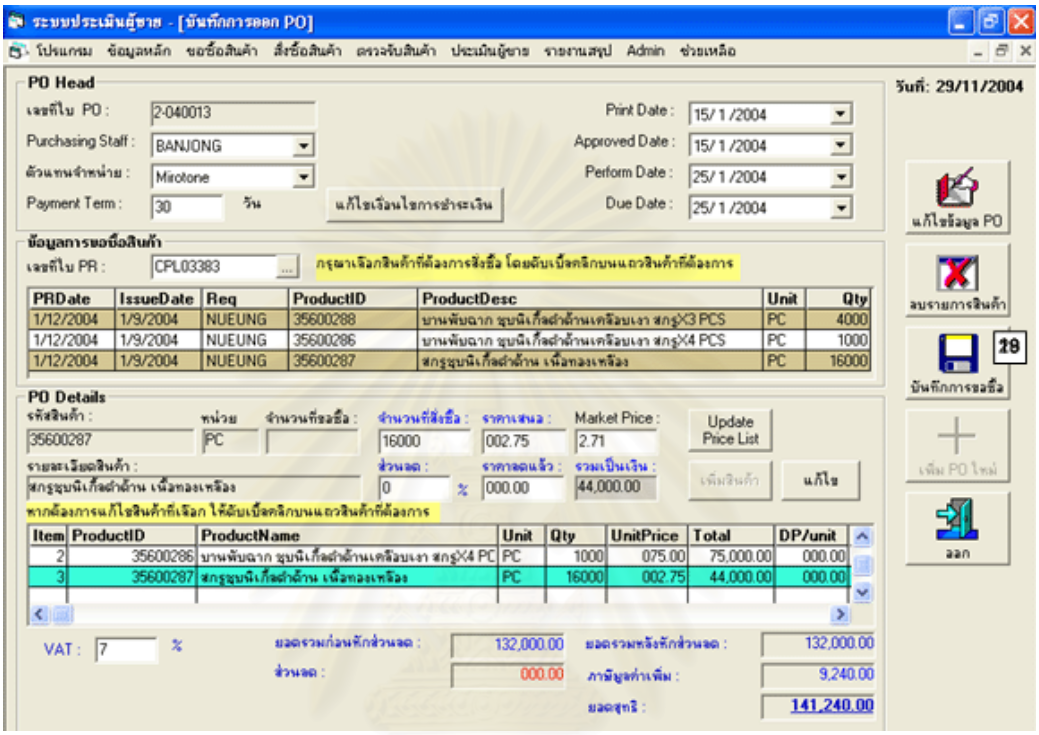
15) and Net Price (No. 16) will be calculated by the program by pressing Enter button of the keyboard.



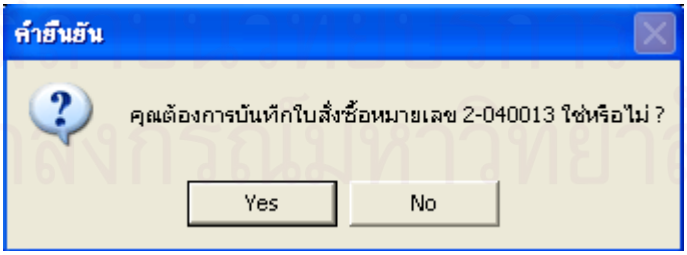
5. When data is complete, pressing button Add product (No. 18) into the table below. The user can add the next product by double clicking the row of PR Details table and do the same process as the step 4.



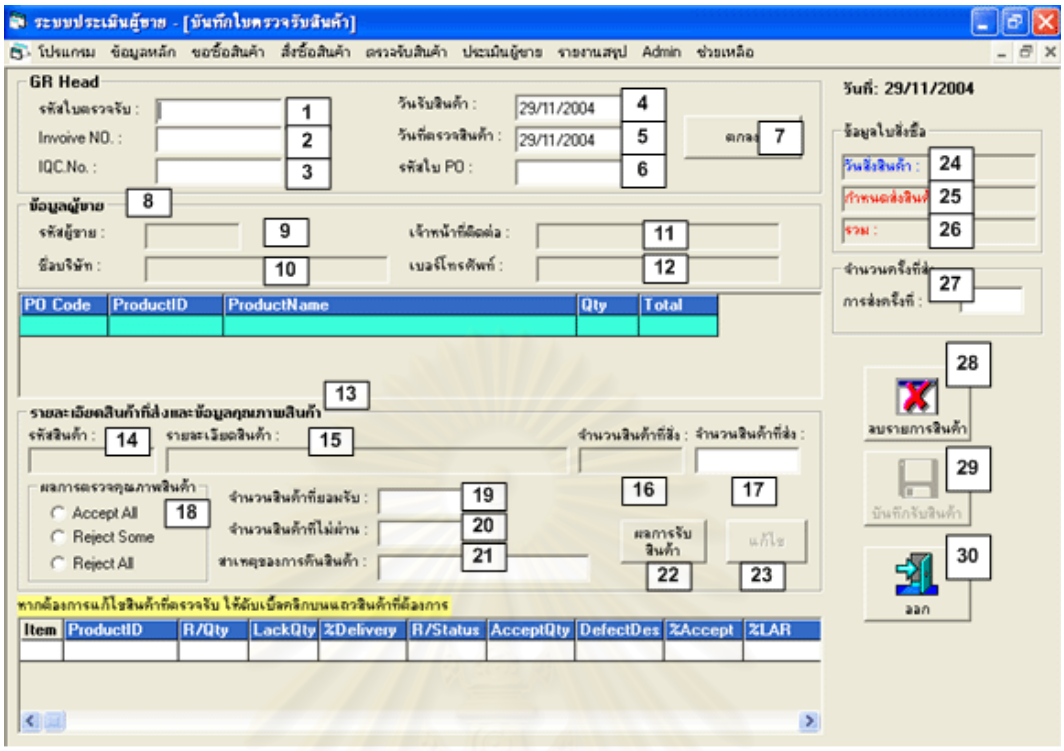
6. In case the user needs to edit product in the table, double click the row of the table required. All data will be retrieved into the text box which the user can change data and presses Edit button (No. 19) to put in the details of product revised into the table.



7. When everything is correct, press save button (No.28) to record data in the database. The Message box will appear to ask for the users' conform before saving.

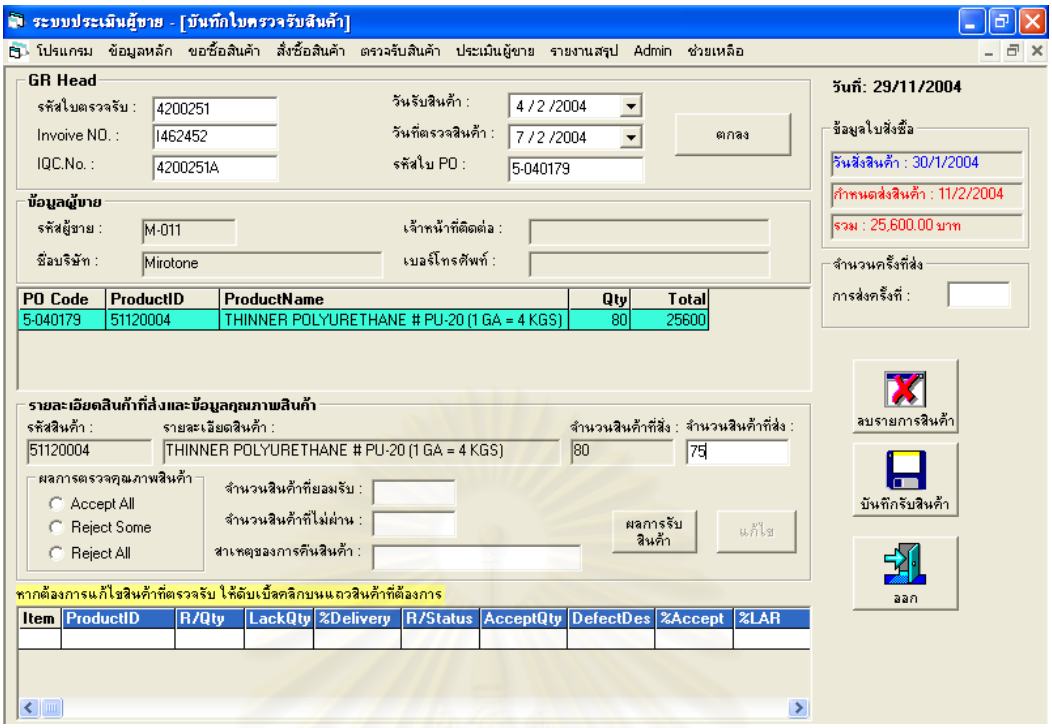


- **Goods receipt**

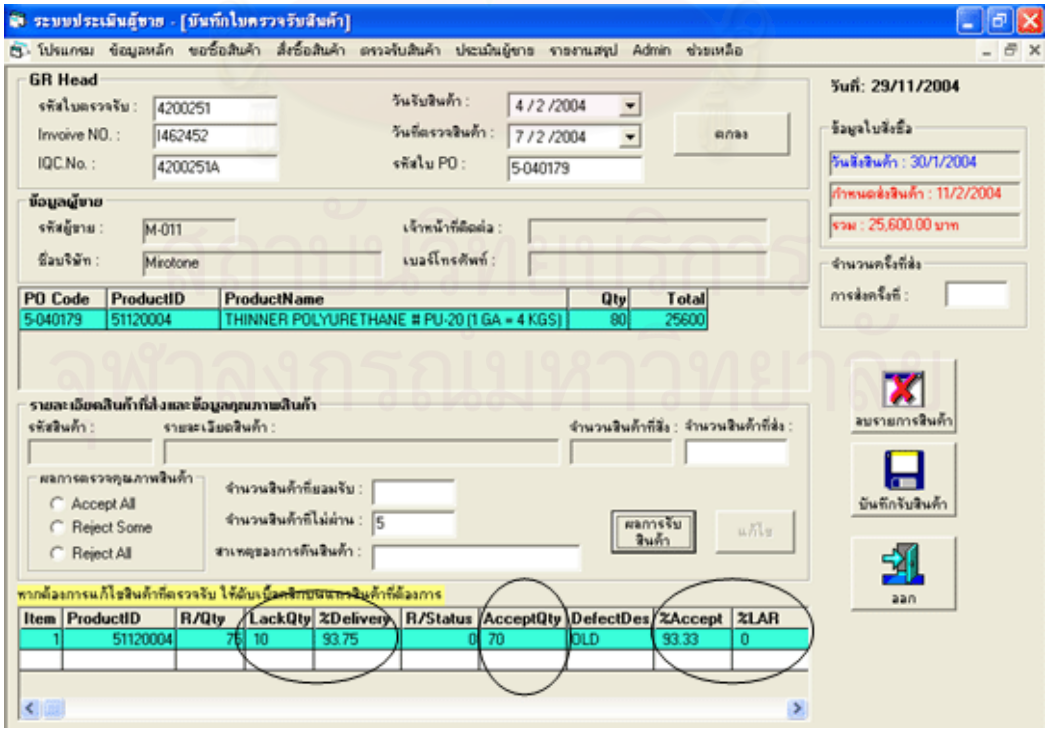


1= GR Code, 2 = INVOICE NO, 3 = IQC NO, 4 = GR Date, 5 = IQC Date, 6 = PO Code, 7 = View, 8 = Supplier Information, 9 = Supplier ID, 10 = Supplier Name, 11 = Contact Name, 12 = Phone, 13 = Quality of Products, 14 = Product ID, 15 = Product Name, 16 = Quantity Ordered, 17 = Quantity Delivered, 18 = Result of Inspection, 19 = Quantity Accepted, 20 = Quantity Rejected, 21 = Defect Description, 22 = Save Inspection, 23 = Edit Inspection, 24= PO Date, 25 = Due Date, 26 = Total Net, 27 = Time of Shipment, 28 = Delete, 29 = Save, 30 = Exit

1. After receiving the Goods receipt report and IQC, the user fills up data in the GR Head and double clicks on the row of the PO Details table to record the results of inspection into the GR Details.

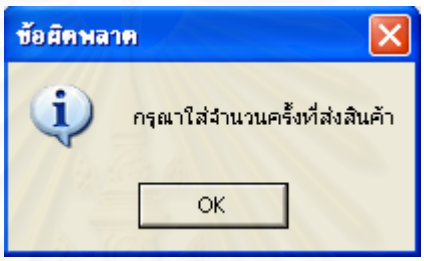


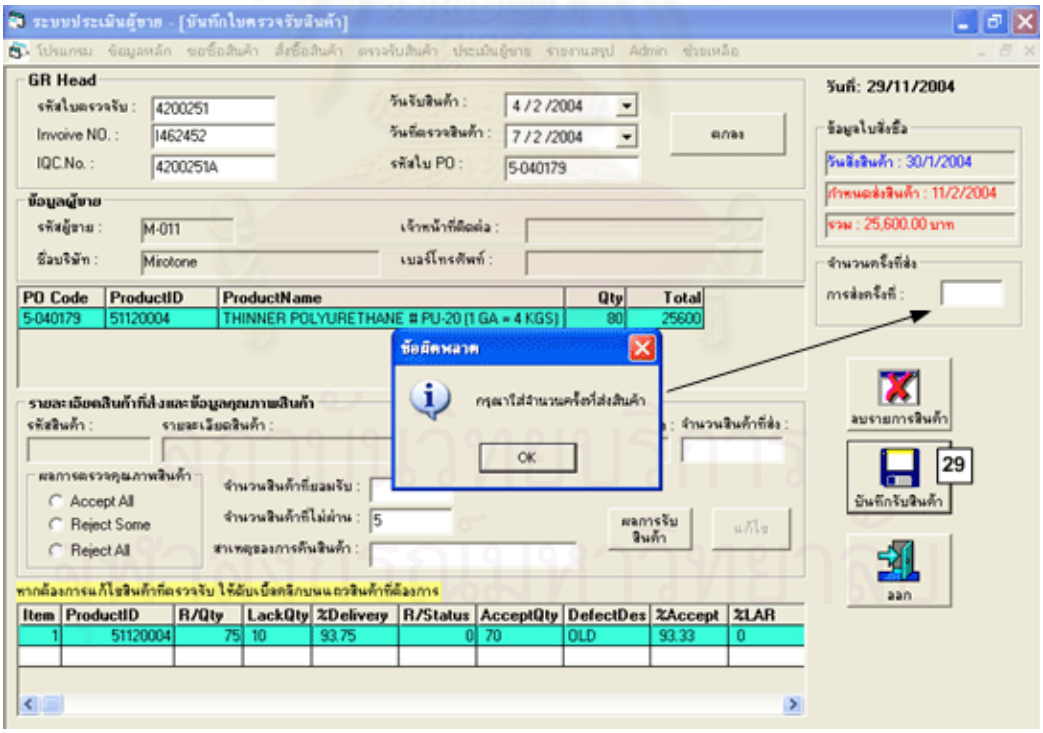
2. Filling up the result of quality inspection of the product (Accept all items, Reject some Items, or Reject all items), the number of accept – the number of reject as well as the cause of rejection. If accept all the program show text box Then press button save inspection (No. 22) to enter data in the below table.



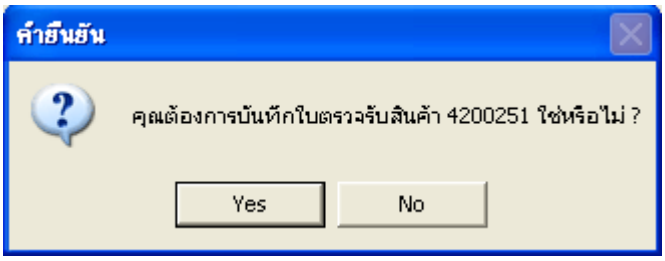
For example, Quantity order was 80, but Quantity receipt was 75. So the percentage of delivery equals 75*100/80 = 93.75. The number of product passed quantity inspection accounts for 70 items (rejected 5 items), thus Lack Quantity was 10 and the amount of product accepted (or Accept Quantity) was 70 items. Therefore, the percentage of Acceptance was 93.33 (= 70*100/75) and the percentage of Lot Accept Received is zero.

3. During save the data, if user did not fill time of shipment (No. 27), the message will warn the user to fill up it before.





4. When data is complete, press save button (Button No.29) to record data in the database. The Message box will appear to ask for the users' conform before saving.



สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

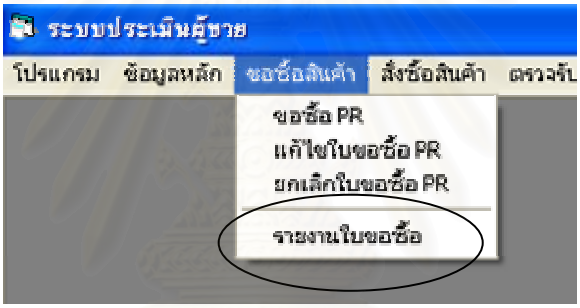
3. Generating Reports

The program offers 4 screens of reports as follows

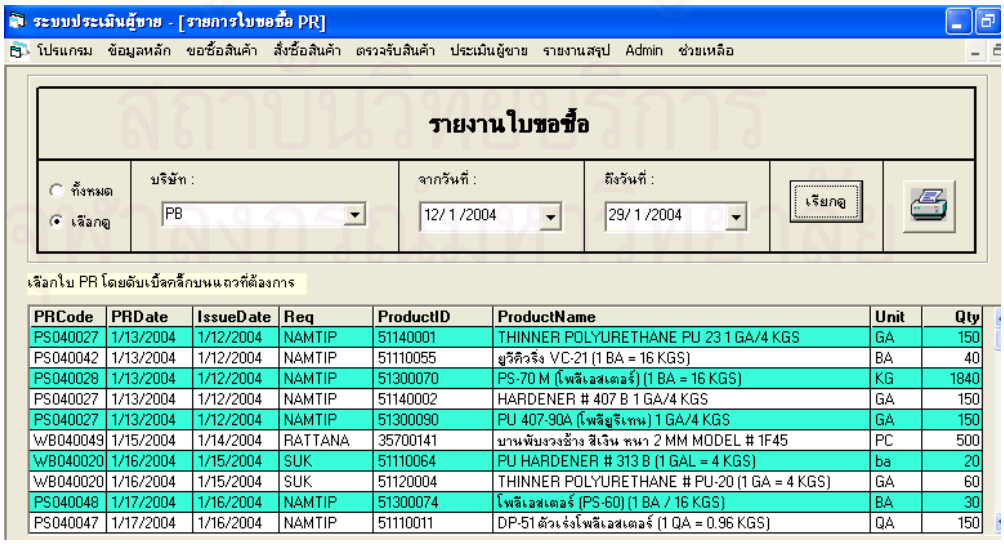
1. PR List
2. PO List
3. GR List
4. Total Report
   4.1.Total Report
   4.2.Price Change Report

1. PR List

At main menu, the users click menu of purchase requisition and select PR Report as shown in the picture below.

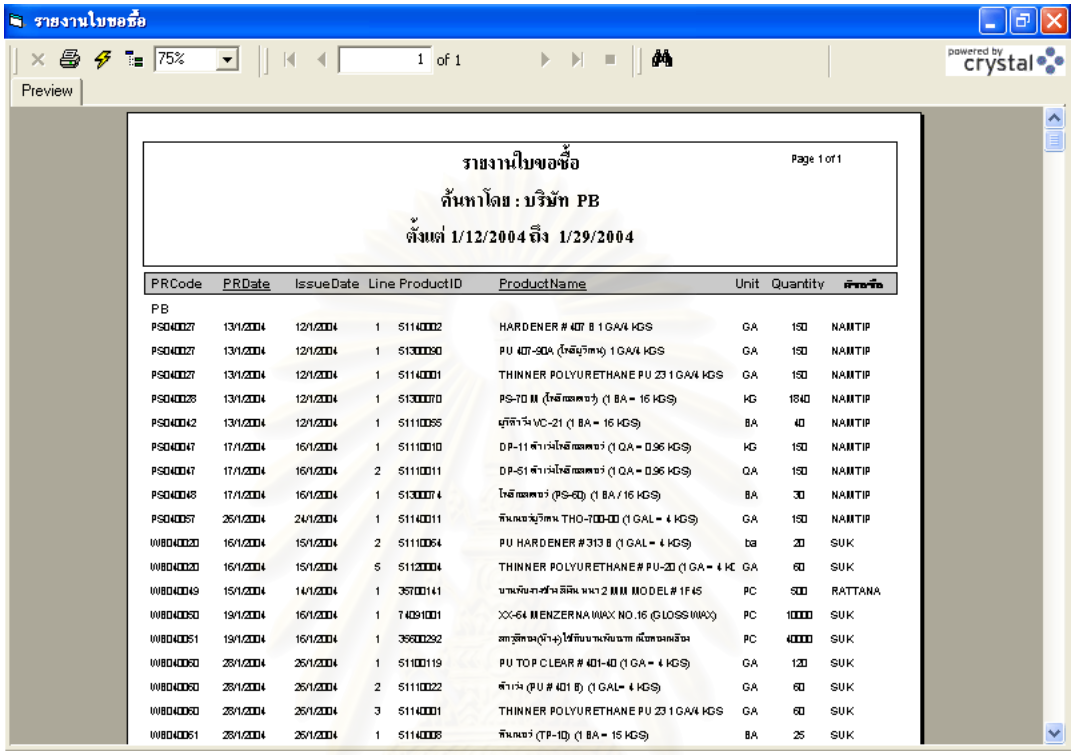


After that the user will see the next screen.



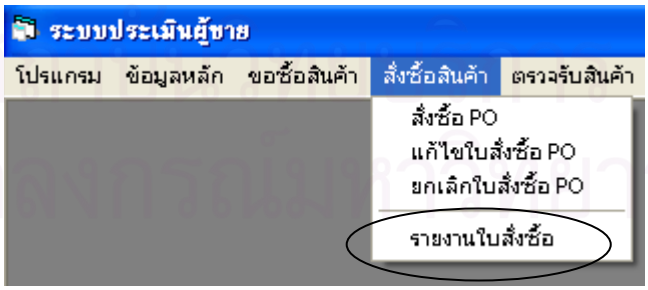
PRCode	PRDate	IssueDate	Req	ProductID	ProductName	Unit	Qty
PS040027	1/13/2004	1/12/2004	NAMTIP	51140001	THINNER POLYURETHANE PU 23 1 GA/4 KGS	GA	150
PS040042	1/13/2004	1/12/2004	NAMTIP	51110055	ยูรีดิวริง VC-21 (1 BA = 16 KGS)	BA	40
PS040028	1/13/2004	1/12/2004	NAMTIP	51300070	PS-70 M (โพลีเอสเตอร์) (1 BA = 16 KGS)	KG	1840
PS040027	1/13/2004	1/12/2004	NAMTIP	51140002	HARDENER # 407 B 1 GA/4 KGS	GA	150
PS040027	1/13/2004	1/12/2004	NAMTIP	51300090	PU 407-90A (โพลียูรีเทน) 1 GA/4 KGS	GA	150
WB040049	1/15/2004	1/14/2004	RATTANA	35700141	บานพับรวงช้าง สีเงิน หนา 2 MM MODEL # 1F45	PC	500
WB040020	1/16/2004	1/15/2004	SUK	51110064	PU HARDENER # 313 B (1 GAL = 4 KGS)	ba	20
WB040020	1/16/2004	1/15/2004	SUK	51120004	THINNER POLYURETHANE # PU-20 (1 GA = 4 KGS)	GA	60
PS040048	1/17/2004	1/16/2004	NAMTIP	51300074	โพลีเอสเตอร์ (PS-60) (1 BA / 16 KGS)	BA	30
PS040047	1/17/2004	1/16/2004	NAMTIP	51110011	DP-51 ตัวเร่งโพลีเอสเตอร์ (1 QA = 0.96 KGS)	QA	150

This report searches two types, which all company in subsidiary issued PR or selected company with the range of PR Date. The user is able to view PR report from all company or each company

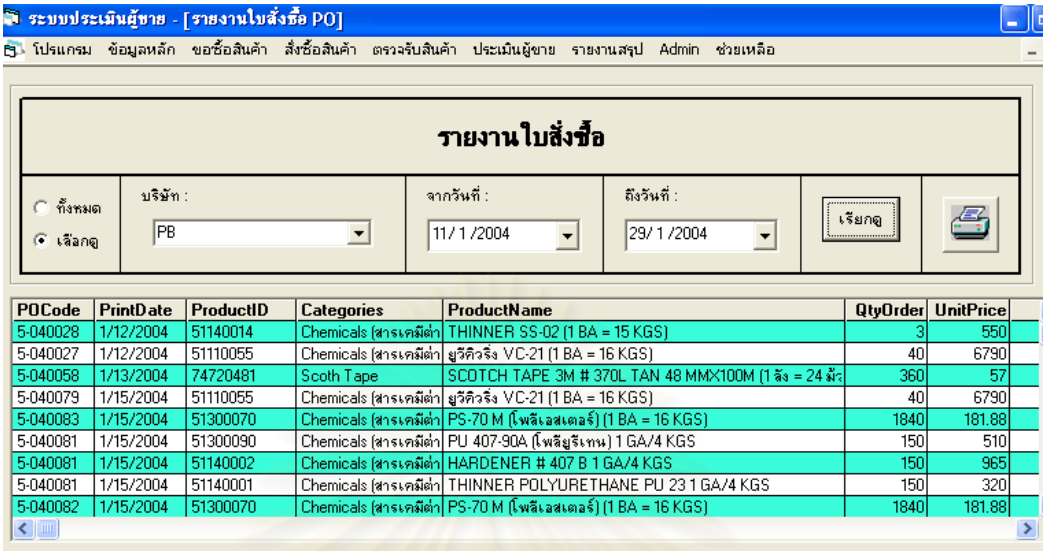


2. PO List

At main menu, the users click menu of purchase order and select PO Report as shown in the picture below.

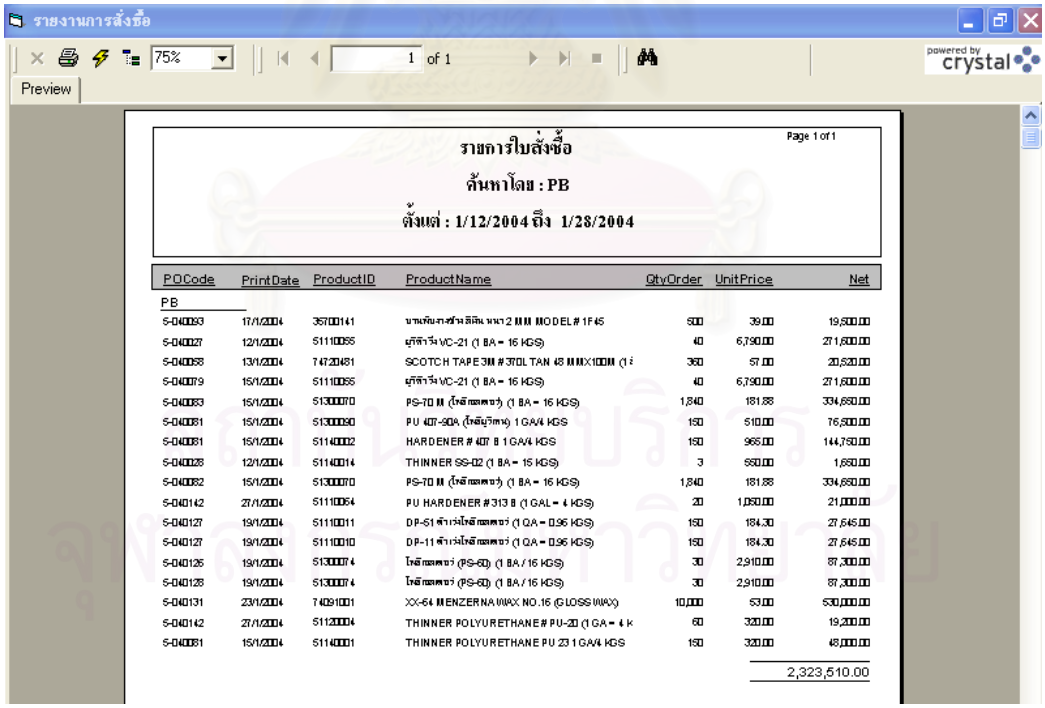


The screen of PO report is



POCode	PrintDate	ProductID	Categories	ProductName	QtyOrder	UnitPrice
5-040028	1/12/2004	51140014	Chemicals (สารเคมีต่า	THINNER SS-02 (1 BA = 15 KGS)	3	550
5-040027	1/12/2004	51110055	Chemicals (สารเคมีต่า	ยูวีคิวริง VC-21 (1 BA = 16 KGS)	40	6790
5-040058	1/13/2004	74720481	Scoth Tape	SCOTCH TAPE 3M # 370L TAN 48 MMX100M (1 ลัง = 24 ม้ว	360	57
5-040079	1/15/2004	51110055	Chemicals (สารเคมีต่า	ยูวีคิวริง VC-21 (1 BA = 16 KGS)	40	6790
5-040083	1/15/2004	51300070	Chemicals (สารเคมีต่า	PS-70 M (โพลีเอสเตอร์) (1 BA = 16 KGS)	1840	181.88
5-040081	1/15/2004	51300090	Chemicals (สารเคมีต่า	PU 407-90A (โพลียูริเทน) 1 GA/4 KGS	150	510
5-040081	1/15/2004	51140002	Chemicals (สารเคมีต่า	HARDENER # 407 B 1 GA/4 KGS	150	965
5-040081	1/15/2004	51140001	Chemicals (สารเคมีต่า	THINNER POLYURETHANE PU 23 1 GA/4 KGS	150	320
5-040082	1/15/2004	51300070	Chemicals (สารเคมีต่า	PS-70 M (โพลีเอสเตอร์) (1 BA = 16 KGS)	1840	181.88

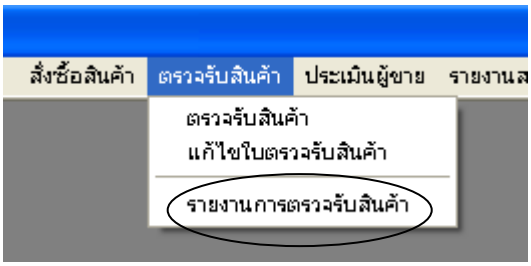
This report searches according to the range of PO Date. The user is able to choose to view PO report from all company or each company in subsidiary.



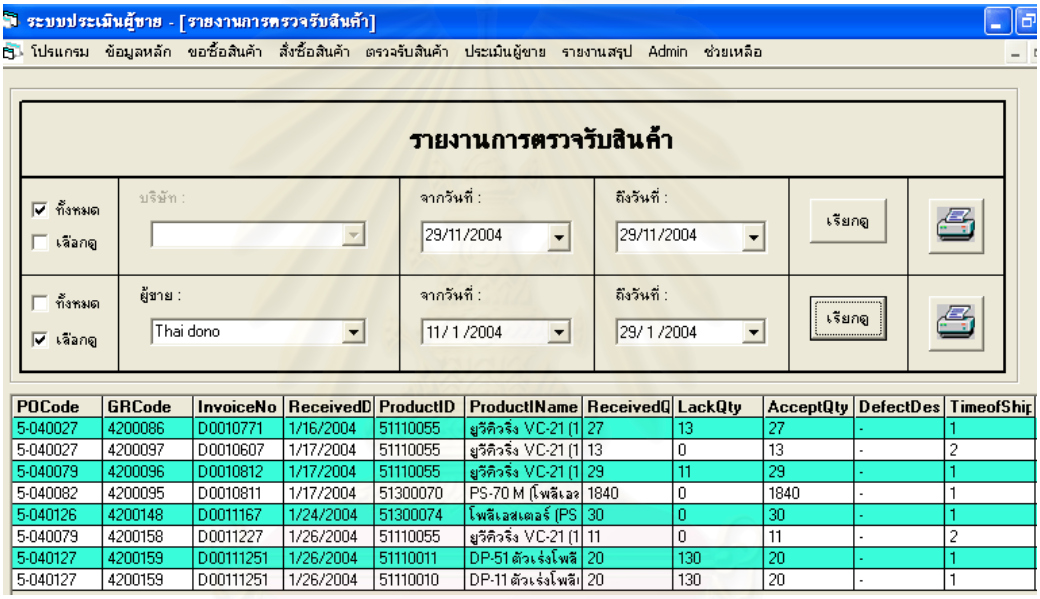
POCode	PrintDate	ProductID	ProductName	QtyOrder	UnitPrice	Net
PB						
5-040093	17/1/2004	36700141	บานพับ-ฝาชำระสีเงิน หนา 2 MM MODEL # 1F45	500	39.00	19,500.00
5-040027	12/1/2004	51110055	ยูวีคิวริง VC-21 (1 BA = 16 KGS)	40	6,790.00	271,600.00
5-040058	13/1/2004	74720481	SCOTCH TAPE 3M # 370L TAN 48 MMX100M (1 ล	360	57.00	20,520.00
5-040079	15/1/2004	51110055	ยูวีคิวริง VC-21 (1 BA = 16 KGS)	40	6,790.00	271,600.00
5-040083	15/1/2004	51300070	PS-70 M (โพลีเอสเตอร์) (1 BA = 16 KGS)	1,840	181.88	334,650.00
5-040081	15/1/2004	51300090	PU 407-90A (โพลียูริเทน) 1 GA/4 KGS	150	510.00	76,500.00
5-040081	15/1/2004	51140002	HARDENER # 407 B 1 GA/4 KGS	150	965.00	144,750.00
5-040028	12/1/2004	51140014	THINNER SS-02 (1 BA = 15 KGS)	3	550.00	1,650.00
5-040082	15/1/2004	51300070	PS-70 M (โพลีเอสเตอร์) (1 BA = 16 KGS)	1,840	181.88	334,650.00
5-040142	27/1/2004	51110054	PU HARDENER # 313 B (1 GAL = 4 KGS)	20	1,050.00	21,000.00
5-040127	19/1/2004	51110011	DP-51 ตัวเร่งโพลีเอสเตอร์ (1 QA = 0.96 KGS)	150	184.30	27,645.00
5-040127	19/1/2004	51110010	DP-11 ตัวเร่งโพลีเอสเตอร์ (1 QA = 0.96 KGS)	150	184.30	27,645.00
5-040126	19/1/2004	51300074	โพลีเอสเตอร์ (PS-60) (1 BA / 16 KGS)	30	2,910.00	87,300.00
5-040128	19/1/2004	51300074	โพลีเอสเตอร์ (PS-60) (1 BA / 16 KGS)	30	2,910.00	87,300.00
5-040131	23/1/2004	74091001	XX-64 MENZERNA WAX NO.16 (GLOSS WAX)	10,000	53.00	530,000.00
5-040142	27/1/2004	51120004	THINNER POLYURETHANE # PU-20 (1 GA = 4 K	60	320.00	19,200.00
5-040081	15/1/2004	51140001	THINNER POLYURETHANE PU 23 1 GA/4 KGS	150	320.00	48,000.00
						2,323,510.00

3. <u>GR list</u>

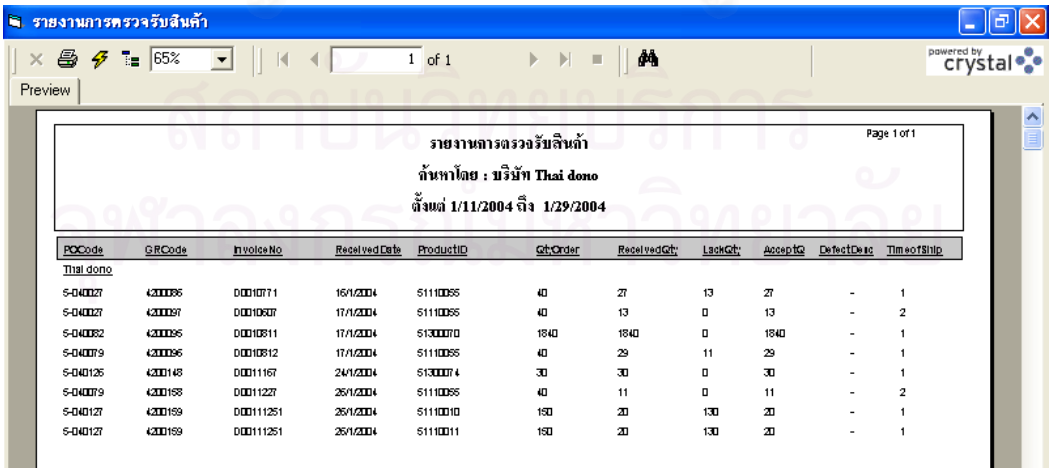
At main menu, the users click menu of good receipt and select GR Report as shown in the picture below.



This report searches according to GR Date. The user is able to view GR report two types (subsidiary and supplier) from all companies or each company in subsidiary and all suppliers or each supplier.



POCode	GRCode	InvoiceNo	ReceivedD	ProductID	ProductName	ReceivedQ	LackQty	AcceptQty	DefectDes	TimeofShip
5-040027	4200086	D0010771	1/16/2004	51110055	ยูรีดิวริง VC-21 (1	27	13	27	-	1
5-040027	4200097	D0010607	1/17/2004	51110055	ยูรีดิวริง VC-21 (1	13	0	13	-	2
5-040079	4200096	D0010812	1/17/2004	51110055	ยูรีดิวริง VC-21 (1	29	11	29	-	1
5-040082	4200095	D0010811	1/17/2004	51300070	PS-70 M (โพลีเอส	1840	0	1840	-	1
5-040126	4200148	D0011167	1/24/2004	51300074	โพลีเอสเตอร์ (PS	30	0	30	-	1
5-040079	4200158	D0011227	1/26/2004	51110055	ยูรีดิวริง VC-21 (1	11	0	11	-	2
5-040127	4200159	D00111251	1/26/2004	51110011	DP-51 ตัวเร่งโพลี	20	130	20	-	1
5-040127	4200159	D00111251	1/26/2004	51110010	DP-11 ตัวเร่งโพลี	20	130	20	-	1

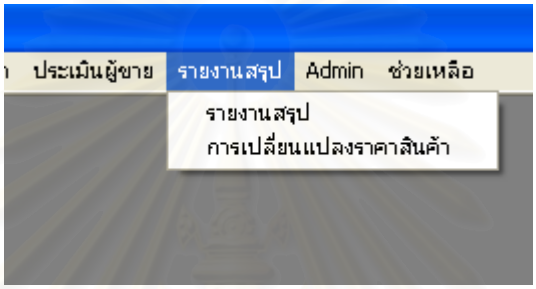


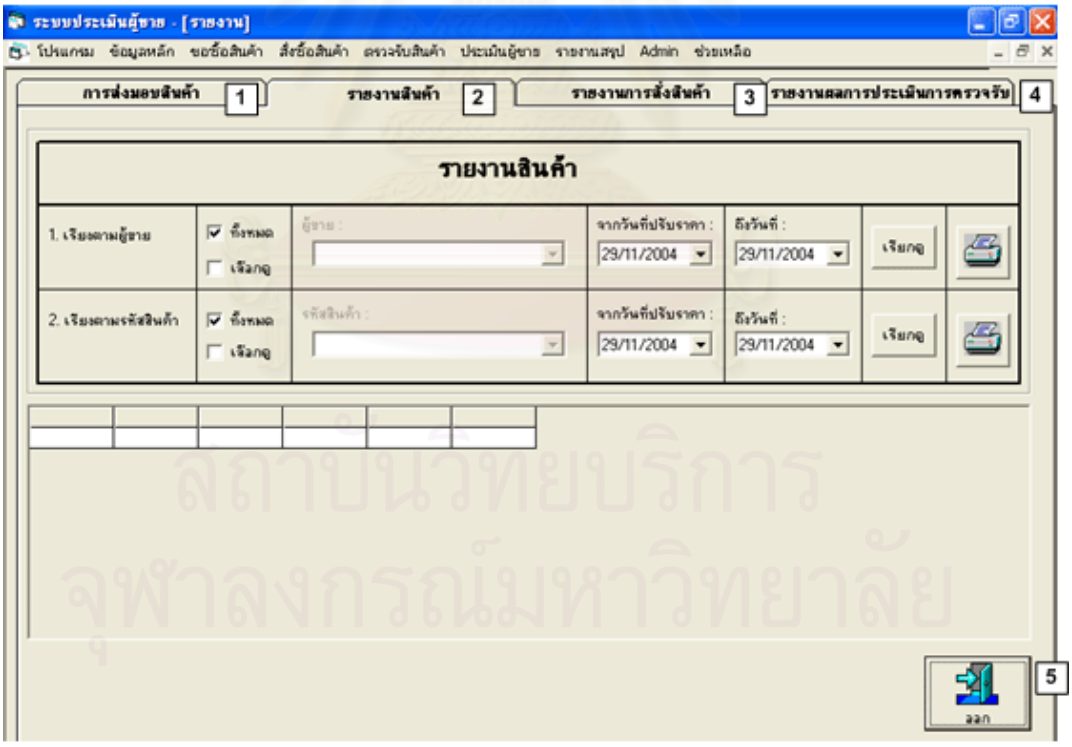
POCode	GRCode	InvoiceNo	ReceivedDate	ProductID	QtyOrder	ReceivedQty	LackQty	AcceptQ	DefectDesc	TimeofShip
Thai dono										
5-040027	4200086	D0010771	16/1/2004	51110055	40	27	13	27	-	1
5-040027	4200097	D0010607	17/1/2004	51110055	40	13	0	13	-	2
5-040082	4200095	D0010811	17/1/2004	51300070	1840	1840	0	1840	-	1
5-040079	4200096	D0010812	17/1/2004	51110055	40	29	11	29	-	1
5-040126	4200148	D0011167	24/1/2004	51300074	30	30	0	30	-	1
5-040079	4200158	D0011227	26/1/2004	51110055	40	11	0	11	-	2
5-040127	4200159	D00111251	26/1/2004	51110010	150	20	130	20	-	1
5-040127	4200159	D00111251	26/1/2004	51110011	150	20	130	20	-	1

4. Total Reports

This screen composes of two groups, which are Summary reports and Price change of Material Report. The Summary reports can be separated into four sub-reports as follows

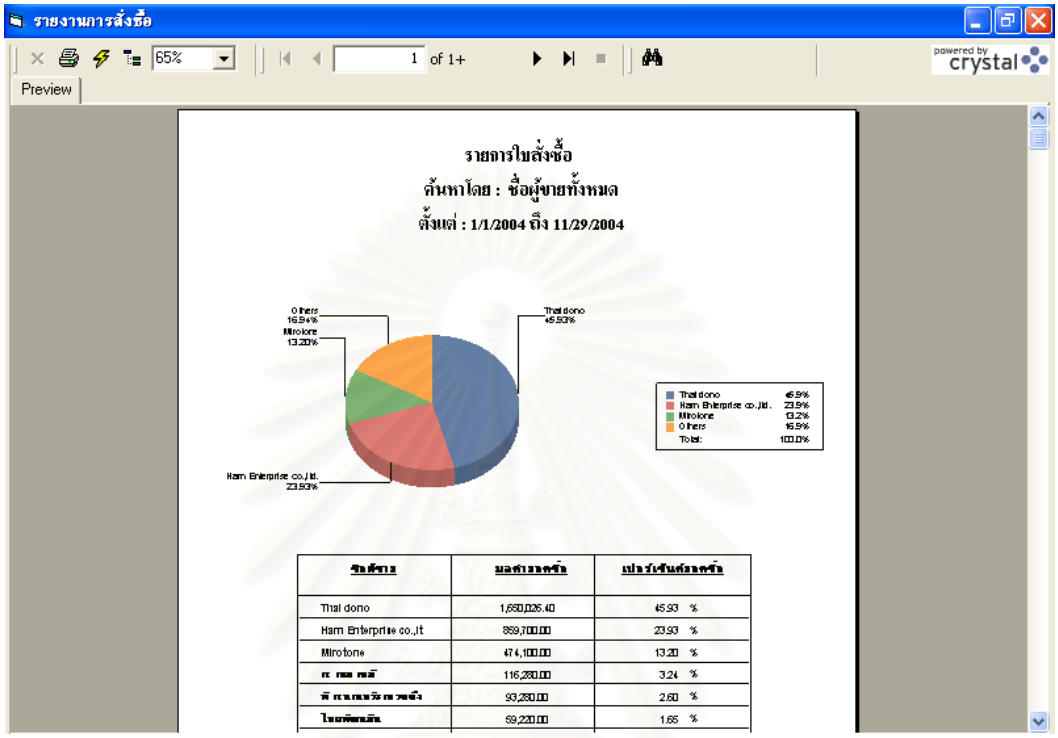
i. Raw Material Delivery Report
ii. Summary of Product Report
iii. Summary of PO Report
iv. Summary of GR Report

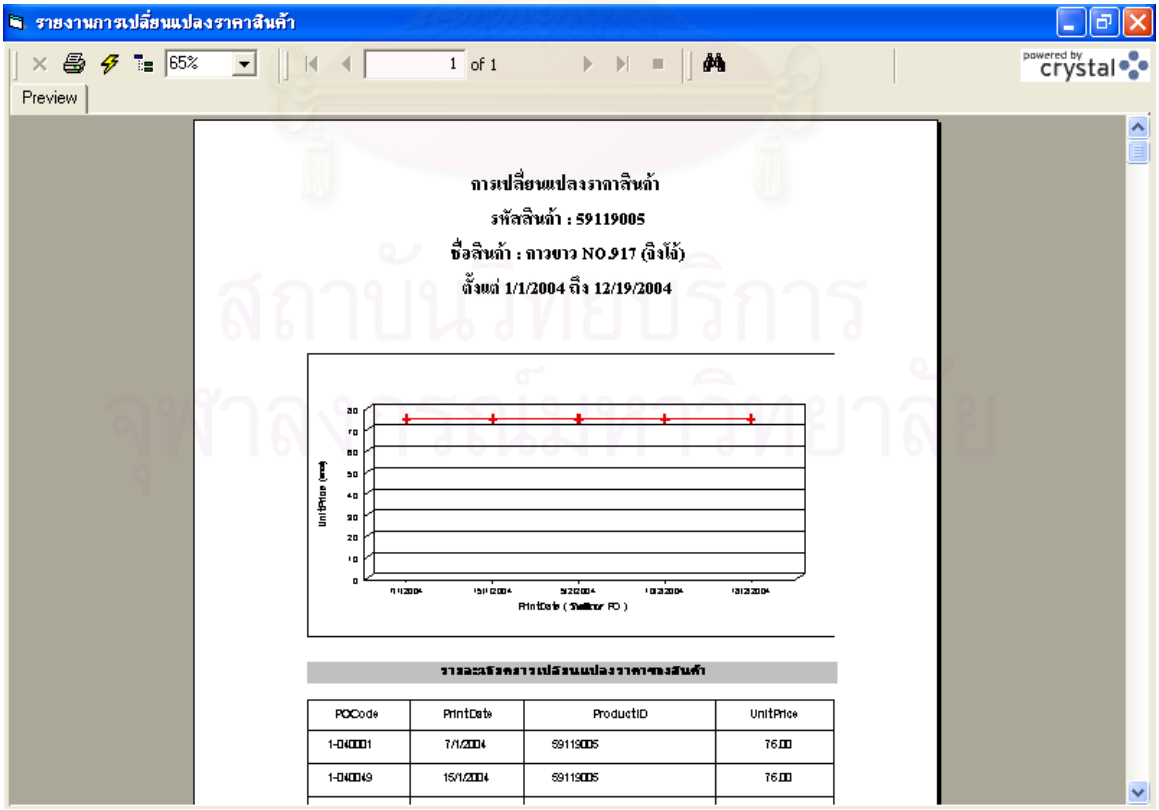




1 = Raw Materials Delivery Report, 2 = Summary of Products Report, 3 = Summary of PO Report, 4 = Summary of GR Report, 5 = Exit

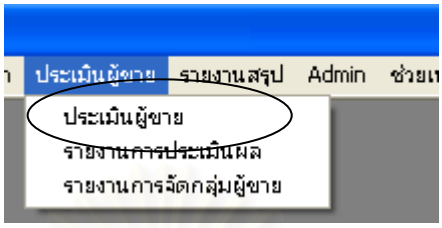
The first following picture is an example of the reports from Summary Report Screen (Summary of Purchase order sorted by suppliers), while the next one isfrom the Price Change report).



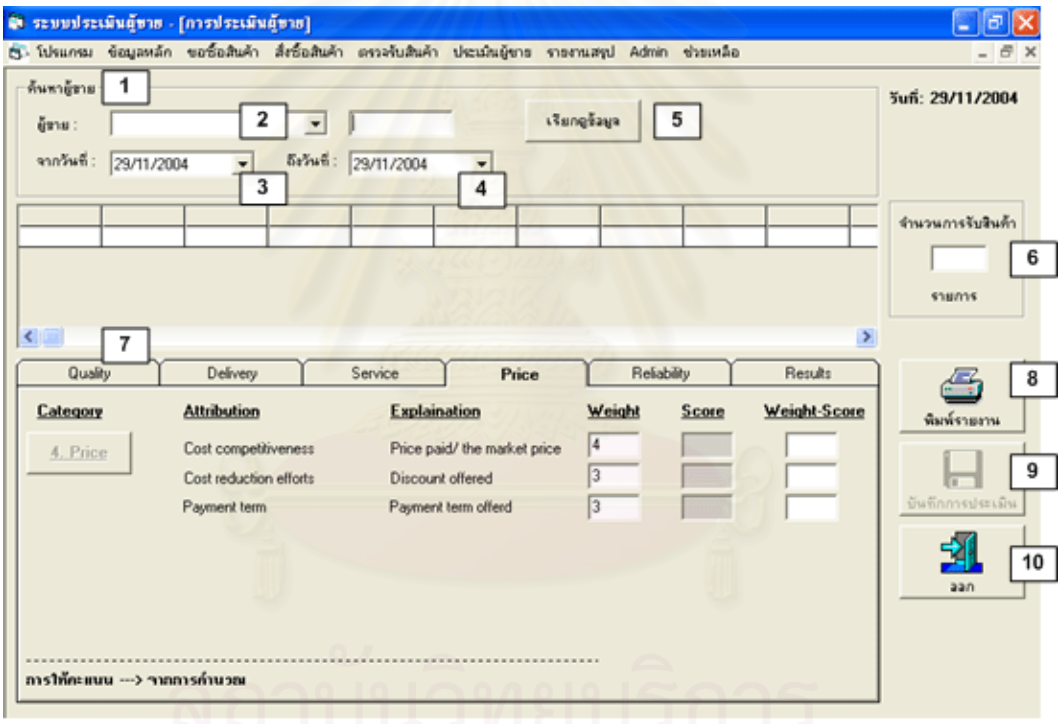


4. Evaluating

Choose the menu evaluating supplier at the main menu as piceture to evaluate supplier.

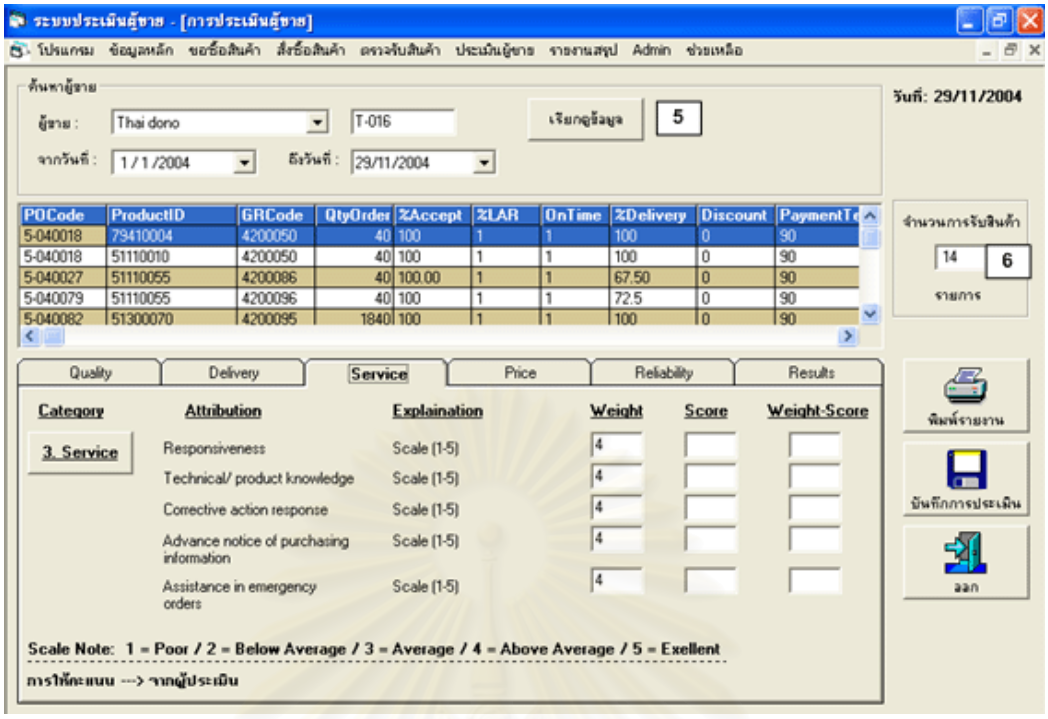


The screen will be as below.



1= Select Supplier, 2 = Supplier Name, 3 = From Date, 4 = To Date, 5 = Call Data, 6 = No of Orders, 7 = Evaluating area, 8 = Print, 9 = Save, 10 = Exit

1. Selecting Supplier name (No. 2) and determining the duration of evaluating (No. 3 -4). Then press the Call data button (No. 5), the information of the selected supplier within the time limited and time of products delivered appear (No. 6)



In evaluating area of quality, delivery and price, the program will automatically calculate score between 1 and 5 (The text boxes appear in dark color), whereas service and reliability it required the evaluator to fill out score between 1 and 5 according to own of the evaluator's opinion. The following pictures are sample of evaluating areas.

Quality

Delivery

Quality | **Delivery** | Service | Price | Reliability | Results

Category	Attribution	Explaination	Weight	Score	Weight-Score
2. Delivery	On-time Delivery	(Percentage of No. On-time)	15	5	75
	Actual / Ordered Quantity	(Percentage of Actual Quantity)	15	3	45

การให้คะแนน ---> จากการคำนวณ

Service

Quality | Delivery | **Service** | Price | Reliability | Results

Category	Attribution	Explaination	Weight	Score	Weight-Score
3. Service	Responsiveness	Scale (1-5)	4	5	20
	Technical/ product knowledge	Scale (1-5)	4	5	20
	Corrective action response	Scale (1-5)	4	5	20
	Advance notice of purchasing information	Scale (1-5)	4	4	16
	Assistance in emergency orders	Scale (1-5)	4	5	20

Scale Note: 1 = Poor / 2 = Below Average / 3 = Average / 4 = Above Average / 5 = Exellent

การให้คะแนน ---> จากผู้ประเมิน

Price

Quality | Delivery | Service | **Price** | Reliability | Results

Category	Attribution	Explaination	Weight	Score	Weight-Score
4. Price	Cost competitiveness	Price paid/ the market price	4	5	20
	Cost reduction efforts	Discount offered	3	3	9
	Payment term	Payment term offerd	3	5	15

การให้คะแนน ---> จากการคำนวณ

Services

Quality | Delivery | **Service** | Price | Reliability | Results

Category	Attribution	Explaination	Weight	Score	Weight-Score
3. Service	Responsiveness	Scale (1-5)	4	5	20
	Technical/ product knowledge	Scale (1-5)	4	5	20
	Corrective action response	Scale (1-5)	4	5	20
	Advance notice of purchasing information	Scale (1-5)	4	4	16
	Assistance in emergency orders	Scale (1-5)	4	5	20

Scale Note: 1 = Poor / 2 = Below Average / 3 = Average / 4 = Above Average / 5 = Exellent

การให้คะแนน ---> จากผู้ประเมิน

Reliability

Quality | Delivery | Service | Price | **Reliability** | Results

Category	Attribution	Explaination	Weight	Score	Weight-Score
5. Reliability	Management capability	Scale (1-5)	0		
	Financial situation	Scale (1-5)	0		
	Registered capital	Scale (1-5)	0		
	Duration of business	Scale (1-2)	0		
	ISO certificate	Scale (1-2)	0		

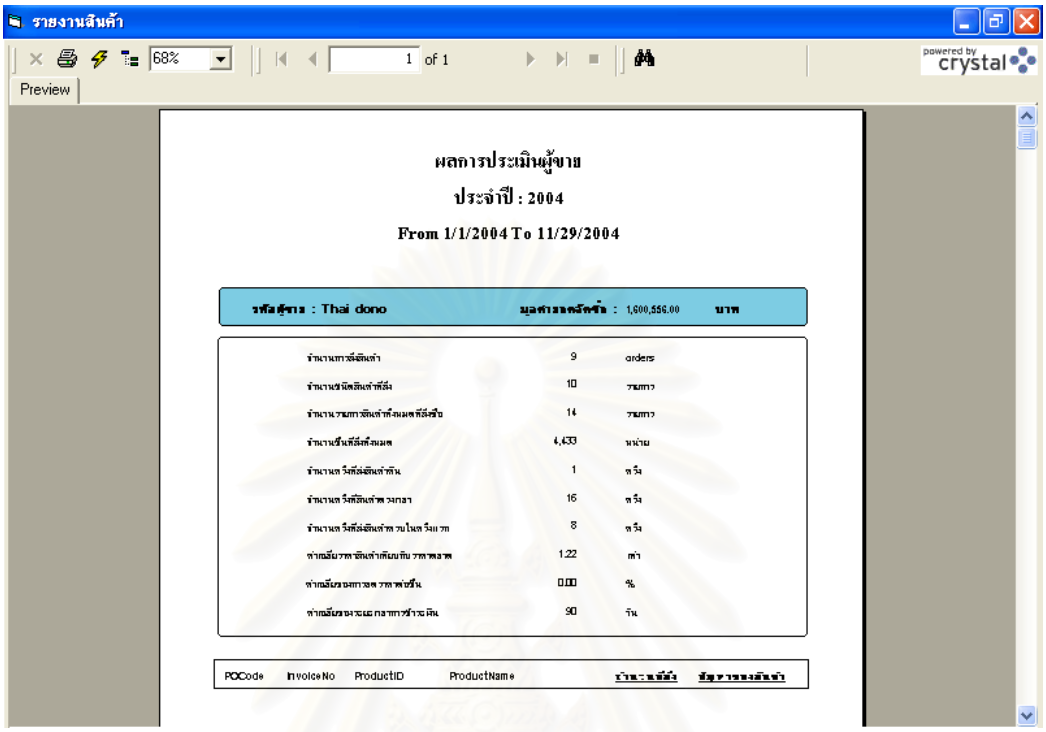
การให้คะแนน ---> จากผู้ประเมิน

Result Evaluating

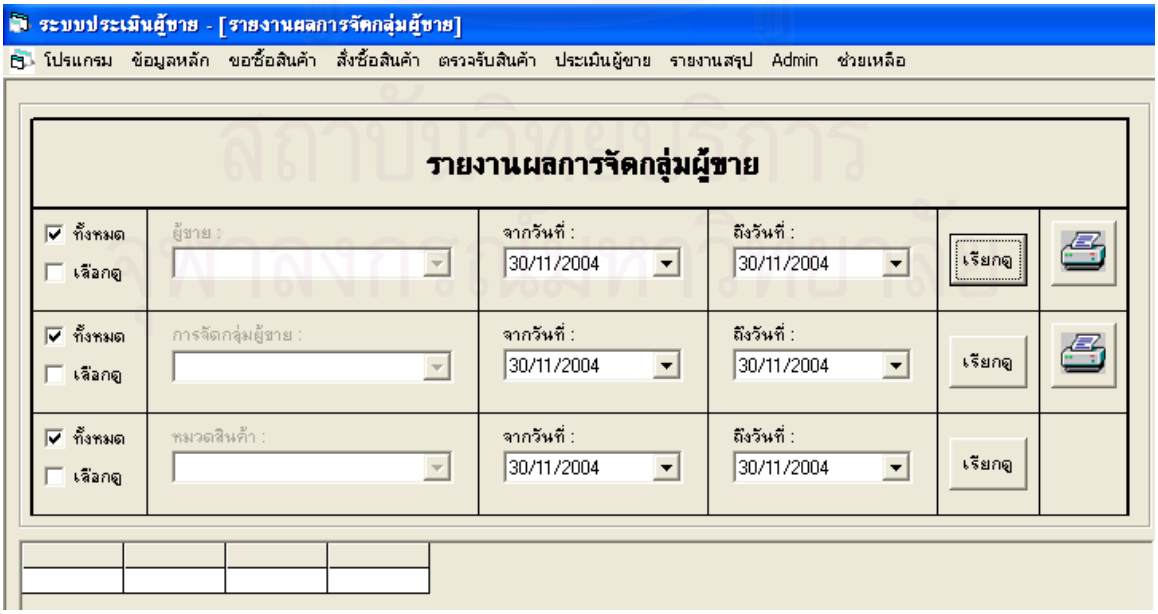
Quality | Delivery | Service | Price | Reliability | **Results**

Category	Attribution	Explaination	Weight	Score	Weight-Score
คำนวณ		Total Rating =	100		460
		Supplier Class :	Potential Supplier		

This report is used to inform suppliers about their performance during the range of time determined.



Moreover, the user can view the classification report of supplier evaluation by selecting the last menu of evaluating menu at the main menu. Then the screen will change to be as follows.



APPENDIX B

Questionnaire Form

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Questionnaire Form
for
Evaluate Performance of Supplier Evalaution System

Evaluator's Name _____

Criteria for Convenience	Score
The proposed system works excellently to support the purchase process.	10
The proposed system works best to support the purchase process.	8
The proposed system works properly	5
The proposed system can work as same as the old system.	3
The proposed system works inferior to the old system.	1
The proposed system cannot work at all.	0

Evaluating Items	Score					
Convenience in	Excellent (10)	Good (8)	Fair (5)	Same (3)	Bad (1)	Poor (0)
1. Keying Input Data						
2. Editing Data						
3. Tracking Purchasing Orders						
4. Searching for Cost of Materials						
5. Searching Historical Orders						
6. Rating Suppliers						
7. Generating Summary Reports						
8. Accessing Database						

APPENDIX C

The Existing Forms

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Sample of Good Receipt Form

ABC CO.,LTD. (BOX DIVISION)
F-CP-09Rev.1Issue:22/03/2000

Goods Receipt

Page: 1

Supplier: SLBA029
บางกอกพิวัฒน์(1980) ศจก.
89-89/1 ถ.วาณิช 1 (ตัวเมือง)
แขวงจักรวรรดิ์ เขตสัมพันธวงศ์
กรุงเทพฯ 10100 T.223-1991 F.225-2346

Invoice No : 1488
Receiver: 04/0980
Receipt Date: 16/09/04
Print Date: 17/09/04
Purchase Order: 1-041415
Indent No.:

21 ก.ย. 2547

Item Number	Description	Order-Qty	Receipt-Qty	UM	Unit Price	Amount	Loc
026201502	RIBBON YELLO W # 7 MM.	20.0	20.0	RO	15.00	300.00	1000

STOCK CARD TO REGISTER

DATE .16.../..09../..04..

STORE BY .....
(.....)

Dr. A/C ..... Bht. .....
..... Bht. .....
COSTING ..... DATE .....

Received By

Approved By

Figure C1 The Sample of Good receipt from

Sample of IQC Form

[X] ABC
[ ] ABC at China

INCOMING MATERIAL INSPECTION REPORT

S-CP-03,Rev.1
PAGE 1 OF 1

SALE ORDER NO.: N/A	REF.NO.: 2-61-09201	IQC.NO.: 75130
P.O.NO.: 1-040735 INDENT NO.: LOCAL VENDOR NAME: BROTHER FOAM. MAT'L NAME: EVA BH-30	INVOICE NO.: 7605 DATE RECEIVED: 12/06/04 DATE INSPECTED: 14/06/04 G.R. NO.: N/A	LOT NO.: 16 NO.OF ROLL/CTN.: 706 PCS. Q'TY PER ROLL/CTN.: N/A LOT/TOTAL Q'TY: 706 PCS.

MATERIAL SKETCH:

A.Q.L.: 1.5 %

SAMPLING PLAN:
[ ] NORMAL [X] TIGHTEN [ ] REDUCE

SPECIFICATION/QUANTITY ORDERED

REF. TYPE	COLOUR	% GRADE A	% GRADE B	% GRADE C	WIDTH	LENGTH	HEIGHT	THICKNESS	TOTAL QUANTITY
-	BLACK	-	-	-	84.5 MM.	273.5	-	24.5 MM.	706 PCS.

	INSPECTION RESULT	QUANTITY CHECKED	CHECKED BY	RESULT	DEFECTS CRI.	DEFECTS MAJ.	DEFECTS MIN.
1	SPECIFICATION	706 PCS.	VISUAL/SAMPLE	PASSED	-	-	-
2	AESTHETIC	706 PCS.	VISUAL.	SEE DEFECT-DETAILS BELOW	-	-	-

	DEFECT DETAILS	QUANTITY	CHECKED BY	RESULT	CRI.	MAJ.	MIN.
1	เป็นรู	12 PCS.	VISUAL.	REJECTED	-	X	-

RESULT OF FINAL

SAMPLE SIZE: 706 PCS(INSPECTED 100%)
ACC.: 694 PCS.
REJ.: 12 PCS.

TOTAL ACCEPTED Q'TY: 694 PCS.
TOTAL REJECTED Q'TY: 12 PCS.

MATERIAL DISPOSITION:
[ ] ACCEPTED/DEVIATION [X] RETURN TO VENDOR [ ] SORTING TO USE [X] QUARANTINE

REMARK:

FAX OK
15 JUN 2004

CC:
[X] Q.A.FILE
[X] PURCHASING
[ ] CENTRALIZE PLANNING
[ ] PRODUCTION
[X] STORES

INSPECTOR: QA.
DATE: JUN 14, 2004

APPROVED BY:
DATE:

Figure C2 The sample of Incoming Material Inspection Form (IQC)

Evaluating form

GD-F-PL-01
Rev.2
Issue:

ใบประเมินผู้ขาย/ผู้รับจ้าง (ในประเทศ)

ประเภทสินค้า ☐ วัตถุดิบ..... อุปกรณ์.....
☐ ตัวแทนจำหน่าย บริการ.....

ชื่อผู้ขาย/ผู้รับจ้างช่วง.....

ข้อกำหนด: ใส่จำนวนเปอร์เซ็นต์ลงในช่อง "เปอร์เซ็นต์ที่ได้รับ" และใช้เครื่องหมาย / ลงในช่อง "ผ่าน, ไม่ผ่าน" ในช่องผลการประเมิน ให้ตรงกับความเป็นจริง

ลำดับ	เกณฑ์การประเมิน	รายละเอียดของเกณฑ์การประเมิน	จำนวนรายการตรวจรับ			A x 100	เปอร์เซ็นต์	D x E
			ผ่าน	ไม่ผ่าน	รวม	C	ความสำคัญ	100
			A	B	C	D	E	F
1	คุณภาพของสินค้า	ตรงตามรายการที่ต้องการหรือเทียบเท่า โดยมีเอกสารอ้างอิง						
2	ระยะเวลาการส่งมอบ	เป็นไปตามที่ตกลงระหว่างผู้ซื้อและผู้ขาย						
3	บริการหลังการขาย	มีตามที่ร้องขอ หรือทำได้จริงอย่างในอดีต						
4	ผลงานในอดีต	พิจารณาจากคุณภาพของสินค้าที่เคยสั่งซื้อในอดีตว่าสามารถ						
		นำมาใช้กระบวนการผลิตได้อย่างมีประสิทธิภาพ หรือมีปัญหา						
		ด้านคุณภาพน้อยที่สุดและพิจารณาจากMaterial Incoming						
		Inspection Report						
5	ความน่าเชื่อถือ	จากประวัติผู้ขาย เช่น ทุนจดทะเบียน, ระยะเวลาการก่อตั้งบริษัท						
6	เงื่อนไขการชำระเงิน	อย่างน้อย 30 วัน(ยกเว้นกลุ่มสินค้าบางประเภท)						
7	ใบรับรองคุณภาพ	ได้รับใบรับรองระบบคุณภาพ เช่น ISO 9000 หรืออื่นๆ						
		รวมผลการประเมิน						

เกณฑ์การตัดสินผลการประเมินผู้ขาย

เปอร์เซ็นต์ที่ได้รับ		สรุปผลการประเมิน	
91-100% = A	ผู้ประเมิน..... วันที่	☐ ผ่าน	☐ ไม่ผ่าน
81-90% = B	ผู้ตรวจสอบ.....		
71-80% = C	วันที่		
61-70% = A	ผู้อนุมัติ.....		
ต่ำกว่า 61% = ไม่ผ่านการประเมิน	วันที่		

Figure C3 The current form of supplier evaluation

BIOGRAPHY

Ms. Supaporn Sa-nguansakphakdee was born in Bangkok in 1978. She earned her bachelor's degree in electrical engineering from Kasetsart University in 1999. After graduation, she started working as a technical and marketing engineering at a trading company for three years. After that, she decided to study for Master of Engineering and Master of Science in Engineering Management jointly offered by Chulalongkorn University and Warwick at the Regional Centre for Manufacturing Systems Engineering. She was enrolled as a full-time student and graduated in the academic year 2004.

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย