



A Framework of Computerized System for Production
in Plastic Recycling Business

by

Ms. Montira Srisuwannahong

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science
in Technology Management
Assumption University

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Master Project Approval


Project Title A Framework of Computerized System for Production in
Plastic Recycling Business

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ABSTRACT

Specialized in plastic business, in recent years recycling plastic business is considered as a high growth rate business. The reasons are many. For example; the conservative trend to preserve environment, the business reason. With the business crisis, the competitive advantage would be created to sustain their advantages among the competitors. Reduce cost seems to be the popular strategy that any companies have to adopt. Nevertheless, as other plastic companies, Thai Plastic Recycling Company is facing the question of how to develop in the environment of fiercer and fiercer competition. Hence, the purpose of this study, computerized system for the company, becomes more necessary and crucial.

In the study, the analysis of the current problems from the manual systems, the design of the new proposed of computerized system to the company, comparing between them to see advantages and disadvantages, design deep detail in the user interface. All would be conducted to provide for further software development as purpose.

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Chapter I: Introduction

Overview of Recycling Plastic in Thailand

Plastic consumption in Thailand is growing. The per capita plastic consumption is 29 kg/ inhabitant/ year in Thailand while it is 100kg/ inhabitant/year in USA and it is 60 kg/ inhabitant/ year in Japan (CEMPRE, 1998). A plastic consumption increase can originate a plastic waste generation increase and also waste destination problems. Plastic recycling is a technological trend that allows the economic value recovery of waste.

Plastic is a type of polymeric material which can be molded by pressure or heat. It can be classified as thermoplastic or thermo set. Thermoplastic is a polymer that become soft or “plastic” when heated, that are molded or shaped with pressure when in the plastic state and become hardened when cooled to retain the mold or shape. The process is reversible and it can be repeated; this kind of plastic can be molded again. Thermos is a polymer which cannot be reprocessed when molded once. The thermo sets are infusible solids that decompose on reheating. Thermoplastics are subdivided on a cost-property performance basis into commodity, engineering plastics, advanced polymers, high-heat resistant polymers and others.

	Full Name	Applications
HDPE	High Density Polyethylene	beverage crates, buckets, car-parts, containers for household chemicals and detergents, household utilities
LDPE	Low Density Polyethylene	grocery bags, food film packaging, industrial bags, garbage bags,

		coating for milk
PP	Polypropylene	noodle and biscuit packaging, margarine containers, throw-away syringes, caps, ketchup and syrup bottles
PS	Polystyrene	meat trays, egg cartons, throw-away coffee cups
PVC	Polyvinyl Chlorine	pipes, connections, mineral water and detergent bottles
PET	Polyethylene Terephthalate	soft drink bottles

Plastic Recycling Technology

Plastic recycling can be classified as primary, secondary and tertiary classifies also recycling as quaternary. Primary and secondary plastic recycling are types of mechanical recycling. Mechanical plastic recycling involves identifying the plastic and separating it from other materials (e.g. papers, metals) and from other types of plastic, grinding it into flakes, washing, drying, agglutinating and making pellets by melting the plastic (extruding) and granulating it into small uniform pieces. There are different types of plastic that have different physical and chemical properties, so that is why each resin type has to be recycled separately. Agglutination is an operation that reduce the chopped plastic volume to be sent to extrusion and it is necessary only for plastic films (it is not necessary for hard plastics). Agglutinating equipment is a rotating cylinder that heats the ground plastic through friction transforming it into a paste. Then, small quantity of water is added to cause a sudden cooling. Plastic molecules contract, plastic density increases, transforming it into granules with

enough mass and density to be extruded in an extruder. Extruder is an equipment which melts the material and converts it into strips (like spaghettis) giving it a homogeneous characteristic. In the last stage, the strips pass through a cooling bath and are chopped into grains called "pellets" that are bagged and sold to plastic products manufactures. The specific operations of the recycling process will depend in large part on the company's confidence in the quality of the plastic and the application into which the recycled plastic will be sold or used.

A recycling company can produce flakes or pellets because they are the two forms that the recycled plastic can be manufactured into an end-use product.

Primary recycling is post-industrial plastic recycling. This kind of recycling is relatively easy due to the cleanness of the industrial plastic scrap.

Secondary recycling is post-consumer plastic recycling. Post-consumer waste is any object discarded by a consumer (e.g. packaging and bottles). Secondary recycling is more difficult because there are different plastic types mixed in post-consumer waste. A selective collection program helps plastic sortation avoiding contaminants. Selective collection is an urban solid waste collection alternative used where recyclable waste is separated by population inside their homes.

Tertiary recycling is a chemical recycling and makes possible to use recycled resins in the same application as they were used originally. It decomposes plastic waste through chemical or thermal process into their monomeric constituents which can be repolymerized to produce virgin resins. But this recycling has a high cost.

Quaternary recycling is an energetic recycling. It is different from incineration because it recovers energy from plastic waste to generate electricity.

Growth and potential for recycling plastic

After the economic crisis on 1997, companies would have to look for opportunities to fit these new exigencies. They indicated that new opportunities are materials recycling, development of new clean production processes and the development of new products for an increasing ecological concerned market.

Plastic waste recycling can be one of these opportunities since it can offer cheaper products and it can offer a differentiated product with an ecological appeal for environmental concerned customers. This means it can offer a competitive advantage according to Porter (1990) by cost reduction or product differentiation.

A large number of customers are concerned with the environment. Environmentalists and consumers' majority affirm that environmental concern affects their choice to buy a product, even if they have to pay more than other similar product.

Problem Statement

Case study being taken is primary plastic recycling in rural provinces, Thai Plastic Recycle Company Limited. TPR has two factories Nakornprathom and Nonthaburi. Both factories perform the same functions but Nonthaburi has more areas.

The competition in recycling plastic business is stronger between firms manufacturing comparable products when there is an economic recession. Therefore, if it wants to survive, any company offering goods or services is faced with the need to react quickly to changing customer demands, to improve continuously the quality of the products and their delivery, to eliminate the inefficient performance activities (e.g. purchasing, planning, procurement) and to reduce costs. Controlling costs mean controlling quality, time limits and quantities.

To increase customer satisfaction, manufacturers have to improve the quality of products and integrate the controlling flow of goods. This can only happen if progress is monitored. Performance Indicators (PIs) are a mean to this end. They provide management with a tool to determine the inefficient performance activities. If the company has many inefficient performance activities then it cannot survive in the market. These inefficient performance activities are the main problems that the company should urgently improve.

TPR Co., Ltd. is in the primary plastic recycling business, the products are produced by TPR is recycle (grade B) plastic pellets. The company's current system is a manual one that supports every department. It leads to many problems such as: the redundancy jobs for records keeping, difficulties in information retrieval, inconsistency format of information, dependence on the hard copy, unnecessary workload for follow-up jobs and etc. These also effect to incorrect stock available,

inefficient reporting system, obsolete inventory data, the inability to keep track of customers, an abundance of paperwork and some inconsistencies and, repetitions.

Because of these reasons, the information system has been developed to enhance the performances of the Inventory and Purchasing, Production and Sales and Marketing Department. To increase the accounting department efficiency by automating existing operations such as issuing purchase orders, delivery orders, billing, payment. To increase the production department efficiency by correct stock available, scrap and waste record, production capacity and efficiency. The Management Information System base is achieved through product description reports, customers description report, suppliers description report, sales information report, production capacity reports, raw-material description report, sales analysis by products, customers and salesman, etc. In essence, the development project aims to integrate the business application to increase its efficiency and support the accurate information for all management levels.

The project is developed to enhance the centralized information of the procurement under the computerized environment instead of the existing manual record keeping and hard copy. The on-line computerized system is supposed to serve the operational staff in their operations and sharing the needed information as well as to provide faster information retrieval for the management.

Objective of the project

The project objectives for the Information System are:

1. To study and analyze the existing system problems.
2. To design a computerized system in the area of inventory and purchasing, production and sales as the requirements by users.
3. To compare the existing manual and proposed computerized system in term of benefit and costing.
4. To design software interface for further software development.

This study attempts to find inefficient performance of procurement activities and suggests way to improve these functions in order to increase customer satisfaction.

Scope of the project

The scope of the study covers the area of 1) Purchasing and Inventory, 2) Production and 3) Sales and Marketing management.

In purchasing and inventory management, the project provides basic information of raw materials, suppliers, integrated information among purchase requisitions, enquiry, and purchase order. History and status of the purchase order can be retrieved and presented by the review screen or report.

For the stock and inventory management, the project provides maintain screen to record the raw material movement and the interface with the purchase order. The system also provides the review screen to check the stock balance. Every user can check the availability of their needs materials. Finally the system provides report that analyzes the consumption of each raw material to help the management with the decision-making. The stock for finished goods would also be records and do process along as the raw materials but in vice versa.

In production management, the project provides basic information of the process status. It would be the lot number as the key primary link. One lot number of production will know the mixtures, production status, percentage of loss, capacity utilization of each machine and labor.

In sales and marketing management, the project provides the information of customer base, sales history classified by customers, product types, timing. Moreover, the general document such as issuing sales order, delivery order, goods return.



Project Plan – Gantt chart

The schedule for developing the information system to TPR is as following:

Activities	Nov				Dec				Jan				Feb			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
System Analysis																
1 Gather information of the existing system																
2 Identify working process of an existing system																
User Requirement Analysis																
3 Gather information of user requirements																
4 Identify user requirements																
System Analysis																
5 Develop data flow diagram of the proposed system																
6 Identify contents of flow data																
7 Data Dictionary																
8 Identify Database information																
9 Screen Interface Design																
10 Report Design																
Comparing Analysis:																
11 Comparing benefit analysis between the manual and the new computerized system																
12 Cost-Benefit analysis																

Security and controls

The data in the system are very important. The balance between the convenience and security level is the one that developer should concern. An unauthorized access must be prohibited.

The following security and control methods are proposed for this system;

1. To ensure the authentication, properly accessed and maintained, password is provided into the program for the users to have and authorized access to certain sensitive area in the data.
2. All input forms must be checked and verified by authorized person before data entry.
3. To ensure input complete and accurate, if the input is accurate, the edit processing must be completed and accurate, since all accepted transactions are completed.
4. To prevent loss of data during a power failure, the UPS is a must.
5. Hardware and printer should not be left unattended when it is printing any information.*
6. To prevent the error accident that may destroy the files during processing, back up is used to recover any destroyed and error on files.
7. Physical place for clients and server should be in the secure place.

Data Dictionary

Primary recycling

It is post-industrial plastic recycling. This kind of recycling is relatively easy due to the cleanness of the industrial plastic scrap.

Secondary recycling

It is post-consumer plastic recycling. Post-consumer waste is any object discarded by a consumer (e.g. packaging and bottles). Secondary recycling is more difficult because there are different plastic types mixed in post-consumer waste. A selective collection program helps plastic sortation avoiding contaminants. Selective collection is an urban solid waste collection alternative used where recyclable waste is separated by population inside their homes. Afterwards it is collected in special days separately from organic waste.

Tertiary recycling

It is a chemical recycling and makes possible to use recycled resins in the same application as they were used originally. It decomposes plastic waste through chemical or thermal process into their monomeric constituents which can be repolymerized to produce virgin resins. But this recycling has a high cost.

Quaternary recycling

It is an energetic recycling. It is different from incineration because it recovers energy from plastic waste to generate electricity.

HDPE

High Density Polyethylene

LDPE

Low Density Polyethylene

PP

Polypropylene

PS

Polystyrene

PVC

Polyvinyl Chlorine

PET

Polyethylene Terephthalate

Communication study

A study approach involving questioning or surveying people (by personal interview, telephone, mail, computer, or some combination of these) and recording their responses for analysis.

Ex post facto design

Researchers have no ability to manipulate the variables but can report what has happened or is happening to the variables.

Personal interviewing

A face-to-face, two-way communication initiated by an interviewer to obtain information from a respondent.

Simple random method

A probability sample in which each element has a known and equal chance of selection.

Telephone conversation

A study conducted wholly by telephone contact between respondent and interviewer.

Chapter II: Literature Review

Information system can be defined as the collected, processed, stored, analyzed, and disseminated information for a specific purpose. It includes input (data, instructions) and outputs (report, calculations). It processes the inputs and produces outputs that are sent to the user or to other systems. A feedback mechanism that controls the operation may be included.

An information system can be formal or informal. Formal system includes agreed-upon procedures, standard inputs and outputs, and fixed definitions. Informal systems take many shapes, range from an office gossip network to a group of friends exchanging letters electronically. It is important to understand the existence of informal systems. They may consume information resources and sometimes interface with the formal systems. They may also play an important role in resisting and/or encouraging change.

A *computer-based information system* (CBIS) is an information system that uses computer technology to perform some or all of its intended tasks. Such system can include a personal computer and software or it may include several thousand computers of various sizes with hundreds of printers, plotters and other devices, as well as communication networks and database. In most cases an information system also includes people. The basic components of information system are listed below. But not every system includes all these components.

- Hardware is a set of devices such as processor, monitor, keyboard and a printer that accepts data and information, processes them and display them.
- Software is a set of program that enable the hardware to process data.
- A database is a collection of related files, tables, relations. And so on, that stores data and the associations among them.

- A network is a connecting system that permits the sharing of resources by different computers
- Procedures are the set of instructions about how to combine the above components in order to process information and generate the desired output.
- People are those individuals who work with the system or use its output.

General Technological Trends

General trends are relevant to any computing system. They include:

- The cost-performance advantage of computers over manual labor will increase.
- Graphical and other user-friendly interfaces will dominate PCs.
- Storage capacity will increase dramatically.
- Data warehouse will store terabytes of information.
- Multimedia use will increase significantly.
- Intelligent systems, especially artificial neural computing and expert systems, will increase in importance.
- Object-oriented programming and document management will be widely accepted.
- Computers will be increasingly compact.

Plastic Recycling Business

The major factors influencing the higher competition in the market, the life cycles for the products are getting shorter, so that new designs must follow one another more frequently. The market place is time-sensitive; it wants its products on time. This time-based competition means that factories must produce in smaller batches on time controlled schedules.

The market place is cost-sensitive, it wishes to lower the break even point. Hence, highly efficient production capabilities are required, with high quality and reliability.

The pace of adopting in advance manufacturing technology is affected by the competitive environment of the industry. This environment, in turn, is determined by social and economic considerations and will include such factors as consumer value and average product life cycles.

The flexible production era, the era of acceptance of technology's strategic importance and incorporation of flexibility into production systems. The task management changed to that of involvement in making technological decisions (rather than leaving the decisions solely to technical staffs), and to creating organizations that are much flatter and more highly integrated.

These efforts are benefiting immensely from advances in information technology which allow cooperate managers to have access to vital data in a timely and cost- effective fashion.

To remain competitive, it is necessary to change and to adapt to new developments on all fronts, not just in manufacturing. This is where management of the new technologies becomes essential.

Trend in manufacturing

Many firms are finding that they can achieve tremendous gains in efficiency and effectiveness by designing products which have fewer parts and are thus simpler to manufacture and assemble.

Process simplification is also being pursued in an attempt to provide firm with the capability to produce a wide range of high quality, low cost products.

Need to reduce inventories. Shorter product life cycle and increased new product introductions have increased the risk that inventories will become obsolete. Because of these costs and risks, manufacturers are rushing to reduce inventories.

Pressures to improve quality. Realizing that, the companies that consistently achieve high quality standard are in much better position to receive future contact from large manufacturer. With inherent high precision and consistency, the new technology provides an important means of producing high quality products.

Smaller plants. There is growing evidence to indicate the plant sizes are shrinking, and that more companies will choose to build smaller plant in the future. New manufacturing technologies have reduced the cost advantages of pursuing economies of scale.

Just in time production has made it all but necessary for many firms to locate a number of smaller plants close to their various customers rather than operating out of one large centralized plant.

Management do workers relationships appear to be more productive in a smaller environment.

Smaller production lot sizes. There are many researches which say that in coming years most manufactured parts will be in small lot sizes. Many factors, including increased market segmentation, just in time delivery requirements and new technology capabilities have contributed to the growing trend toward production in small batch sizes. This in turn makes improved production flexibility a necessity for many firms.

Technology acquisitions and adaptations

Models for strategy formulation - Porter Analysis

The strategic model development by Michale Porter concentrates on the application of experiences curves and economies of scales to identify key components of business policies, cost and differentiation. Depending on where the company is positioned, generic strategies could be developed, which relied on their cost or differentiation.

- Cost leadership

Companies could concentrate on developing cost leadership by establishing economies of scales and benefiting from the learning curves by producing higher volumes than the competitors.

- Differentiation

Companies could concentrate on producing new products either for the entire market or for small niche sectors.

Competitive Advantage

Broad target	Cost leadership	Differentiation
Narrow target	Cost focus	Differentiation focus

Each of the above generic strategies results from the company making consistent choices on product, market, and distinctive competences- choices that reinforce each other. This table summarizes the choice appropriate for each generic strategy.

Product / Market / Distinctive competence – choice and generic competitive strategy

Cost leadership	Differentiation	Focus
Low (principally by price)	High (principally by uniqueness)	Low to High (price or uniqueness)
Low (mass market)	High (many marketing segments)	Low (one or few segment)
Manufacturing and materials management	Research and Development Sales and Marketing	Any kind of distinctive competence

Strategic development directions

Based on sets of “product/market” choice, there are different directions for companies’ strategy development. These directions are shown in this table

Alternative direction for development

Present	Withdrawal Consolidation Market penetration	Product development
New	Market development	Diversification

Opportunity cost – development risk

The model based on concept of looking at the relationship of opportunity cost vs. development risk.

Selecting development strategies

Company has to select a strategy that is most appropriate for development. Options about development strategies involve decisions about three elements that are shown below:

1. The generic strategy to be pursued, i.e. The basis on which the organization will compete or sustain excellence.
2. The alternative directions in which the organization may choose to develop
3. The alternative methods by which any direction of development might be achieved.

Product life Cycle (PLC)

This model uses market position, including introduction growth, maturity and decline to provide valuable insight into the future investment, demanded at each stage.

Operational management

- Managing the productivity
- Productivity should be examined from both efficiency (output) and the effectiveness (outcome) point of view.
- Efficiency of production

With reference to efficiency, productivity deals with the relationship between resource application and production. That means the new adopted technology is aiming at lowering unit cost and creating more profit.

Effectiveness of Production

With regards to effectiveness, productivity concerned with performances in term of end user, such as providing greater flexibility, and a higher number of product variations.

The studies showed that, with the new technology the firm can simultaneously achieve both effectiveness and efficiency in their production process.

There are 5 basic equations for any productivity improvement:

1. Do people know how to do their jobs?
2. Do lower levels of the organization know what upper levels expect?
3. Is the production equipment developed to its fullest potential
4. Are people organized in the most effective way?
5. Do people want to do their jobs?

Quality Management

In the following paragraphs we describe quality dimension and impact of new technology CAD/CAM in quality improvement. Quality has the same basic components : efficiency and effectiveness, that can be categorized in five definitions:

- Transcendent definition

Quality cannot be precisely defined; it is a universally recognized concepts pertaining to excellence.

- Product based definition

Quality refers to the degree or quantity of some attribute contained within the product

- User-based definition

Quality refers to the degree to which a product satisfies customer wants

- Manufacturing-based

Quality means conformance to the required specifications.

- Value-based definition

Quality refers to providing a product with acceptable quality at reasonable price

The manager should be aware that what crucial dimensions of quality can be enhanced by the adopted technology. The following detail presents eight dimensions of quality:

- ✦ Performance
- ✦ Feature
- ✦ Reliability
- ✦ Conformance
- ✦ Durability
- ✦ Serviceability
- ✦ Esthetics
- ✦ Perceived quality

Material Management

The competition is strong between firms manufacturing comparable products.

Therefore, if it wants to survive, any company offering goods or services is faced with the need to react quickly to changing customer demands, to improve continuously the quality of products and their delivery, and to reduce costs. Controlling cost means: controlling quality, time-limits and quantities.

All efforts to improve the quality of products and to integrate the control of the flow of goods (in short: to increase customer satisfaction) are sensible only if progress is monitored. Performance Indicators (PIs) are a means to this end. They provide

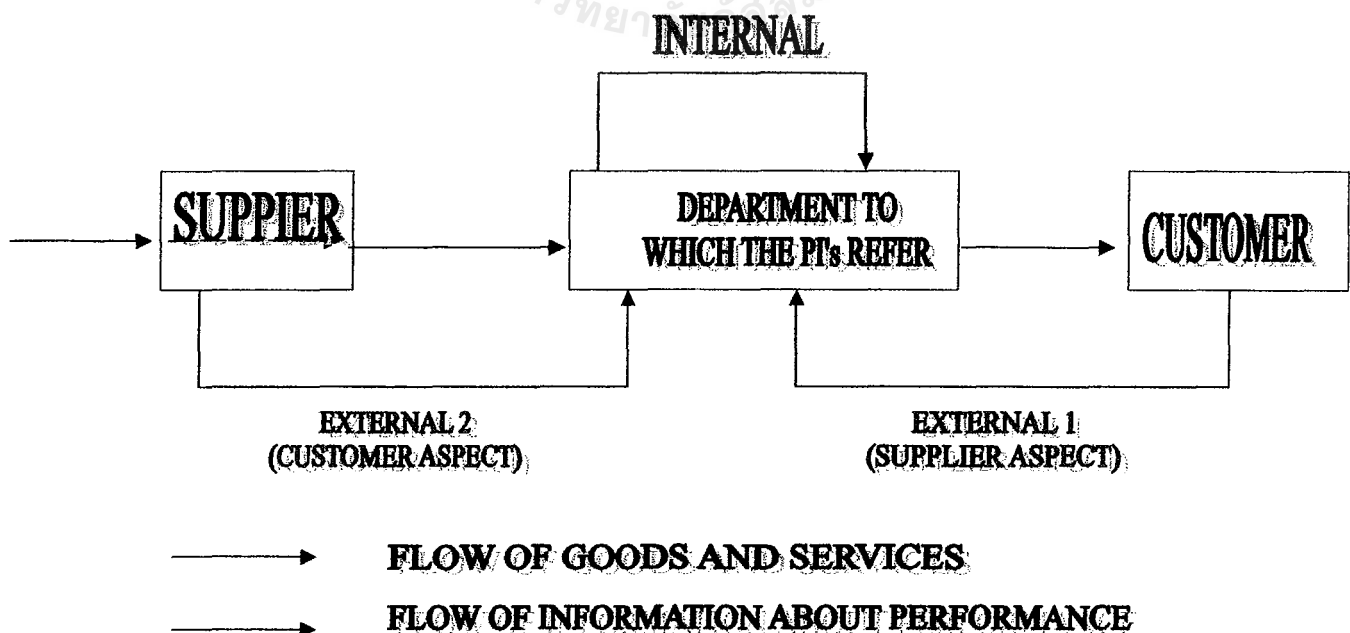
management with a tool to compare actual results with a pre-set target, and to measure the extent of any deviation.

A Performance Indicator is a variable indicating the effectiveness and/or efficiency of a part or whole of the process or system against a given norm/target of plan.

Speed is very important if a company wants to turn an opportunity into a market position. Doing better and remaining ahead of the competition is the overall goal. PIs can help to control the innovation process in such a way that the required time becomes minimal. “Do it right the first time” is here the all-inspiring adage, so that the product not only appears quickly in the market but proves to be reliable as well. Each box in the above table can be sub-divided into department, group or section as mentioned earlier; all of them acting as a supplier to one or more customers. The supplied product often consists of goods, but it can be services as well. All activities in the company are in that sense “products”

PIs are categorized into

- External PI
- Internal PI



External PIs are distinguished in two types.

- Type 1, indicating how the customer of the department judges this department in its role of supplier. For examples, the speed with which a customer order is executed, the quality of a product, as experienced by the consumer.
- Type 2, expressing how the supplier of the department judges this department in its role of customer. For example, the number of times the department wants to modify and outstanding error, the speed with which the department pays its bills.

Internal PIs also exist: turnover per employee and the percentage of actual development times that do not exceed the agreed development times are but two examples. They refer to the efficient usage of internal resources. External and Internal PIs are not independent: poor internal performance is likely to cause a poor external performance. In order to achieve favorable external PIs, optimal employment of internal means is indispensable

Each PI characterizes an activity at a certain instant of time. In order to facilitate comparison with the past only then do progress become visible previous outcomes are shown also. Moreover, the target has to be included, thus indicating how far away the objective still is. The interval of validity of this target should also be mentioned.

Performance Indicators are used to improve performance of all activities in company to serve customer satisfaction. PIs have to be used in concert. If a department is aiming at short throughput time and cost sources such as stock levels, personnel and machine are not considered, it is not so hard to achieve set targets. But this is one-dimensional management and it moves problems around rather than solving them. Customer satisfaction will not be realized. The problem is to balance

the conflicting objectives, and to minimize the total of all the costs involved and maximize customer service consistent with the goals of the whole organization.

Many companies do not make profits despite improved productivity. Customer demand for new and better products and their demand rates change frequently. Under these circumstances, the rapid response to changes in product design and volume is any manufacture's major concern for survival in the ever growing competition. The "productivity paradox" of Skinner indicates that productivity and profits do not always go hand in hand. This occurs when the increased products due to improved productivity are not sold because of poor quality of products and the inflexibility of manufacturing system to customer expectations. As productivity is the measure of the efficiency of converting tangible inputs into output, it does not consider whether the produced item generate profits through sales. So this productivity paradox can be cured only through evaluation of a performance measure, integrated manufacturing performance (IMP), which is a ration of total output to sum of productivity cost, quality cost, and flexibility cost. We have to simultaneously consider performance indicator to solve the multi-objectives decision making (MODM).

PIs can enter the picture: they can indicate quantitatively how the performance is qualitatively going. They show also whether actions for improvement have the desired result and to what extent. This implies that good PIs are derived from the organization's objectives. The quality of MM activities can be monitored and discussed by using PIs.

The list examples of PIs that can be encounter within industrial companies is shown in the table below.

Activity	Performance Indicator
Market research	Image of the company Product image Accuracy of forecasts
Products development	Speed with which new technology is applied Number of technical changes after commercial releases of a product
Manufacturing	Price Scrap Throughput time
Logistics	Delivery ratio (volume) Delivery ratio (no. of order) Stock ratio
Distribution	Delivery reliability Inventory level
Sales	Delivery time Quality of direction for use
Service after sales	Call rate Response time of technicians Compliance with appointments
Administration	Timeliness of financial reports Accuracy of financial report
Internal service	Timeliness of travel documents

	Throughput time of typing work
Management	Percentage of executed decisions Execution speed of decisions
Implementation of Performance Indicator	Number of deadliness reached in time



CHAPTER III: PROJECT METHODOLOGY

3.1 Sample size background and characteristics.

Regards to the number of the users in the company which project would be implemented for, all the samples that are concerned with same plastic recycling business size would be used as the population. The scope will not cover the blue collar workers who use the labor in the factory.

Sample size is one of the important factors we use in the research methodology because we can select some of the elements in a population, and can draw a conclusion about the entire population that can get greater accuracy of results and greater speed data collection. So our sample size background for this project should be the people who are the users in the system. With the 50 recycling plastic business companies which are the same size with TPR, the sample will draw from this population by random the 10 companies and give them quota 10 questionnaires each for only users as the correspondences.

With the variety of the staffs and workers and the level of education in the companies, some are lower than bachelor. So some of them may know or may not know much about these kinds of Information System. Anyway, in order to know what they think about computerized system in terms of Small and Medium plastic recycling companies, we should use questionnaires to focus what we would like to know from them and apply these kinds of technology to the factories and ask what they expect from the computerized system. Finally, the solutions can be found in order to solve the present problems.

3.2 Scope of Study.

This project concentrates on 100 questionnaires of TPR and other nine plastic recycling companies in Bangkok. To get clearer point of views it is necessary to study more related manufacturing companies and go to the real situation because plastic recycling has a mainstream on the production so we have to observe the process and procurements of plastic recycling business that can effect to same areas of problems and how they can solve those problems. It will not be possible to cover all the factories in Bangkok. Therefore, only ten companies are chosen for this study.

3.3 Data Collection Method:

Methodology is one of the important parts in carrying out the project because it can help us to conduct the project and solve the problems more effectively to the decline of products profitability due to higher costs of raw resources in the plastic recycling business companies.

- **Tools:**

We are also analyzing our questions and providing *communication study*, collecting information through questionnaires with close-ended questions by using 100 people of system users in recycling plastic companies with *simple random method*. After we get the possible results through questionnaires, we can use SPSS as the quantitative tools to formulate in order to get more accurate results.

3.4 Data Analysis:

By analyzing our questionnaires we use Descriptive analysis in order to analyze our responsiveness so this project employs both primary and secondary data, which are related to the subject being studied.

Primary data:

The data had been obtained through detailed questionnaires so this project is quantitative. All questions were close-ended, and the idea was to investigate and analyze after gathering information.

Secondary data:

Our secondary data can be obtained through other publications of the recycling plastic business. Other journals, magazines and textbooks that are related to this topic as well as from other official company documents and reports.



Chapter IV: Data Analysis and Interpretation

This chapter is presented with analysis of 100 questionnaires from users of 10 samples plastic recycling companies Bangkok and Metropolitan by separating into each category as follows:

4.1 Personal Data Analysis

The personal data showed that there are 100 respondents in this descriptive study that consist of 21 male and 79 female who are different in age interval: Below 20 years, 20-25 years, 26-30 years, 31-35 years, 36-40 years, 41-45 years, 46-50 years, 51-55 years, 56-60 years, 60 years and over. The detail will show in the table below.

The results of position level that 7% of respondents is Self-employed, own company, 3% of total respondents is Executive/Managerial, 21% of total respondents is Manager, 65% of total respondents is Administrative staff and 4% is other e.g. clerk and part- time staff.

The results of education level showed that there are 49% of total respondents who are below bachelor degree level, 29% of total respondents in Bachelor degree level, 4% of respondents in Master degree level and 18 % of total respondents in other category.

Personal Data:

Figure 4.1-1: Gender of Respondents

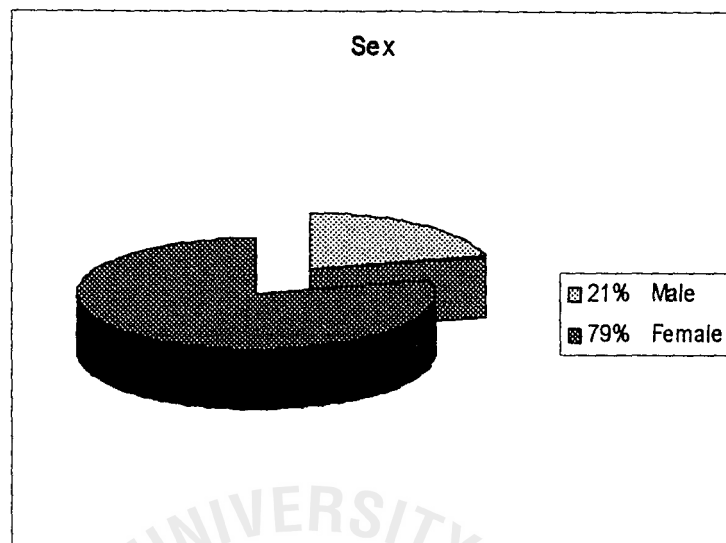


Figure 4.1-2: Age interval of Respondents

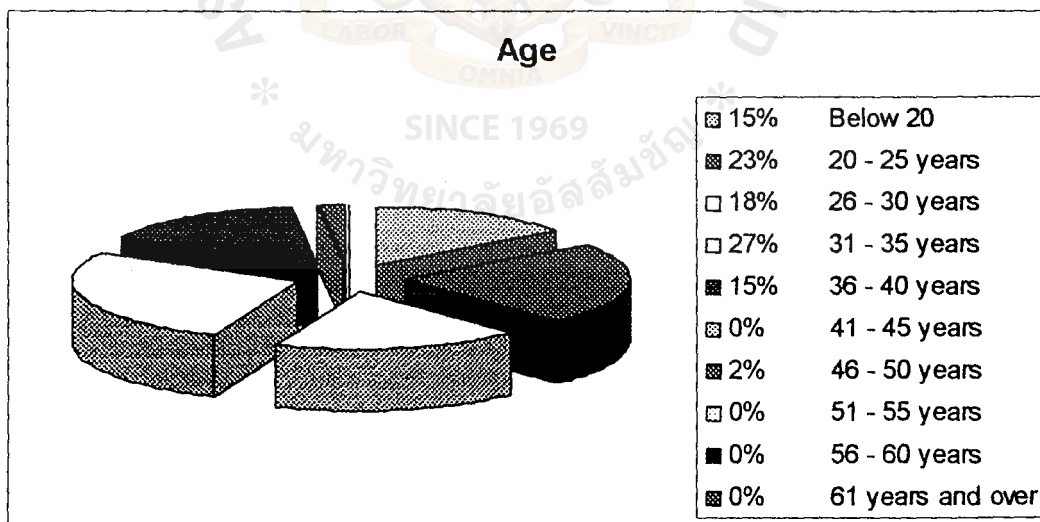


Figure 4.1-3: Status

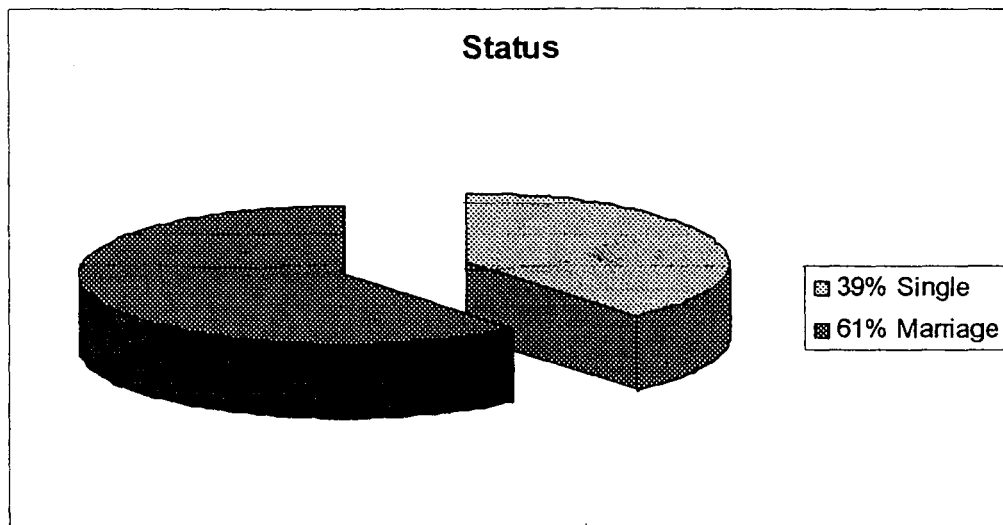


Figure 4.1-4: Position

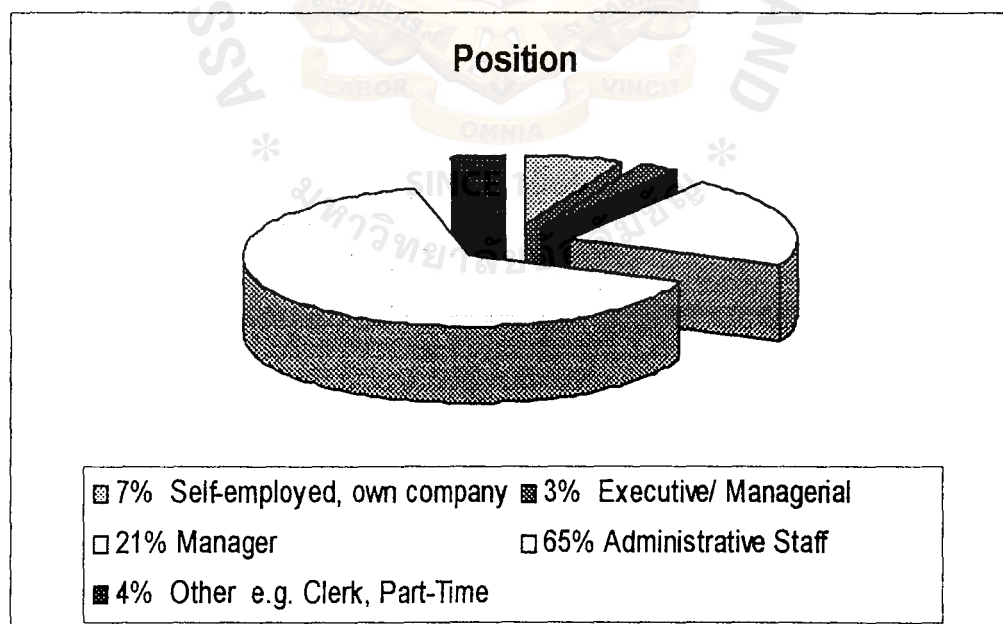
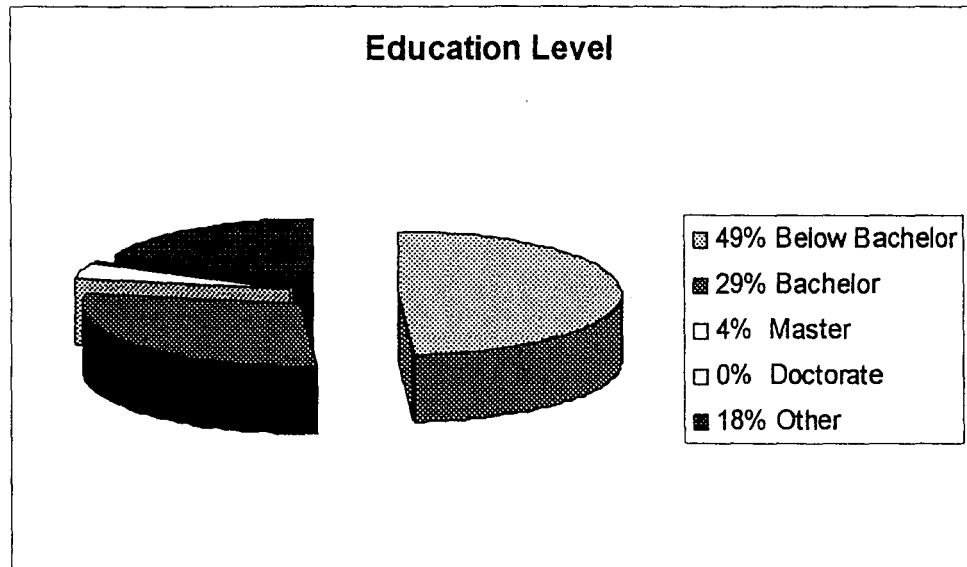
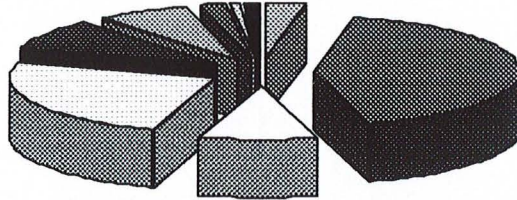


Figure 4.1-5: Education Level



Part II: Question Analysis

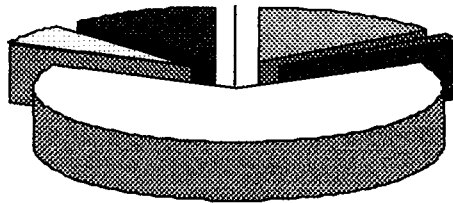
1. What are the problems in your organization?



■ 3%	Dependence on the hard copy file
■ 43%	Redundant jobs for record keeping
□ 9%	Unnecessary workload to follow-up the other
□ 25%	Difficulties in information retrieval
■ 9%	Inconsistency format of information
■ 7%	Oversupply and shortage of inventory value

As the results after conducting 100 questionnaires, redundant jobs for record keeping is the highest score 43% of the total answers, the second is the difficulties in the information retrieval which is 25%. Usually other problems are dependence on the hard copy file, unnecessary workload for the follow-up jobs, inconsistency format of information, oversupply and shortage of inventory value, limited security handling, lack of control in problem solving or processing performance and others. By showing the percentage are 3%, 9%, 9%, 7%, 2%, 1% and 1% respectively.

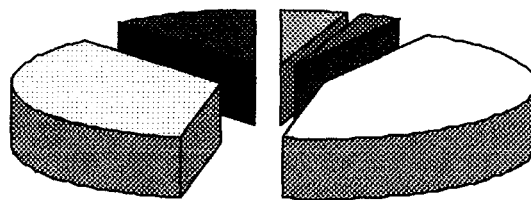
2. Which solution do you think is the best ways to eliminate your problems in your organization?



- 15% Increase the number of admin staffs to decentralize the jobs
- 2% Increase the number of computers
- 65% Use computerized system to reduce the working steps
- 6% Set Evaluate team to check the performance
- 12% Rearrange the working process

65% of the respondents agree that the use of computerized system should be the solution to solve the problems, 15% shows that they should increase the number of the staffs to decentralize the jobs, 12% of the respondents express the organization should rearrange the working process, the verification department should be set up to solve the problem is the 6% portion and 2% for increasing the number of computer machine to solve or reduce the problems in their organization.

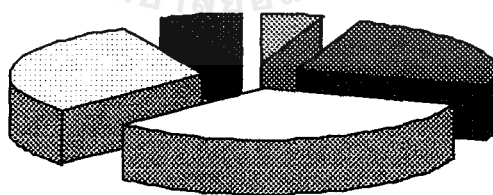
3. How often have you faced the problem?



■ 5%	Less than 10 times / week
■ 3%	10 - 20 times / week
□ 45%	20 - 30 times / week
□ 36%	31-40 times / week
■ 11%	More than 40 times / week

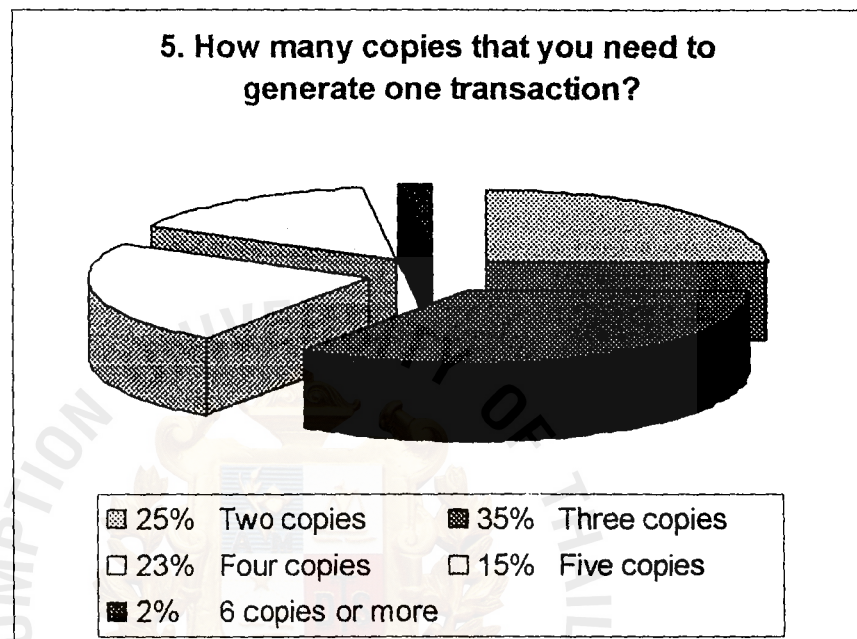
The highest portion of the answer is 45% shows that 20-30 times/week that they have to faced the problem on their procurement, 36 % shows that 31-40 times per week, 11 % has to faced the problem more than 40 times per week, 3% for 10 – 20 times per week. While there is only 5% for the less than ten times per week faced the problems.

4. How many transactions do you have to do per week?



■ 5%	Lower than 150 transactions / week
■ 25%	151 - 249 transactions / week
□ 33%	250 – 299 transactions / week
□ 30%	300 – 349 transactions / week
■ 7%	More than 350 transactions / week

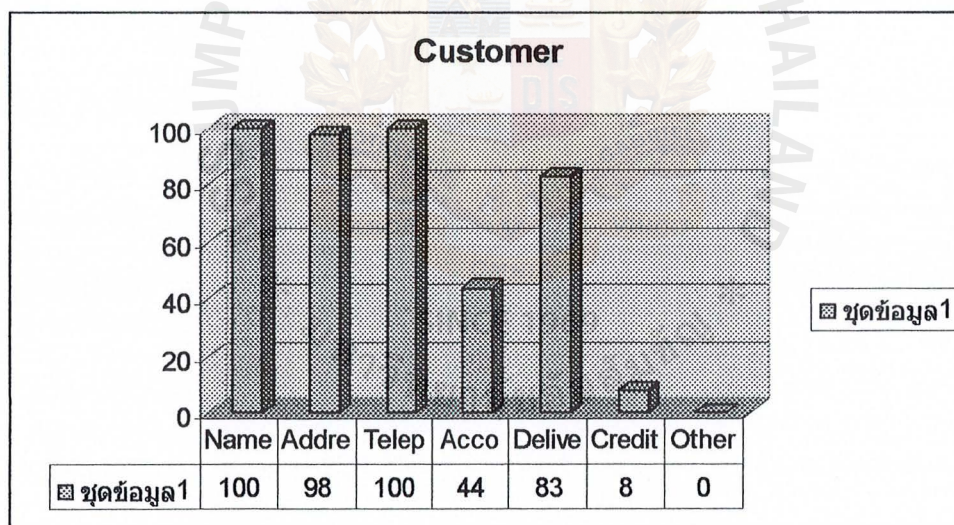
5% of the total respondents has to run the less than 150 transactions per week, 25 % for 151 – 249 transactions per week, 33% for 250 – 299 transactions, 30 % for 300 – 349 transactions per week and 7% has to process the transactions more than 350 transactions per week.

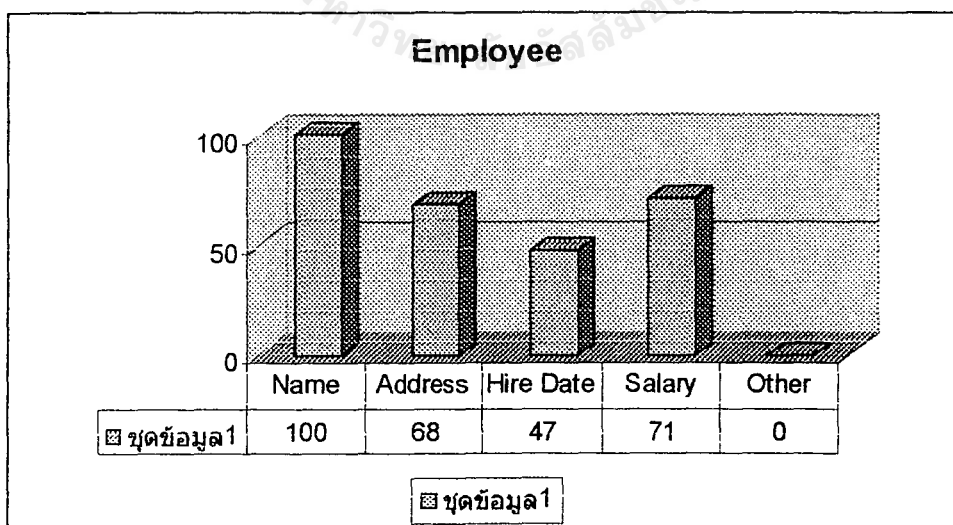
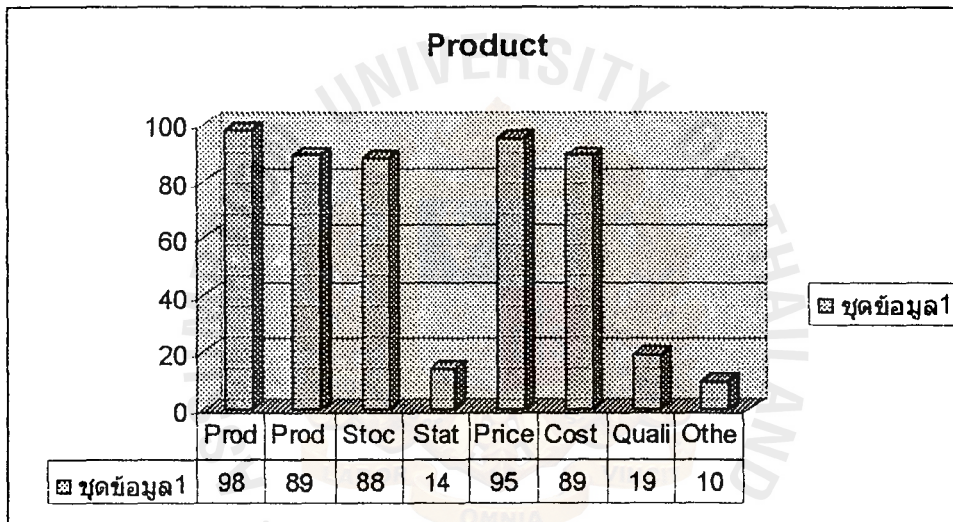
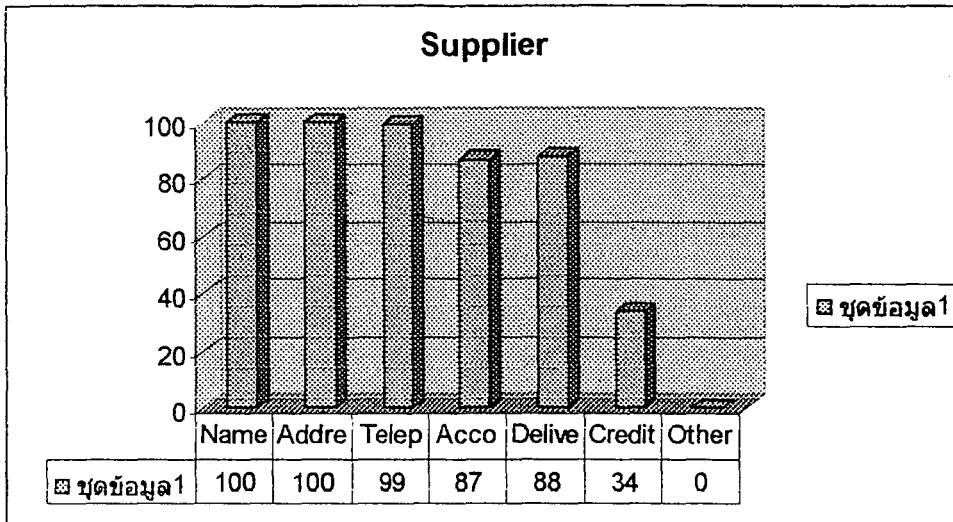


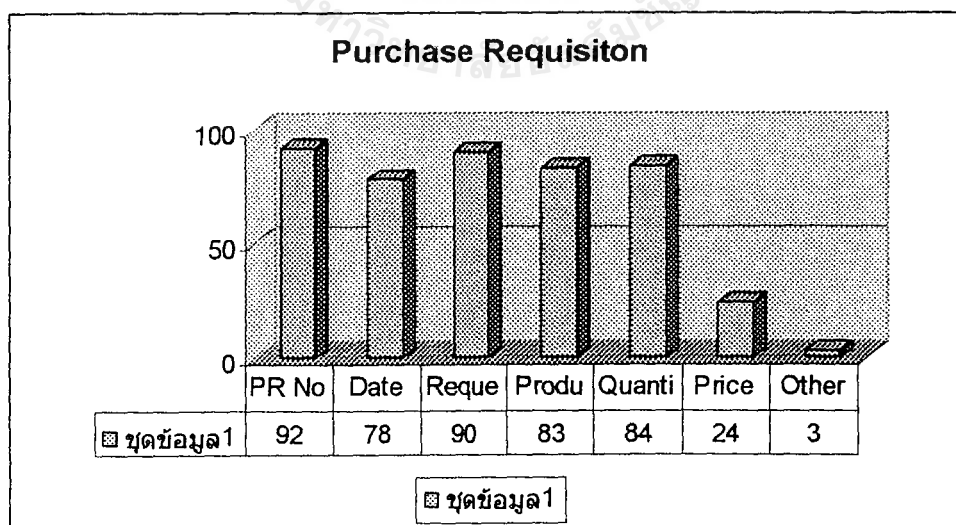
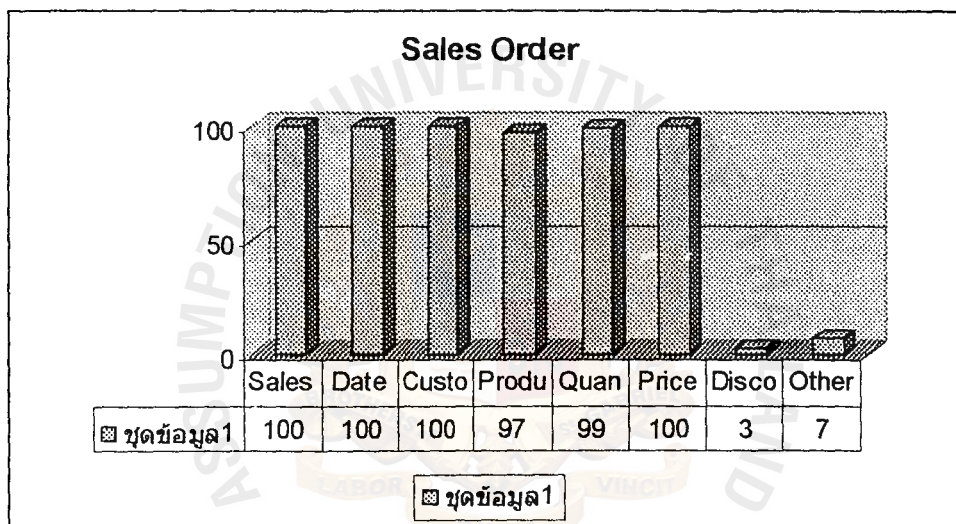
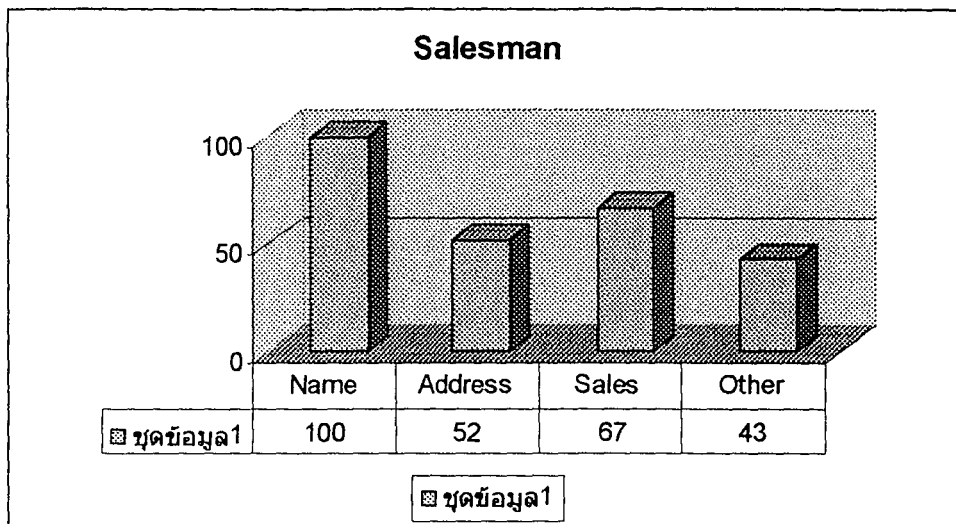
25% of the respondents use two copies, 35% for three copies, 23% for four copies, 15% of the respondents use five copies and 2% use 6 or more than 6 copies to generate one transaction.

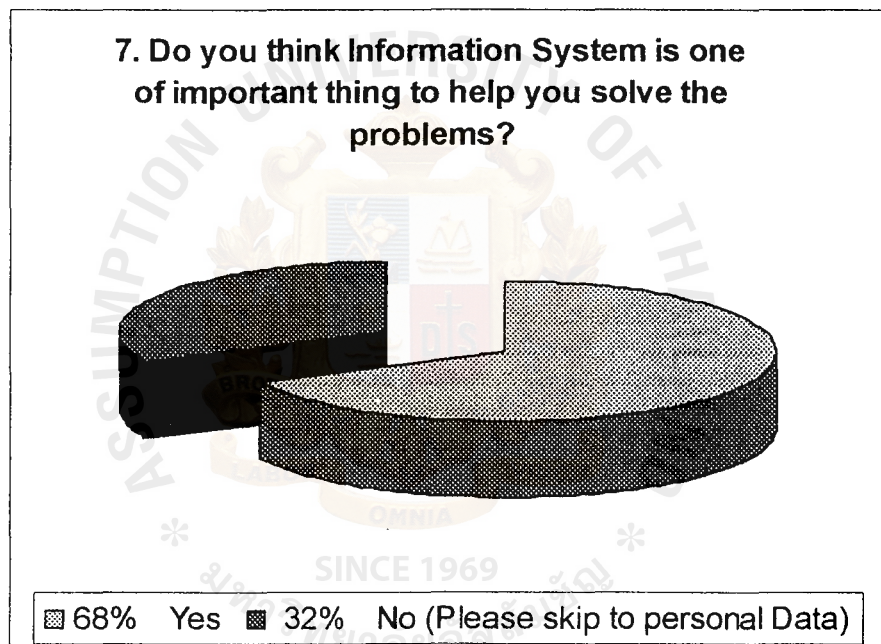
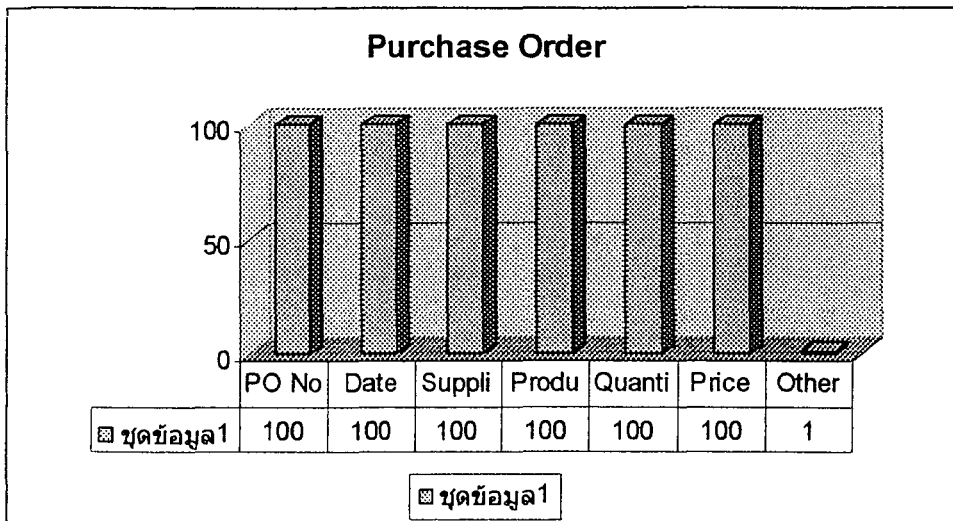
6. This question was set for the purpose to ask the questions to the user what they need or think of in these following items. For example, when in the process or the procurement needs the item of customers, what attributes do you need more? Refer to the reply from the respondents that they can check in any and can show more ideas in the other which is not specified. One hundred respondents will show more, not specific only one for each item.

When 100 of the respondents need customer entity, they all think that they need information name, 98 respondents need address, 100 respondents need telephone number, 44 respondents need account bank number, 83 respondents need delivery place, 8 respondents need credit term information and zero has no other ideas.



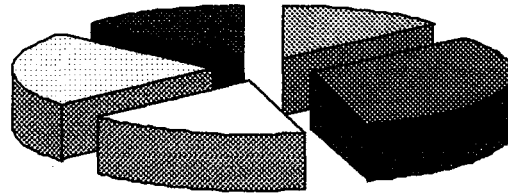






68% of the respondents agree that information system is one tool that may help them solve the problems, while 32% disagrees in the information system tool.

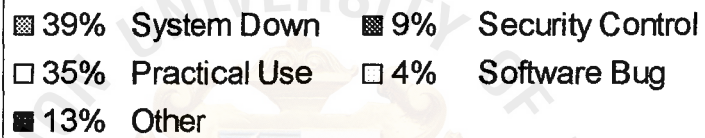
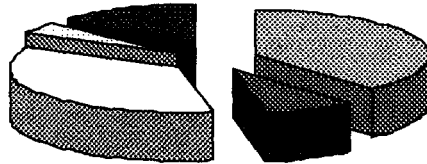
8. What is the most important thing that you need in the information system?



■ 13%	Friendly interface
■ 32%	Easy to retrieve or tracking information
□ 18%	Complete information
■ 24%	Up to Date information
■ 13%	Accurate information

From 68% of the respondents that agree to use information system to solve the problem, they feel the information system should be the character that is easy to retrieve or tracking information as the most 32 %, 24% of the respondents say that information system should be up to date, provide real time information, 18% feel information system should be completed, and 13% equally for friendly interface and accurate information.

9. What is/are the problem you expect to face after implementing the computerized system in the organization?



Although 68% of the respondents agree to use information system to solve the problem, 39% of them are still to face the problem of system down, 35 % are aware to face the difficulties in practical use, 9% concerns on the security and 13% focus on the other general area.

Chapter V The existing system

Background of the company

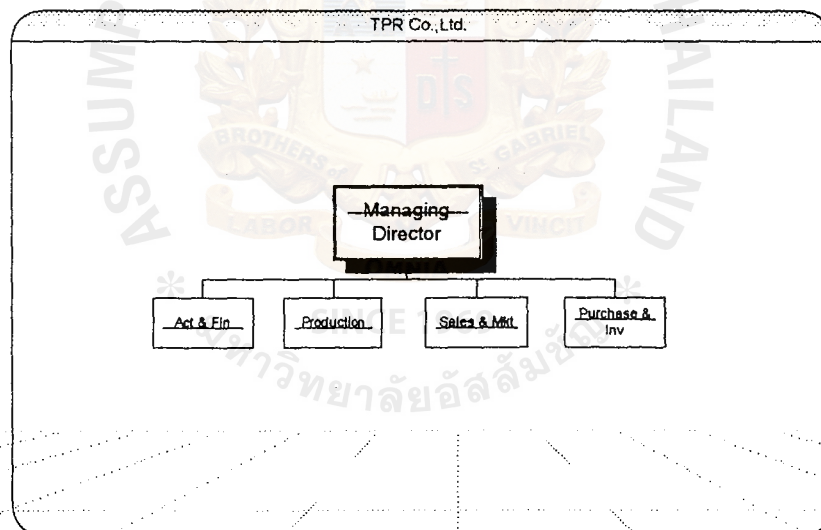
TPR Co., Ltd. is in the plastic recycling business, the products are produced by TPR is recycle (grade B) plastic pellets. TPR has two factories Nakornprathom and Nonthaburi. Both factories perform the same functions but Nonthaburi has more areas. The competition in recycling plastic business is stronger between firms manufacturing comparable products when there is an economic recession. Therefore, if it wants to survive, any company offering goods or services is faced with the need to react quickly to changing customer demands, to improve continuously the quality of the products and their delivery, to eliminate the inefficient performance activities (e.g. purchasing, planning, procurement) and to reduce costs. Controlling costs mean controlling quality, time limits and quantities.

TPR Co., Ltd. is in the primary plastic recycling business, the products are produced by TPR is recycle (grade B) plastic pellets. The company's current system is a manual one that supports every department. It leads to many problems such as: the delay in meeting customer orders, incorrect stock available, inefficient reporting system, obsolete inventory data, the inability to keep track customers, an abundance of paperwork and some inconsistencies and repetitions. Because of these reasons, the information system has been developed to enhance the performances of the Inventory and Purchasing, Production and Sales and Marketing Department. To increase the accounting department efficiency by automating existing operations such as issuing purchase orders, delivery orders, billing, payment. To increase the production department efficiency by correcting stock available, scrap and waste record, production capacity and efficiency.

The Management Information System base is achieved through product description reports, customers description report, suppliers description report, sales information report, production capacity reports, raw-material description report, sales analysis by products, customers and salesman, etc.

In essence, the development project aims to integrate the business application to increase its efficiency and support the accurate information for all management levels.

Organization Chart



Current Problems

The current company system is a manual one which supports every department leading to many problems:

Redundant jobs for record keeping

Many redundancy data entries are done for the order details starting from the buyer's log book, generating order to supplier, follow-up and reporting to collect all the transactions occurred with a lot of time spending.

Difficulties in information retrieval

All of the redundant records lead to the problem of inconsistent information. Management cannot retrieve all the relevant information they want in time.

Unnecessary workload to follow-up the other

Because the buyer has to do the follow-up the purchase order that is sent to the supplier, some orders are lost or no response is received from suppliers.

Dependence on the hard copy file

Too many personal database were created as mentioned earlier leading to the inconsistency of updated information. Therefore, users need to depend on the hard copy file, which is uniquely created and cannot be shared among the groups of buyers and users. It also caused the excessive copies.

Inconsistency format of information

As all the record details are kept depending on the record owner's purpose, the formats of data being kept are different forms. It affects the loss and missing in inconsistency of information.

Lack of control in problem solving or processing performance

There is no measurement to control for the staff that use the trigger all the processed performed. Each person performs all the processes by their experiences and styles. The system also depends on the expertise of all the existing staffs.

Limited security handling

There is no security control for the information that is very important for the company, e.g. the cost of raw material, the selling price of the finished goods. Without the security handling, the information may get lost or even modified by mistake for any purpose.

Oversupply and shortage of inventory value

When the inventory status is not reliable, it will effect to the purchasing and production department. The company has to pay more for inventory while the production still faces the problem insufficient of raw material.

Chapter VI: The proposed system

The objective of the new system requirements is to assemble an overall picture of input, output, operations and resources required by the system to meet the present and future needs of the organization.

After analyzing an existing system procedure, new system requirements can be mainly stated for a sharable computerized database that contains all the transactions. The user expected that, such a database will provide them faster information retrieval and better information and better decision making for management. In conclusion, the new system requirements can be clarified as follows:

1. Reduce time and difficulties in searching for the required information
2. Simplify all the workload and procurement
3. Increase efficiency in management control
4. Reduce error and preparation time for receiving operation
5. Identify where the status occur the over expectation for loss and waste

Requirement for the proposed system

The system requirement for the new computerized in the proposed system is developed by input, resource and control components balance all of the activities and processes defined for the new system. A conceptual requirement will be specified as follows:

- **Data manipulation**

This function provides the user with the ability to add or update variety information with the authorized access.

- **Information retrievals**

The user can retrieve the information that they are interested in by selecting the main topic of the interest.

- **Reports**

This function provides the necessary reports to the users as their interested area.

- **System maintenance**

System maintenance function allows the authorized user to update or import some important topics. Besides the back up and contingency plan needed in the urgent case, the company has to run the process as usual.

The proposed system can be divided into the processes as shown below;

- 1. Check stock availability for raw materials**

When the warehouse staff received the request from user, they will check the availability of the inventory stock from the computer system. If there is sufficient stock, the warehouse staff will prepare the raw material for doing the next process.

If there is no available stock, the warehouse staff will inform the user and ask them to create the purchase requisition.

- 2. Check stock availability for finished goods**

When the salesman placed sales order, they will check the availability from the inventory stock from the computer system. If there are available, the sales order will be passed to the accounting and inventory to issue invoice and packing for delivery order to the customers.

If not, the production order will be informed to the production department and process back to the step of checking the raw material available.

3. Issue Sales Orders

When the salesman place sales order, the inventory will check for the availability, the inventory will be prepared for packing, loading, the accounting will be prepared for the invoice.

4. Issue Production Orders

When the stock is not sufficient, the production order will be placed to the production department to wait for queue in the production schedule.

5. Issue Invoices to customers

Sales order would be placed to the accounting for the invoice issuing. After issuing, the invoice and account statement will be provided with the goods which are ready to send to the customers.

6. Issue Purchase requisition

All users must create purchase requisition when they want to buy the raw materials, purchase requisition form must be approved by their department manager before being sent to the logistics department. The logistics clerks verify the completeness of each purchase requisition, if incomplete, return that purchase requisition to the user.

If completed, update the purchase requisitions data into the computer system, and send to the buyer to prepare the enquiry form

7. Enquiry

Each buyer collects the appropriate price from the suppliers, the key in the enquiry information into the computer system, verify the completeness of each enquiry and print into enquiry form. Send the enquiry to each supplier.

After that when supplier has sent back the quotation of the request specification of raw material, buyer must update the enquiry with the quotation information.

8. Issue Purchase order

After comparing the quotation, the buyer creates the purchase order into the computer system, verifies the purchase order and prints purchase order form and send it to the suppliers.

9. Reports

The updated information will be collected in the information system. The system provides the various items of standard reports that user can choose from the list provided. The reports are general and customized by needed information.

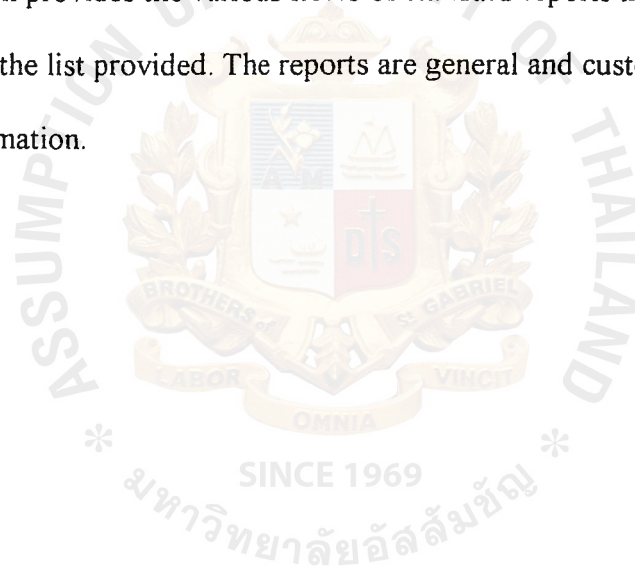


Figure3: Context Diagram - Level 0

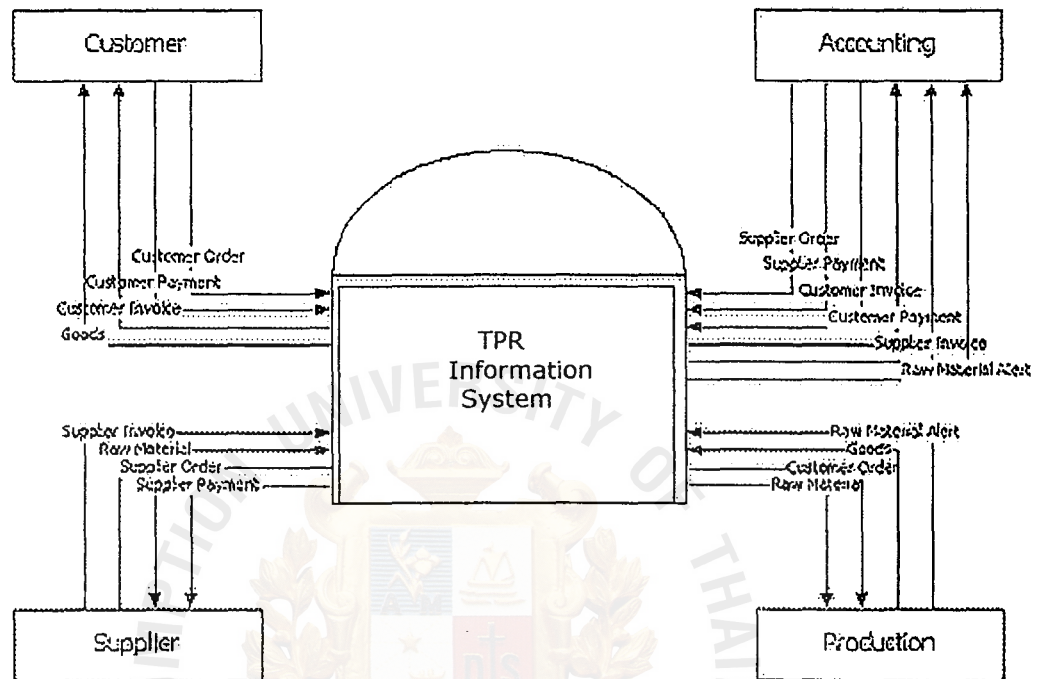


Figure 3.1 Activity flow Diagram (Overall)

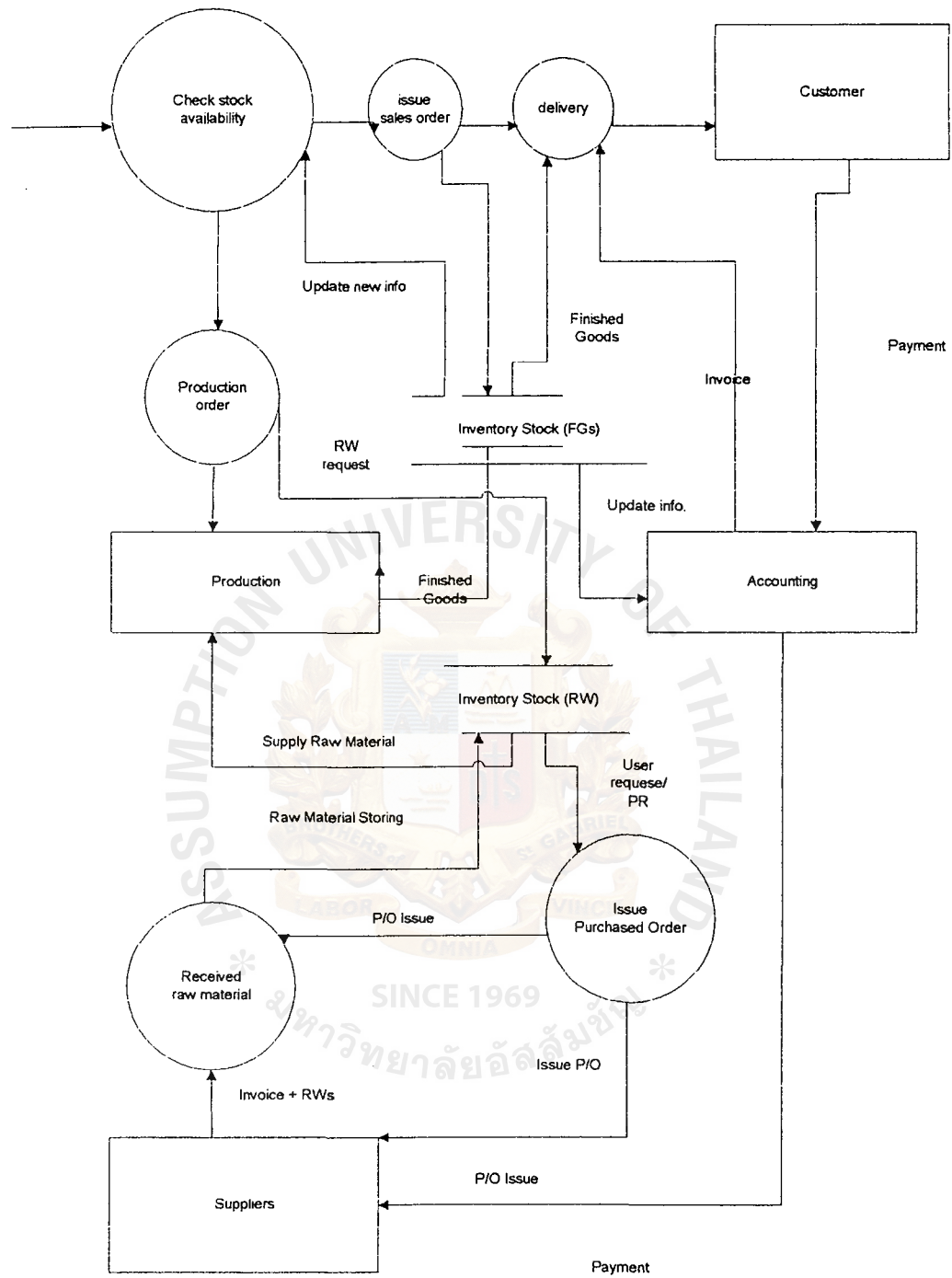


Figure3.2 Activity Flow – Purchasing & Inventory

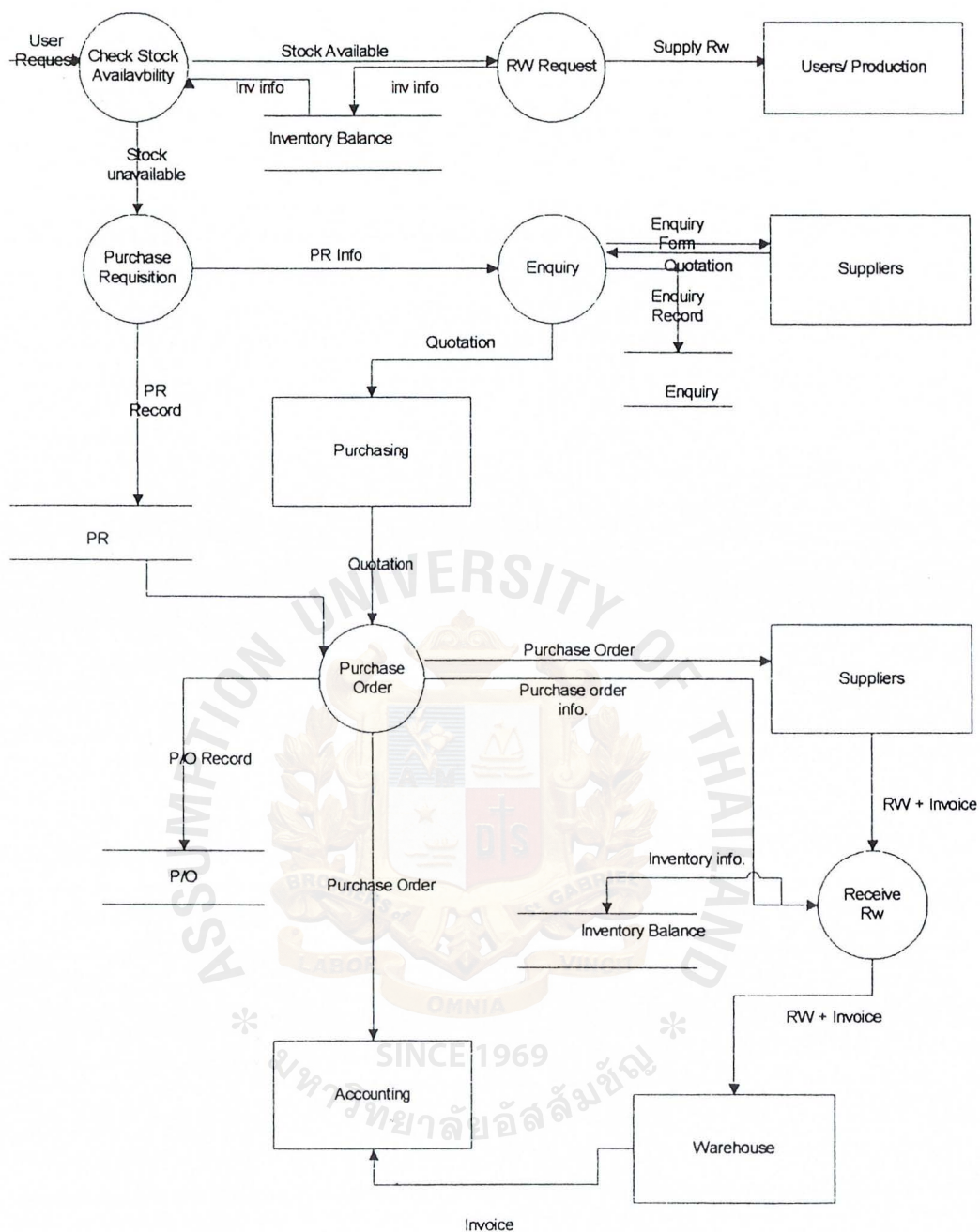


Figure 3.4 Activity Flow – Production

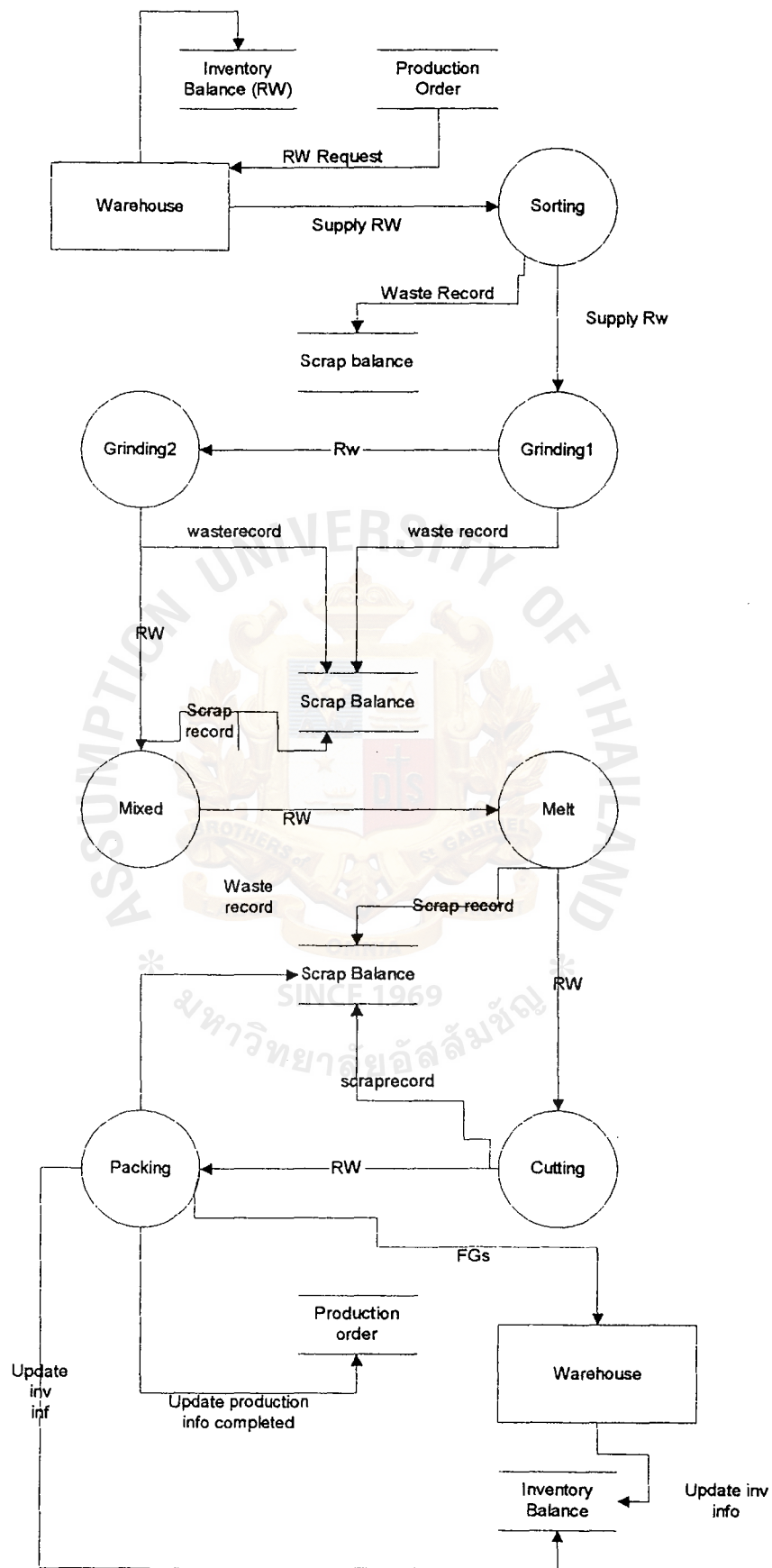
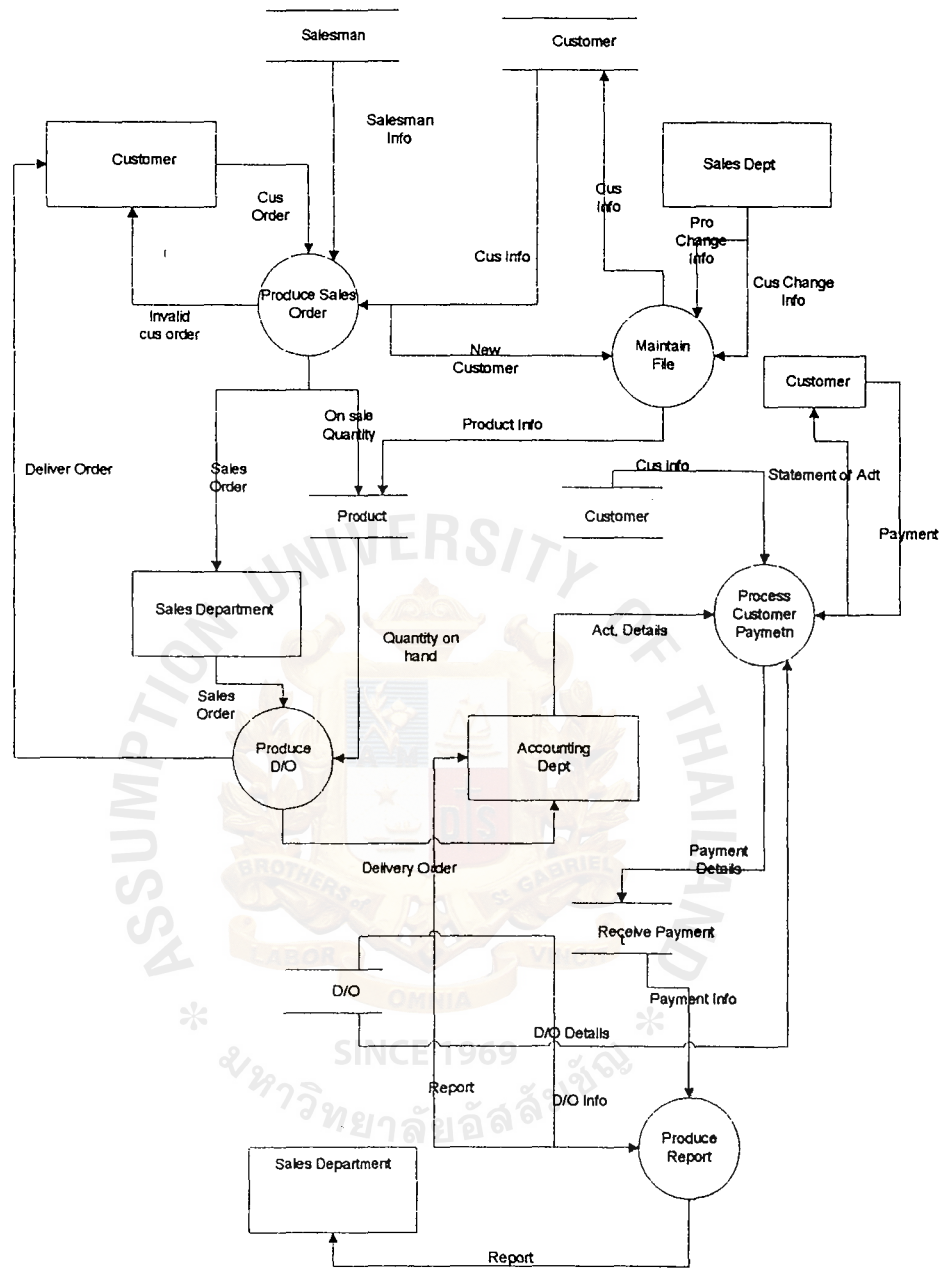


Figure 3.6 Activity Flow – Sales



Details of user requirements

In TPR, after implementing the proposed system, the reports can be generated to meet the following user requirements;

1. Supplier Description Report

This report should provide the supplier number, supplier name, supplier address, telephone number and credit term.

2. Product Description Report

This report should provide the code number of the products. In the details for recycling plastic company, the code would be classified as the raw materials for production process and the finished goods after we can produce or even trading.

The method for coding will start with RW and FG chronologically, for example; RW-PP00-01 and FG-PP01.

3. Customer Description Report

This report should provide the customer number, customer name, customer address, delivery place, telephone number, credit term and credit limit.

4. Employee Description Report

This report should provide the employee number, the employee name.

5. Customer Sales Report

This report should provide the customer number, customer name, purchased date, invoice number, product purchase numbers, product purchase details, prices purchased, total amount purchased.

6. Product Sales Report

This report should provide the details the customers who purchased the specified products. Thus, the product sales report should have the details as the

following; the product number, product description, date purchased, customer name, quantity and price purchased.

7. Inventory Report

This report should provide the code number of raw materials, raw material description, stock available and cost, the code number of finished goods, finished good description, stock available and price.

8. Production Report

This report shows the production capacity and evaluates the efficiency of the production in each stage of production. In the report should have the details as the following; the production lot number, date, the input, actual output, scrap weight, the percentage of efficiency in each stage.

9. Purchasing Report

This report should have the details of the purchasing order number, date, product number, product description, quantity and cost.

Information Design

- **Inventory and purchasing**

Inventory (Raw Materials)	Purchasing Order	Suppliers
- Raw Material Number	- Purchasing Number	- Supplier Number
- Raw Material Description	- Supplier Number	- Supplier Name
- Price	- Supplier Description (Auto)	- Address
- Stock On hand	- Raw Material Number	- Telephone
	- Raw Material Description (Auto)	- Credit term
	- Date	
	- Quantity	
	- Price (Auto)	
	- Total Amount	

- **Production**

Inventory (Raw Materials)	Production	Employees
- Raw Material Number	- Production Number	- Employee Number
- Raw Material Description	- Raw Material Number	- Name
- Price	- Raw Material Description	
- Stock on hand	- Input Quantity	
	- Finished Goods Number	
	- Finished Goods Description	
	- Output Quantity (Actual)	
	- Waste Quantity	
	- Employee number	
	- Percentage of acceptable loss	
	- Expected output quantity	
	- Input Timing	
	- Output Timing	

- **Sales**

Inventory (Finished Goods)	Sales Order	Customers
- Finished Goods Number	- Sales Order Number	- Customer Number
- Finished Goods Description	- Customer Number	- Customer Name
- Price	- Customer Description (Auto)	- Address
- Stock on hand	- Finished Goods Number	- Telephone
	- Finished Goods Description	- Credit Term
	- Date	- Credit Limit
	- Quantity	- Delivery Place
	- Price (Auto)	
	- Total Amount	

User Interface Design

The way to retrieve information in the easy way, friendly and simply are the concept designs for the users, besides the accurate information provision. The input information would be done on key in and the shown out interface would be done on screen and printing to response with the users.

On the basis of the database design, it would be classified as three main areas; forms, tables and reports. Only management study on user interfaces, not cover the area of programming, the design will be only the forms and reports.

1. Data Entry (Forms)

- Customer Details
- Suppliers Details
- Product Details
- Employee Details
- Salesman Details
- Production Details
- Purchased Order
- Sales Order
- Purchase Requisition
- Enquiry

2. Report Printing

- Product Description Report
- Salesman Description Report
- Employee Description Report
- Supplier Description Report

- Customer Description Report
- Stock Reports (Raw Materials & Finished Goods)
- Sales Order (Printing)
- Sales Report (Products)
- Sales Report (Customers)
- Sales Report (Sales man)
- Sales report (Summary)
- Purchase Order (Printing)
- Purchase Report (Products)
- Purchase Report (Customers)
- Production Report (weight)
- Production Report (machine)
- Production Report (timing)
- Production Report (summary)
- Employee Report

Data Entry (Forms)

- Customer Details
- Suppliers Details
- Product Details
- Employee Details
- Salesman Details
- Production Details
- Purchased Order
- Sales Order
- Purchase Requisition
- Enquiry



Customer Details Form

Customer Details

Customer No.	<input type="text"/>	Contact Person	<input type="text"/>
Customer Name	<input type="text"/>	Credit Term	<input type="text"/>
Address	<input type="text"/>	Credit Limit	<input type="text"/>
Telephone	<input type="text"/>		
Fax	<input type="text"/>		
E-Mail	<input type="text"/>		
Delivery Place	<input type="text"/>		

OK

Cancel

Supplier Details Form

Supplier Details

Supplier No.	<input type="text"/>	Contact Person	<input type="text"/>
Supplier Name	<input type="text"/>	Credit Term	<input type="text"/>
Address	<input type="text"/>		
Telephone	<input type="text"/>		
Fax	<input type="text"/>		
E-Mail	<input type="text"/>		

OK

Cancel

Product Details Form

Product Details

Product No.

Product Description

Cost

Selling Price

Unit

Employee Details Form

Employee Details

Employee No.

Employee Name

Position

Address

Telephone

E-Mail

Salesman Details Form

Salesman Details

Salesman No.

Salesman Name

Address

Telephone

E-Mail

Enquiry Details Form

Enquiry Details

Enquiry No.	
Enquiry Date	
Product Code	
Cost	
Supplier Name	
Credit Term	
Special Specification	
Remark	

OK

Cancel

ASSUMPTION UNIVERSITY OF THAILAND

SINCE 1969

มหาวิทยาลัยอัสสัมชัญ

Data Entry Form

Data Entry

Date: _____

Fac. No.: _____

Lot. No.: _____

OK Cancel

Input	Product Description	Quantity	Cost	Store
RW-PP00-01	Product Description	1,200.00	12	AW1
RW-PP01-01	Product Description	4,000.00	8	AW1
RW-G001-01	Product Description	25.5	87	AW1

No.	Product Stage	Input		Output		% Loss	Employee	Waste
		Weight (kgs)	Timing	Weight (kgs)	Timing			
1	Soring							
2	Grinding 1							
3	Grinding 2							
4	Mixing							
5	Melting							
6	Cutting							
7	Packing							

Report Printing

- Product Description Report
- Salesman Description Report
- Employee Description Report
- Supplier Description Report
- Customer Description Report
- Stock Reports (Raw Materials & Finished Goods)
- Sales Order (Printing)
- Sales Report (Products)
- Sales Report (Customers)
- Sales Report (Sales man)
- Sales report (Summary)
- Purchase Order (Printing)
- Purchase Report (Products)
- Purchase Report (Customers)
- Production Report (weight)
- Production Report (machine)
- Production Report (timing)
- Production Report (summary)
- Employee Report

Report Product Description Report

Product Description Report

No	Pro Code	Product Description	Remark

The watermark is a circular seal for Assumption University of Thailand. It features a central shield with a cross and other symbols, surrounded by a wreath. The text 'ASSUMPTION UNIVERSITY OF THAILAND' is written in a circle around the shield. Below the shield, it says 'BROTHERS OF ST. GABRIEL' and 'OMNIA VINCIT'. At the bottom, it says 'SINCE 1969' and 'มหาวิทยาลัยอัสสัมชัญ' in Thai script, flanked by two stars.

Report Salesman Description Report

Salesman Description Report

No	Salesman Code	Salesman Name	Remark

Report Employee Description Report

Employee Report

No	Em Code	Employee Name	Remark



Report Supplier Description Report

Supplier Description Report

[illegible]

Report Customer Description Report

Customer Description Report

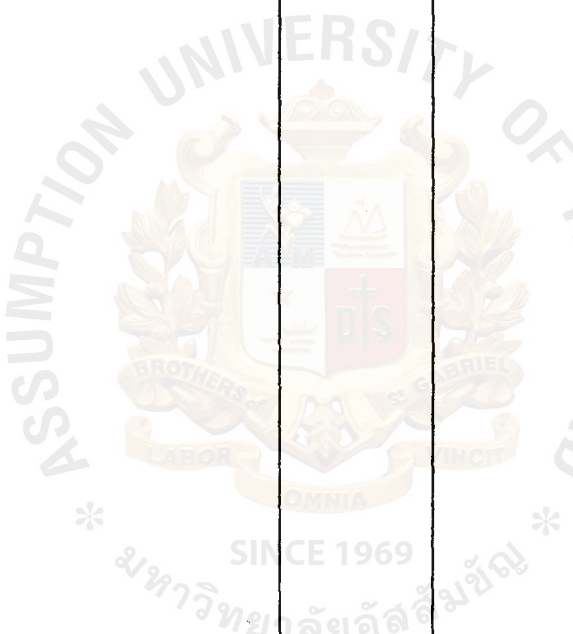
No.	Code No	Customer Name	Address	Telephone	Fax	Cr Term	Contact Person	Remark
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Report

Stock Balance

Date _____

Store No

Pro. Code	Description	Quantity	Price	Total
 <p>ASSUMPTION UNIVERSITY OF THAILAND</p> <p>* มหาวิทยาลัยอัสสัมชัญ *</p> <p>SINCE 1969</p>				
Total				

Sales Order

Customer Name**Address****Telephone****Delivery Place**

SO No

Date

Sales Man

Delivery Date

Credit Terms

[illegible]

Report

Sales Report

By Customer

Cus No.

Customer Name

Timing

[illegible]


Report

Sales Report

By Product

PRO
No.

Timing

Date	SO No.	Invoice No.	Customer Name	Quantity	Price	Total
						
<div>Total</div>						

Report

Sales Report

By Salesman

Saleman No

Salesman Name

Timing

Date	SO No.	Invoice No.	Amount
		 <p>ASSUMPTION UNIVERSITY OF THAILAND</p> <p>* มหาวิทยาลัยอัสสัมชัญ *</p> <p>SINCE 1969</p>	
Total			

Report

Sales Report

Summary

No.	Date	Invoice No.	Amount
		 <p>ASSUMPTION UNIVERSITY OF THAILAND</p> <p>* มหาวิทยาลัยอัสสัมชัญ *</p> <p>SINCE 1969</p>	
		Total	

Form 1 Purchased Order

Purchased Order

Supplier Name
Address

PO No

Date _____

Contact Person

Telephone

Delivery Place

Delivery Date

Credit Terms

[illegible]

Report

Purchase Reports

No	Date	PO No.	Products	Supplier	Quantity	Price	Total

Form2

Report

Production Report

By Weight

Date

Fac No

Lot No

Details	Sorting	Grinding 1	Grinding 2	Mixing	Melting	Cutting	Packing
Input							
%Loss							
Expected							
Actual							
Efficiency							
Employee							
Scrap							

Form3

Report

Production Report

By Production Time

Date

Fac No

Lot No

Details	Sorting	Grinding 1	Grinding 2	Mixing	Melting	Cutting	Packing
Input							
%Loss							
Expected							
Actual							
Efficiency							
Employee							
Scrap							

Report

Employee Report

Em.No	1	2	3	4	5	6	7	8	9	10	11	12
Sorting												
Grinding1												
Grinding2												
Mixing												
Melting												
Cutting												
Packing												
Total												

Em.No	13	14	15	16	17	18	19	20	21	22	23	24
Sorting												
Grinding1												
Grinding2												
Mixing												
Melting												
Cutting												
Packing												
Total												

Date _____
Fac No. _____

85

Form 4 Report

Production Report

Summary

Date _____

Fac No.

[illegible]

Hardware and Software requirement

The proposed system requires the hardware and software specification as follows:

Hardware Requirement

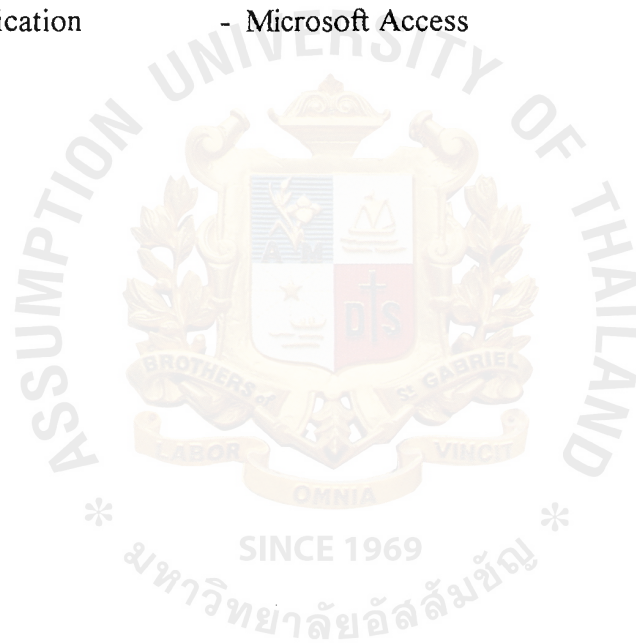
Server	<ul style="list-style-type: none">- Pentium IV 1 G.- 256 SD RAM- Hard disk 40 G.- Main board for Pentium IV support- VGA , Sound Built In- 2 P/S 2 Ports, 2 USB Ports- Keyboard P/S 2- Mouse P/S 2- 14" Monitor	1 Unit
Clients	<ul style="list-style-type: none">- Pentium IV 1 G.-128 SD RAM- Hard disk 20 G.- Mainboard for Pentium IV support- VGA , Sound Built In- 2 P/S 2 Ports, 2 USB Ports- Keyboard P/S 2- Mouse P/S 2- 15" Monitor	3 Units

- UPS	1 Unit
- Printer Laser HP 1200	1 Unit
- Printer Dot Epson 580	1 Unit
- LAN Card	4 Units
- Switch	1 Unit

Software

Operating System - Microsoft Window 98

Application - Microsoft Access



After implement the company expect

Current problems	Manual System	Computerized System
Redundant jobs for record keeping	Many redundancy data entries are done for the order details starting from the buyer's log book, generating order to supplier, follow-up and reporting to collect all the transaction occurred with a lot of time spending.	Data will be entered only once for the one procurement, the users can easily retrieve the needed information from the system with no need to reenter that data again.
Difficulties in information retrieval	All of the redundant records lead to the problem of inconsistency information. Management cannot retrieve all the relevant information they want in time.	With the database management system of a new one, the specified problems can be solve easily. The system also provided the review screen and the efficient report for user to use in their jobs.
Unnecessary workload for follow-up the other	Because the buyer has to do the follow-up the purchase order that is sent to the supplier, some orders are lost or no response is received from suppliers.	The buyer can easily trace the purchase order status with the provided review screen and report since the information is always up to date.
Dependence on the hard copy file	Too many personal data base were created as mentioned earlier leading to the inconsistency of updated information. Therefore, users need to depend on the hardcopy, which is uniquely created and cannot be shared among the groups of	With centralized database, data were kept in one place. Every department can utilize and share the purchase order and inventory information together. The need for hard copy will be reduced.

	buyers and users. It also caused the excessive copies.	
Inconsistency format of information	As all the record details are kept depending on the record owner's purpose, the formats of data being kept are different forms. It affects the loss and missing in inconsistency of information.	The database system of the proposed system can solve this problem. The data are kept in restricted format. The database recovery is also provided in case of data loss or data corruption.
Lack of control in problem solving or processing performance	There no measurement to control for the staff that use the trigger all the processed performed. Each person performs all the processes by their experiences and styles. The system also depends on the expertise of all the existing staffs.	The proposed system was created based on the simplicity and minimizes the redundant work, all the screens are user friendly. The interface is very simple. The needed information can be analyzed by the report that is created based on the user requirements, or if there are some further requirements, the report can be easily created.
Limited security handling	There is no security control for the information that is very important for the company, e.g. the cost of raw material, the selling price of the finished goods. Without the security handling, the information may get lost or even modified by mistake for any purpose.	The new system will provide the security by the use of password at two levels, first at the login on LAN system, and second step on authorized access to use of the specific screen or report.

<p>Oversupply and shortage of inventory value</p>	<p>When the inventory status is not reliable, it will effect to the purchasing and production department. The company has to pay more for inventory while the production still faces the problem insufficient raw material.</p>	<p>With up to date information, this problem can be solved. The user will rely on the system information. Excessive request will be reduced and shortage of raw materials will be reduced.</p>
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Costing-Comparison

The cost occurred in the existing system can be clarified mainly by 2 items, the first one is for the fixed cost for running the operation and the other is variable operation cost that depends on the transactions occurring yearly.

- Fixed cost of the existing system operation is salary paid for the staff required in the operating the system.

Salary Expense	@ 9,500* 4	456,000	baht
----------------	------------	---------	------

- Variable operation cost

- Paper Use

This expense refers to total paper use for duplicating the documents.

Average paper use for each copy of the paper is at least 3 copies, for accounting, for management, for workstation, for person concerns outside the company. This meant many pieces of paper needed for each transaction. The estimated total transaction issues as yearly may be over 15,500 transactions. Estimated expense for paper use is 12,800 baht.

(Calculated the cost of paper @ 115 baht per ream)

- Storing cost

This is the expense for files and shelves that occurs as the storing all the used paper record which increases as the day passes. Yearly policy is the reason why they have to keep all the paper record for searching (when necessary). The estimated cost of handling and storing these files is 12,000 baht.

- Xerox expense

Estimated cost for per copy is 1 baht per page, the estimated transactions for one year effect the copy cost is 46,800 baht.

The cost of the proposed system

- Implementation costs
 - This is the main expense that will occur only once when the new system is implemented. Generally, the implementation cost will include the computer hardware and software investment cost but in this case, the proposed system is developed under the condition of using only the existing computer resources available. Somehow, the additional investment for computer hardware or software is the cost besides one client set and dot printer.

Three PC Sets with monitors	80,000 baht
Printer laser	18,000 baht
UPS	5,500 baht
LAN Card	8,000 baht
Switch	5,000 baht
Microsoft License	10,000 baht
Software Application	35,000 baht
Installation and Training Cost	15,000 baht
Total	166,500 baht

- Operation costs of the computerized system

Operation cost for the proposed system contains the three main categories of expenses the same as in the existing system with which are computer fee, salary of the staff and variable operation cost. Somehow, the difference between these two costs gains from the benefits of the new system can be clarified by the reduced number of clerk from four persons to only two;

Salary for staff @ 9,500 *2	228,000	baht
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Variable operation cost

When the computerized database is implemented, every staff related to the system no longer needs to make his/her own reference information as they can retrieve it in the real time system. The cost of duplication the purchase order and file storing are totally reduced as well as the cost of total paper consumption for reproducing the copy. The estimation for those reductions can be shown as follows:

- Paper Use

After implementation, all information would be shared by the system, the using of paper is expected to reduce only one copy. So the estimated cost of paper is 4,300 baht. It reduced by 8,500 baht or 60% off from the normal consumption.

- Storing Cost

The handling cost for these papers also reduces as the number of paper reduced to 5,500 baht.

- Maintenance Cost

The incurred cost is the maintenance cost that will be run along the system running. Normally it will be based on only yearly expense which is approximately 12,000 baht.

The Cost – Comparing

Before Implement	Yearly expense	527,600	baht
Computerized Implement	Installation Cost	166,500	baht
	Operation Expense	249,800	baht

Tangible Benefit

The calculation from the estimated cost and current expense as yearly base, the TPR has to pay 416,300 baht for implementing new system, while the current on the operating expense is 527,600 baht.

As the first year, the company will save 113,300 baht. But for the second and third the company will save more due to no more fixed cost on the new computer and installation. The second year the company will save more 277,800 baht as a total.

Intangible Benefit

- Reduce losses from error of input key in.
- Provide effective work in sales for sales person, sales history classified by customers or products.
- Faster for retrieving information, e.g. stock status.

- Reduce losses from wrong calculation on stock value, cost and price to customers.
- Integrate all business application together to increase the efficiency of work and the accuracy of information for all management levers.



Chapter VII: Comparing benefit between the existing system and the computerized system

Comparing the existing and the proposed inventory

On the existing function of Inventory department, there is less coordination with other related departments such as the Production Department and Sale & Marketing. They don't know exactly the replaced order from the customers. What are the required equipments to use in the process? They are still having no significant classification in the inventory system of the company. Let all the process is as on demand system which leads to the delay in the production process finally.

For the inventory system, there are increasing in coordination between the inventory, purchasing and technician to eliminate some redundant process. Use some price agreement and enquiry to record terms and conditions in some items to reduce the multiple steps to get the confirmation from the suppliers.

Table2: Benefit comparing between the existing manual system and the computerized proposed system.

Procurement and Functions	Existing System as Manual and Hardcopy Record	Computerized Proposed system for Plastic Recycling companies	Benefits
Decision Making	The owners control the procurement by themselves and spend a lot of time to predict what raw materials are needed due to their sales	The owners use information system to predict their sales volumes and predict what raw materials should be the replenishment at the	Reduce time and costs by knowing what raw materials should order or not order in order to save their costs to invest in their inventory.

	volumes is not update information and they have to hedge some stocks due to fluctuating order for each month.	right time	
Procurement	Have to do each procurement by using hardcopy with many files.	User keys in the necessary information at once per procurement.	Reduce error and create more accuracy to all details of information, for all stock, sales and production.
Warehouse system	Check by manuals and send all finished products to the warehouse system	Send all finished products to the warehouse system by computerized system	Reduce time and manpower to double check the products again
Inventory System	Check by manuals Actual inventory has not matched with the inventory on account, effect to the production planning missing. The missing value cannot check where the problems are.	On the system design, the key information would be as the measurement to check and see where the problems are, for example; the efficiency of the machine, man or raw material quality.	More standardized of scheduling More efficiency between warehouse and production department
Sales System	Use manual to record all sales transaction, send S/O, issue invoice. Provide report as paper. Use manual to record all sales transaction classified by salesman.	All sales information would be done by computerized system, and also report. Use computerized to record the salesman in the related invoice, product, customer and amount.	Reduce error, more accuracy and faster speed for information retrieval. Reduce error and can use update information to apply the tactics for sales to increase the sales volume. Increase more sales volume to the company.

			Response market quickly.
Employee Quality Control	Control workers by manual check only before sending the goods to customers	Control and record the performance in each stage with the computerized system.	Easy to evaluate the employee performance as individually. Increase more efficiency for the quality of work.
Production System	No record emphasized on each process to check the waste and scrap rate. Underestimated loss occurred during the production stages. Cannot achieve the production schedule with the insufficient inventory in the warehouse.	Provide the record on waste and scrap, efficiency on the machine and manpower. Inventory can run along the production as the schedule.	Help the management get more tactics planning to customize the production strategies in order to create competitive advantage in the cost control.

Chapter VIII: Conclusion and Recommendations

Conclusion

The proposed system development project is a beginning point of the computerized system for the company. The system can be developed to eradicate the current problems and for the future requirements of users. The system development project is as the following; User specified the wish to have a computerized database system that supports the information related to the historical purchasing inventory control and also information related to the historical purchasing, inventory, production, sales and also the information sharing among the users.

After considering the study of the entire system, there are several problems in information retrieval for making procurement action plan and management decision making because the existing system is a manual system and all the information was not kept properly. The users have to spend too much time for record keeping and searching for all the records produced just to find only one or two needed records. The inventory stock is too high but some are not sufficient. This means that there is inefficient inventory control. Moreover, the company still wastes a lot of resources available in the system because of low level of the utilization. After surveying and collecting user requirement, the researcher has proposed a new system of the procurement by data flow diagrams, which show the process in each area of work. The system design for the new system has been developed. Data dictionary, process specification, screen layout and report layout are provided for the application developer.

Standardized data are results of investigating, analyzing and classifying the functional activities of the company in terms of their data needs. Standardized data can reduce the duplicating effort in data recording and inspire the greatest consciousness in maintaining the database.

The new computerized system is designed to provide suitable solutions and to response the user requirements and for more utilization of the system resources. It helps the staff to reduce the redundant work and routine workload tasks, leading to increased efficiency in process time.

Recommendations

The new proposed system will provide computer support for the immediate requirements of user that is declared as the transaction database. The designed system has already extended the requirement boundary to support more automated function over the legacy process such as interface among purchase orders, sales order, inventory stock or report classified by each needed details. This extension was created to serve more users operations. However, there is still some opportunity that the computerized system can be extended in these following areas.

- To study in the accounting area. Connection with the relevant users in each department to let them find out the information of a record they are interested in.
- Machine and maintenance record to focus on the production area. All spare parts and maintenance record could be in the study area more. The reservation for needed part, with this feature user will be ensured that they will get the reserved part to utilize in their plan. The system

will block that quantity to the requested users, the reserved part cannot be issued without the permission of the warehouse staff.

- Use EDI between the authorized buying agents to transfer the necessary information in the same pattern among all the suppliers.
- With the up to date and accurate information, the system will provide information for the managerial level. This will help them with the decision making process and forecast the purchasing and inventory control.

These expected extensions would determine whether they should be applicable to the new system in the future or not depending on the trend of procurement strategy and its investment cost.

Somehow, this new proposed system should take full account of the requirements specified by the procurement and the warehouse department. Hopefully, this system will lead to better company competitive advantages in seeking the continued improvement for along the chain of procurement in the plastic recycling business companies.

Appendix



Questionnaire

Part I: Questions

1. What are the problems in your organization? (Please select the most three important from 1-3 , 1 is the most important , 3 is the third important)
 - ☐ Dependence on the hard copy file
 - ☐ Redundant jobs for record keeping
 - ☐ Unnecessary workload to follow-up the other
 - ☐ Difficulties in information retrieval
 - ☐ Inconsistent format of information
 - ☐ Oversupply and shortage of inventory value
 - ☐ Limited security handling
 - ☐ Lack of control in problem solving or processing performance
 - ☐ Other _____ (Please specify)
2. Which solution do you think is the best ways to eliminate your problems in your organization?
 - ☐ Increase the number of admin staffs to decentralize the jobs
 - ☐ Increase the number of computers
 - ☐ Use computerized system to reduce the working steps
 - ☐ Set Evaluate team to check the performance
 - ☐ Rearrange the working process
 - ☐ Other _____ (Please specify)
3. How often have you faced the problems? (as you specify on No.1 Questions)
 - ☐ Less than 15 times / week
 - ☐ 16 - 25 times / week
 - ☐ 26 - 40 times / week
 - ☐ 40 - 50 times / week
 - ☐ More than 50 times / week
4. How many transactions do you have to do per week?
 - ☐ Lower than 150 transactions / week
 - ☐ 151 - 249 transactions / week
 - ☐ 250 – 299 transactions / week
 - ☐ 300 – 349 transactions / week
 - ☐ More than 350 transactions / week
5. How many copies do you need to generate for one transaction?
 - ☐ Two copies
 - ☐ Three copies
 - ☐ Four copies
 - ☐ Five copies
 - ☐ Six copies

6. Please check the information requirement on these following items that you needed;

Customer

- | | | |
|---|---|--------------------------------------|
| <input type="checkbox"/> Name Address | <input type="checkbox"/> Address | <input type="checkbox"/> Telephone |
| <input type="checkbox"/> Account No | <input type="checkbox"/> Delivery place | <input type="checkbox"/> Credit term |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Supplier

- | | | |
|---|---|--------------------------------------|
| <input type="checkbox"/> Name | <input type="checkbox"/> Address | <input type="checkbox"/> Telephone |
| <input type="checkbox"/> Account No | <input type="checkbox"/> Delivery place | <input type="checkbox"/> Credit term |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Product

- | | | |
|---|--|--|
| <input type="checkbox"/> Product code | <input type="checkbox"/> Product Description | <input type="checkbox"/> Stock on hand |
| <input type="checkbox"/> Status | <input type="checkbox"/> Price | <input type="checkbox"/> Cost |
| <input type="checkbox"/> Quality grade | | |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Employee

- | | | |
|---|----------------------------------|------------------------------------|
| <input type="checkbox"/> Name Employee | <input type="checkbox"/> Address | <input type="checkbox"/> Hire Date |
| <input type="checkbox"/> Salary | | |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Salesman

- | | | |
|---|----------------------------------|---------------------------------------|
| <input type="checkbox"/> Name Employee | <input type="checkbox"/> Address | <input type="checkbox"/> Sales record |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Sales order

- | | | |
|---|-----------------------------------|------------------------------------|
| <input type="checkbox"/> Sales order No | <input type="checkbox"/> Date | <input type="checkbox"/> Customers |
| <input type="checkbox"/> Product | <input type="checkbox"/> Quantity | <input type="checkbox"/> Price |
| <input type="checkbox"/> Discount | | |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

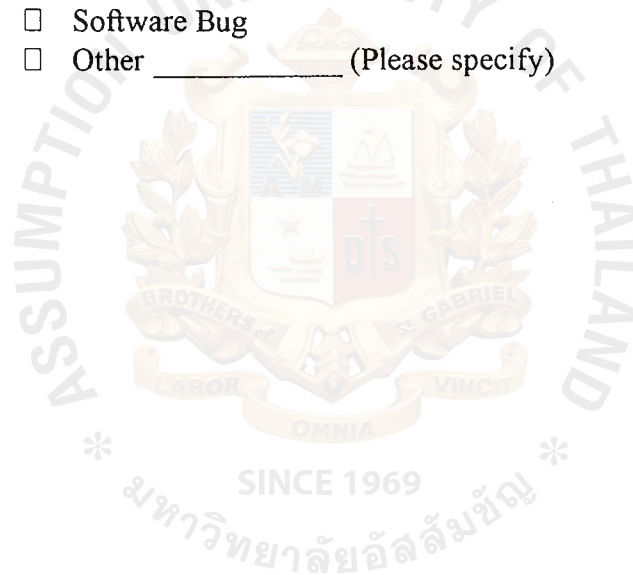
Purchase requisition

- | | | |
|---|-----------------------------------|---|
| <input type="checkbox"/> PR No | <input type="checkbox"/> Date | <input type="checkbox"/> Department Request |
| <input type="checkbox"/> Product | <input type="checkbox"/> Quantity | <input type="checkbox"/> Price |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

Purchase order

- | | | |
|---|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> PO No | <input type="checkbox"/> Date | <input type="checkbox"/> Supplier |
| <input type="checkbox"/> Product | <input type="checkbox"/> Quantity | <input type="checkbox"/> Price |
| <input type="checkbox"/> Other (_____ Please Specify) | | |

7. Do you think Information System is one of important thing to help you solve the problems?
- ☐ Yes
 - ☐ No (Please skip to personal Data)
8. What is the most important thing that you need in the information system.
- ☐ Friendly interface
 - ☐ Easy to retrieve or tracking information
 - ☐ Complete information
 - ☐ Up to Date information
 - ☐ Accurate information
9. What is/are the problem you expect to face after implementing the computerized system in the organization?
- ☐ System Down
 - ☐ Security Control
 - ☐ Practical Use
 - ☐ Software Bug
 - ☐ Other _____ (Please specify)



Part: 2 Personal data

1. Gender:

☐ Male ☐ Female

2. Age:

☐ Below 20 years. ☐ 20-25 years.
☐ 26-30 years. ☐ 31-35 years.
☐ 36-40 years. ☐ 41-45 years.
☐ 46-50 years. ☐ 51-55 years.
☐ 56-60 years. ☐ 60 years and over.

3. Status:

☐ Single ☐ Married

4. Position:

☐ Self-employed, own company.
☐ Executive/Managerial.
☐ Manager.
☐ Administrative Staffs.
☐ Other (Please specify) _____

5. Education level:

☐ M6
☐ Below Bachelor Degree. ☐ Bachelor Degree.
☐ Master Degree. ☐ Doctorate Degree.
☐ Other (Please specify _____)

