

# CHAPTER III

## THEORITICAL CONSIDERATIONS

The theoretical concept of quality cost were introduced since 1980s during the prospering of quality improvement era, purposing to achieve both efficiency and effectiveness of quality program because of higher sophistication level of business activity. Greater complexity business management, mistakes would be higher. Like other management tools, Quality cost is namely as a tool to response the growing of complexity quality management, since the cost is the best measures in any businesses. Their tools and techniques help to arouse and capture the organization development systematically.

At present, Quality Cost concepts are accepted extensively in worldwide, since the Organizational for International Standard has introduced the managing economics of quality standard, ISO 10014, in 1998 as a tool for implementing a quality system in a company. In this chapter, the quality cost principal including its tools and techniques such as cost management will be addressed though illustration and ideas from many gurus.

### 3.1 COST OF QUALITY CONCEPTS

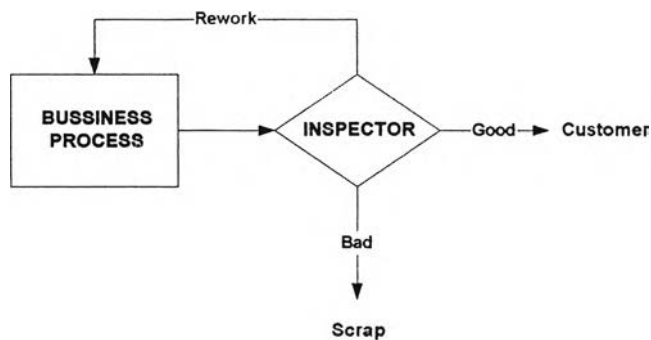
#### 3.1.1 The importance of Reliable Cost Information

In a program of quality management succeeds or fails depend upon the accuracy and immediacy of cost information. This cost information will be used to ensure reliable decision-making through company-wide management, so call CWQM, because any decision making of quality involves time, material, people and finances. These involvements have to balance against other competitors and demand.

Most small businesses automatically think that they don't have the money to implement a quality program. That's wrong ideas. Referring to many quality gurus, they believed a well plan for quality actually reduces costs and they also said that many companies don't understand what their return on quality investment. For example: If there are poor quality is costing them \$10,000 a month, they would be able to afford to spend \$10,000 to improve, because they save \$10,000 a month, which is 120,000 a year.

One important thing, the traditional concept of quality is just control as shown in Figure 3.1 and lacking of preventive or corrective activities. This results many companies founded that they invest a lot of waste money for quality. Consequently, Quality Cost Information is a management tools to monitor, planning and control quality cost of manufacturing, projects. Especially, the cost information can be used to:

- 1) Identify the hidden costs of customer dissatisfaction
- 2) Determine failure cost
- 3) Create quality benchmarking
- 4) Make accurate decisions
- 5) Evaluate management performance
- 6) Evaluate the effectiveness of corrective and preventive programs



**Figure 3.1:** Traditional concepts of quality

Source: Warwick Manufacturing group, Management for quality, 1999 page 3

One important thing, quality cost information helps to establish a quality improvement program.

### 3.1.2 Definitions

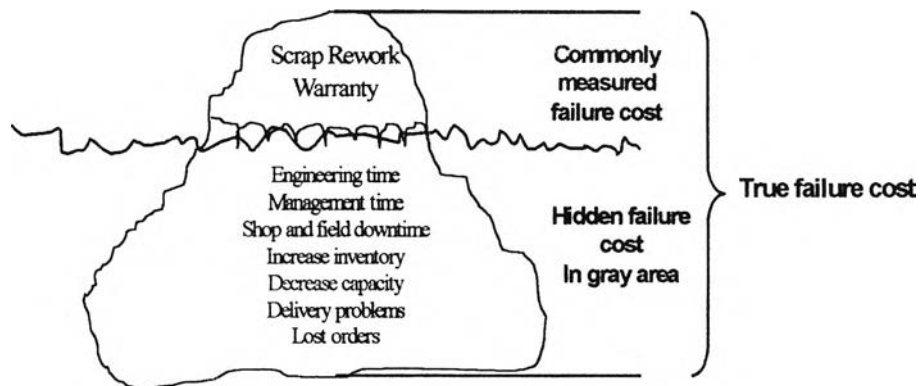
The meaning of quality cost can be discussed in several views from various gurus as shown in the following:

Dr. J. M. Juran, who is one of the earliest writing about quality cost, has discussed various definitions of quality cost in his book of Quality Control Handbook such as:

*“ Quality costs are a means of communication between the quality staff departments and the company managers, because the main language of those managers is money, while their staffs wants to sell their improvement activities. ”* And

*“ Quality costs mean cost of poor quality with mainly purpose that is finding and correcting defective works.”*

For Barrie G. Dale, Director of UMIST Quality Management Center in Manchester believed that the company has many gray areas or unsatisfied quality area as shown in Figure 3.2. This result, Quality cost is an indicator of a company's quality performance to reduce those areas.



**Figure 3.2:** Hidden costs of quality and the multiple effect

Source: ASQ Quality Costs Committee, Principles of Quality Costs, 1999 page 7

In addition, Crosby said in his book of “Quality is free” that quality cost is a systematically measurement of all expense of non-conformance, doing thing wrong. He also said that measurement is very important because people like to see results.

In short, quality cost is one of several tools and techniques, which can help companies to improve their product and service quality for efficiency and effectiveness in their business. Especially, huge poor quality and its improvement expenditure without any measure of the cost-effectiveness likes a blind activity. One important thing, these costs are starting ideas for improving quality, product development and etc.

By the way, there are many names of quality-related cost such as Quality cost, Quality Costing as well as Cost of Quality depending upon each guru idea, however those are the same and broadly used in many quality books.

### 3.1.3 Quality costs and TQM

#### 3.1.3.1 TQM Philosophy

In the past, the traditional quality techniques cannot solve the quality problems, because they correct the problems by more inspection, tightening up standards, repair and rework. These activities have only a responsibility of QC department, while the problem mostly occurs from other department such manufacturing. This result, the root cause of problem is not corrected completely. As a result, the consumers in business today environment have to seek a product or service, which has higher value on quality.

Besides, W. Edwards Deming, a pioneer of quality management in Japan said quality does not come from inspection but from improvement of the process, as a result quality management was designed to prevent the problems.

Total Quality Management was established in 1980s to achieve higher quality. TQM is a new management technique for improving quality at all level of organization and from supplier to customer and it focuses on prevention not detection of problems. TQM focus on employee involvement to enhancing competitiveness, effectiveness and flexibility of whole organization to serve whatever customer needs. It also help the management understanding through system thinking, which means understanding all the elements in the company and putting them to work together towards the company's goal.

Philip Crosby has said in his book of quality that the concept of total of quality management is "Do It Right First Time" and "Zero defects". He realized that most problems in the company came from internal mistakes. If we prevent people from mistakes and encourage everyone to improve continuously. Thus, It is TQM. He concluded that the concepts of TQM is composed of 4 sentences:

- 1) Quality is defined as conformance to requirements, not as 'Goodness' or Elegance'.
- 2) The system for causing poor quality is prevention, not appraisal.
- 3) The performance standard must be Zero Defects, not "That's close enough".
- 4) The measurement of quality is the cost of quality, not indices.

In addition, Ishikawa, who contributes the cause and effect diagram, has thought similar as Crosby. He though that TQM does not means the quality of product, but also after sales service, quality of management, the company itself and

the human life. The concept is called Company-Wide Quality Control, CWQC. He also has introduced several benefits of TQM are:

- 1) Both product and service quality is improved and uniformity.
- 2) Reliability of products or services is improved.
- 3) Cost is reduced.
- 4) Quantity of production is increased, and becomes possible to make accurate production planning.
- 5) Wastes, Rework and Repair are reduced.
- 6) New Techniques are founded and improved.
- 7) Expenses for inspection and testing are reduced.
- 8) The sales market is enlarged, market share increase.
- 9) Better relationships between departments as teamwork. And, Human relations are improved; as a result the morale of employees is increase.

In the same point of views, Juran has developed his ideas to TQM as called Quality Trilogy. He thought that Total Quality Management is composed of trilogy of quality: Quality planning, Improvement and Quality control, and these would support company-wide strategic quality planning.

### **3.1.3.2 TQM & Quality cost relationship**

Currently, many companies realized that Total Quality Management helps them to overcome and sustain competitive in markets, both international and local market. The TQM provides a philosophy of continuous improvement and zero defects, which help them to achieve customer satisfaction, the zenith goal of business. Once the company can satisfy their customer, its brand name will be recognized in their client's mind whenever they buy later products.

However, quality improvement requires patience, toughness and numerous commitments from every level in the organization. Traditionally, it was too difficult to cover 100% of improvements because of lacking of any performance measurements in the organization. Most companies usually improved only critical quality issues, which frequently occurred such as Rework, Penalty, Repair and Etc. They have been solved the problems based on their basic experiences, not lean on engineering background.

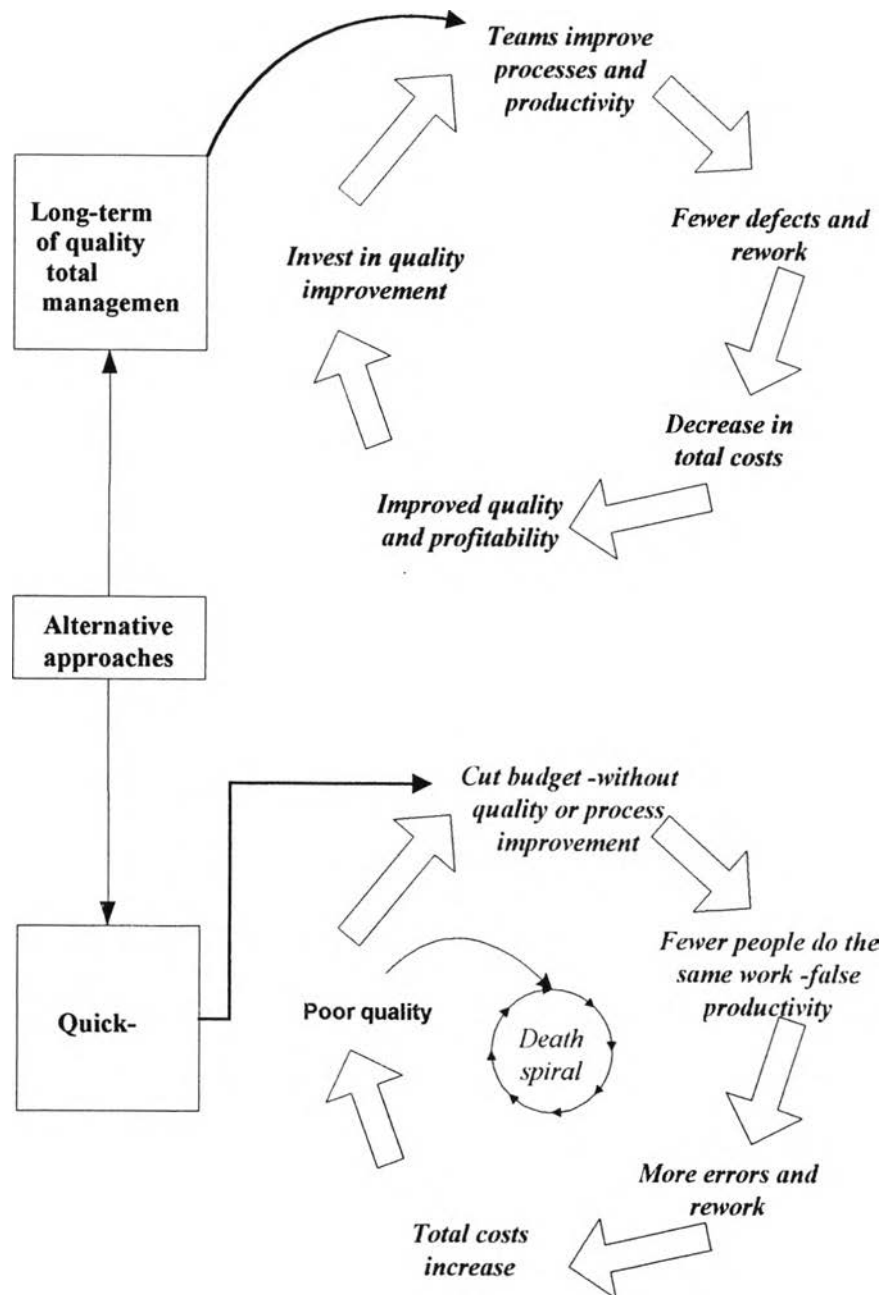
Consequently, the traditional companies founded that several quality problems were hardly to manage and the problems still happen again and again and leaving a sense of inefficiency management in the entire organization and especially

they are costly. By the way, Quality improvement may effects to higher cost instead of cost reduction.

Additionally, all costs are contributed in the factory in according with doing things wrong such as delay, high inventory, rework, repair and etc., as a result the company is far and away from gaining customer satisfaction. Some researchers said that some company founded this type of costs almost 50% of their profit.

This result, one of important TQM tools is Quality Costs, which established by Crosby around 1980s. Quality cost is useful tools for organize quality problems with effectiveness and efficiency. All kinds of problems can be detected and correct till to Zero with improving continuously.

Cost of quality is new alternative of modern improvement techniques though using the ideas of performance measurement on monetary basis. It is normally applied to find out improvement opportunities and control them to be conformity for long term, not similar to the past "Quick-fix" concept. The Figure 3.3 shows the cost of quality: long term improvement perspective.



**Figure 3.3:** Cost of quality: long term improvement perspective VS the previous techniques "Quick-Fix".

Source: The Pacific Bell Cost-of-Quality Handbook, 1992

### 3.1.4 Quality cost categories and its elements

Quality costs are divided into two broad categories; conformance and nonconformance costs.

#### 3.1.4.1 Conformance costs

They are established with attempting to meet to product specifications or trying to satisfy customer requirements, so called Price of conformance (POC). The conformance costs are further broken into two groups, Prevention costs and Appraisal costs.

**1) Prevention costs** are the costs of proactive activities that are accomplished before or during processing or delivery. It is associated all activities, which are incurred to prevent poor quality from occurring. The costs are associated with quality planning, quality managing, quality training and etc.

**2) Appraisal costs** are the costs incurred to measure quality levels and to determine a degree of conformance comparing with standards and performance requirement. These are the costs involved with measuring, evaluating, inspecting and testing products and etc. These costs are such as incoming inspection costs, in-process and final inspection costs, calibration costs and etc.

#### 3.1.4.2 Nonconformance costs

It results from the product not being able to comply the specifications or satisfy customer requirements, so called Price Of Nonconformance (PONC). These costs usually result directly from product discontinuity, defects and from not following to a procedure. The costs can be further broken down into two categories, Internal failure costs and external failure costs.

**1) Internal failure costs** are the costs that are resulting from correcting the products or services that do not conform to standards or specification prior shipping to customer. These are the costs concern with the cost of rework, scrap, machine downtime, and product re-testing. This cost occur prior to delivery to customers. For examples: Scrap costs, rework costs, re-inspection costs and downgrading costs.

**2) External failure costs** are associated corrective action when the products or service do not conform the standards or specification after delivery to customer. These are the costs associated with warranty claim, product liability and etc, resulting from poor quality. These costs happen after shipping the product or



service to customers. Examples include the costs of warranty claims and product recalls.

### **3.1.5 Quality cost benefits**

#### **3.1.5.1 Improve communication in the organization**

Helps to quantify problem in language that will have impact on upper management, since the language of money is to improve communication between top management, middle management and operation level. The communication is an important factor to a continuous improvement project.

#### **3.1.5.2 Opportunities of cost reduction**

According to, costs of poor quality effect directly to the cost of products and company's profits. The quality costs helps to find out the high cost area for reducing them until to Zero, a TQM concept.

#### **3.1.5.3 Increase customer satisfaction level**

In order to gain higher customer satisfaction level, the company have to deal with all poor quality related costs, which effects to customer loyalty and product reliability such as warranty claims and product recalls because of lower cost of poor quality, higher customer satisfaction.

#### **3.1.5.4 Improve budgetary and cost control in the organization**

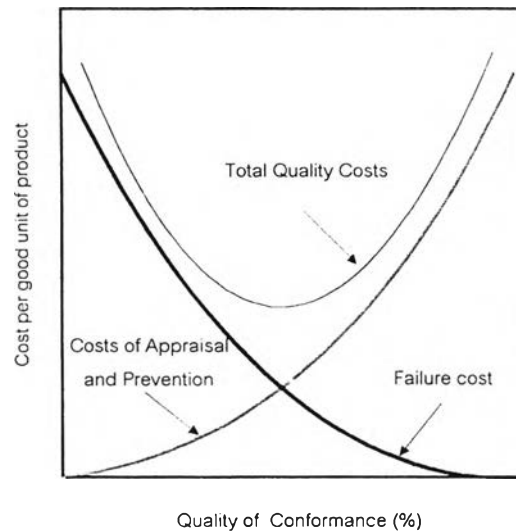
Most company controls their budget through organizational structure, which define the budget depended upon their experiences, not accuracy. Especially, they did not have any plans for the quality improvement. As a result, the actual usage and budget is too different significantly.

#### **3.1.5.5 Helps to achieve an Economics of quality: PAF model (Prevention, Appraisal and Failure model)**

A Quality cost model will helps to find out the optimum investment for reducing poor quality performance, consequently the quality is not costly anymore. The quality cost model is illustrated in Figure 3.4.

#### **3.1.5.6 Helps to set up a clear strategy about quality and cost**

Considering that Quality cost information, the company can set an effective strategy to cope with their weakness of quality and costs to overcome their competitors. They can manage both quality strategy and cost leadership strategy at the same time.



**Figure 3.4:** Cost of quality model

Source: Jack Campanella, Principles of quality costs, page 10

In Figure 3.4, the relationship between conformance (Prevention and Appraisal) and nonconformance (Internal failure and external failure) costs can be applied to a quality costs curves, which are theoretical concepts for exploring the quality situations. The horizontal axis indicates the distribution of nonconformance and conformance costs spending to make an improvement. If products and services are 100% conforming to zero failure costs, prevention and appraisal are very high. Similarly, if the products or service are 100% nonconforming, prevention and appraisal costs are very low, while nonconformance costs would be higher. By theory, the minimum point of total quality cost is the lowest point of the total cost curve.

In addition, the shape of the quality cost curve extremely depends on the particular industry or product. For example: electrical power plant, prevention and appraisal normally higher than other industry.

### 3.1.6 Use of quality costs: Implementation process

The establishment of quality cost process is broadly composed of 3 procedures: Collection, Reporting and Analysis. The following shows how each step working in the organization.

#### 3.1.6.1 Quality Cost Collection, Reporting and Analysis

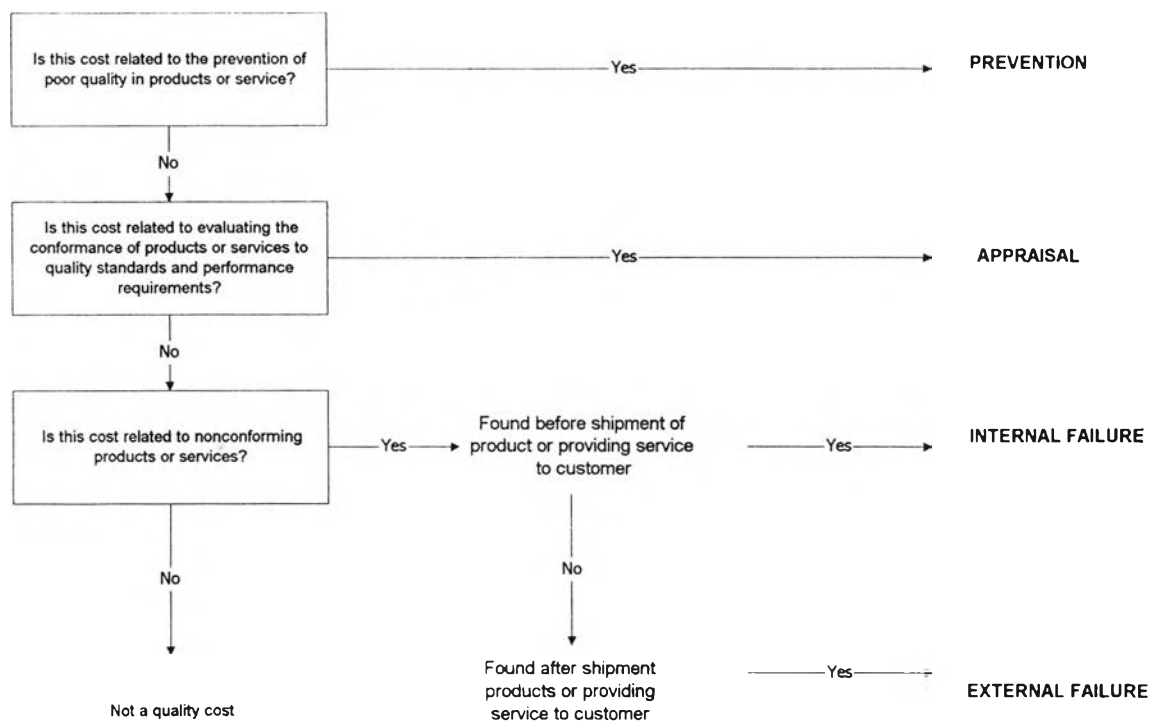
Cost collection is an important step to establish quality cost system, since the information will show preliminary the major problems, which involve in the organization.

Cost collection process compose of 5 steps:

- 1) List of cost elements
- 2) Identify potential elements of cost, which will be collected, from the prior list. The identification is mostly depended upon company's experiences and accounting information. The methods of quantifying quality costs are for example:
  1. Collection from account
  2. Collection from whole person
  3. Labor responses
  4. Surveys
- 3) Brainstorming to make a final decision of those elements and to identify which department, which concerns the collecting of each cost element.
- 4) Set up cost collection procedures and their categories as shown in Figure 3.5.
- 5) Collect the quality cost information and identify Price of Conformance (POC) and Price of Nonconformance (PONC) for each department.

In term of reporting, quality cost data can be reported into several styles as following.

- 1) By product, process, component or defect types: This type of report is easily to provide a parato analysis. The example of this report is shown in APPENDIX I.
- 2) By organizational unit: Reporting by organizational such department, the performance of each department will be shown as a benchmarking process. This result, the highest performance department would be the operating standard for the organization. In addition, this type of report can be applied to evaluate suppliers as well.
- 3) By categories of cost of poor quality: this report is useful for study quality cost relationships between POC and PONC to find out an optimum total quality as shown in Figure 3.4.
- 4) By time: The cost information will be provided information on trends.



**Figure 3.5:** Assignment of cost element to quality cost categories

Source: Jack Campanela, Principles of quality costs, page 51

## 3.2 ACTIVITY-BASED COSTING

### 3.2.1 Introduction

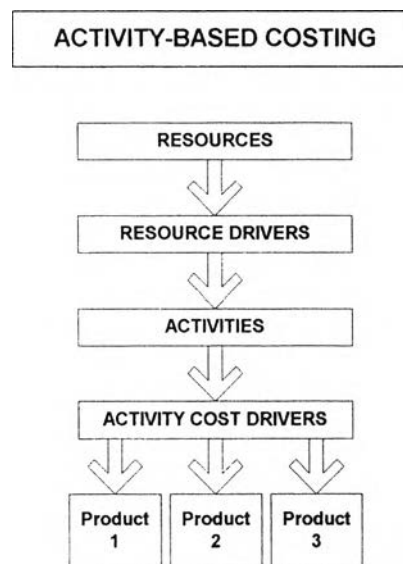
In executive views, both financial and cost data are crucial information for operation learning and control system, helping to provide economic feedback on process efficiencies. However, traditionally the financial information was not provided accurately in the accounting paper, so some cost was ignored and then it was hidden. Consequently, Activity-Based Cost (ABC) systems was developed to address deficiencies in financial systems, which were designed to meet higher level of balance sheet and income statement accounts such as cost of good sold.

In addition, ABC are purposed to allows managers to assess product, customer, and business unit profitability by assigning costs based on usage of company-wide resources. Cost of resources used based on standard activity cost driver rates and practical capacity of organizational resources that is difference between the cost of unused capacity and expenditure variation in short term. The variation of all costs is not central but these cost variable through activity-based

management, as a result it make an easy to find out the profitability of different product line and tracking the overhead cost as well as hidden loss during the processes.

### 3.2.1.1 Activity-Based costing Model

The model traces the costs from resources such as peoples, machines to each activity and then from activities to specific products and services. The model is shown below.



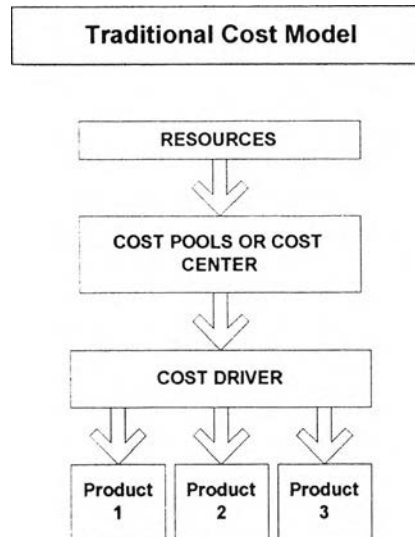
**Figure 3.6:** Activity-Based Costing Model

Source: Robin Copper, The promise and peril of integrated cost system, page 109

Comparing to the traditional cost model, the overhead cost or resource costs was assigned to plant or departmental cost pools, so called cost centers and then to production outputs based on volume-based or unit-level cost drivers such as:

- 1) Direct labor
- 2) Machine-hours
- 3) Direct material costs
- 4) Output units

However, the cost may inaccurate measures of cost to individual product because each product may have different process and used different materials. Consequently, they have to separate each product by using activity base.



**Figure 3.7:** Traditional cost Model

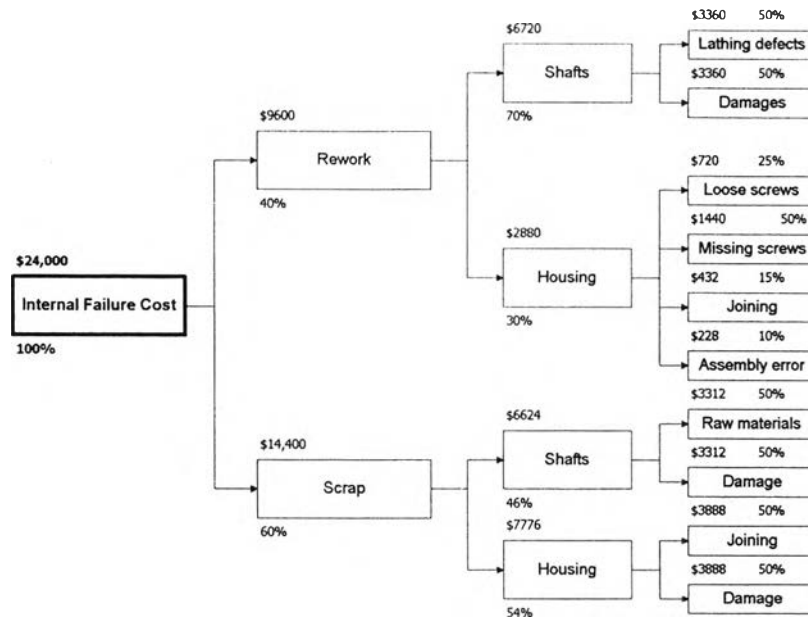
Source: Blocher, Cost management a strategic emphasis, page 96

### 3.2.1.2 Quality Cost and Activity-Based Costing

According to the aim of ABC is to improve overall cost effectiveness through focusing on key cost element, which has an influent to quality of products. ABC is a methodology to identify and collect quality information within the company with a financial accounting system.

The using of ABC concept makes it easier to find and assign the quality cost in each gray area, as mentioned earlier. ABC also helps to allocate the cost of indirect and overhead expenses, which is mostly the cost of a company's resources) in an accordance with the use of resource by activity.

In theory, the company is able to assign a quality cost to a root cause of a quality problem. Solving a problem, it proves extremely valuable and make up higher profit. In addition, it can calculate the return on investment and the pay back period for investing to fix a root cause. The Figure 3.8 shows the internal failure cost breakdown of shafts and housings.



**Figure 3.8:** Internal failure costs breakdown – Shafts and housing

Source: Jack Campanela, Principles of quality costs, page 67

Using ABC to identify Quality Costs, there are five steps recommended by D.W. Webster for find out costs of poor quality.

- 1) Identify all activities, which concerns all quality costs: Appraisal, Prevention and results: Internal and External failure.
- 2) Determine the costs, which associate with prevention and appraisal activities and with internal and external failure.
- 3) Identify the activities, which gain from prevention and appraisal tasks and reducing the internal and external failures.
- 4) Contribute the cost of prevention and appraisal to the activities that gain from prevention and appraisal. And, assign the costs of internal and external failures to the activities, which causes of failures.
- 5) Calculate the optimum point of quality costs.