CHAPTER II

LITERATURE REVIEW

This chapter represents an overview of the literature being pertinent to quality engineering and evaluation methods for quality management systems and practices.

Taylor, the father of scientific management, laid foundations for setting work standards, job allocation, training and proper incentives for good works. He believed that workers should concentrate on their tasks solely. Such belief sometimes led to the separation of planning and management from work.

Shewhart, a statistician, was employed by Bell Laboratory during the 1920s. His book named "The Economic Control of Quality of Manufactured Products" was aimed to improve the quality of manufactured goods. He also developed statistical process control (SPC) which took into account quality when controlling the process.

Dodge and Roming developed sampling plans for accepting or rejecting a production lot in 1943. The more rigid a customer's acceptance sampling plan is, the more indirect impact a supplier receives to improve quality.

Deming went to Japan in 1950 and introduced Statistic Quality Control (SQC), which was well implemented in USA. He believed that the use of SQC could result in the statistical understanding of a system that allowed an accurate diagnosis and solution of problems. Statistical techniques such as control charts and sampling inspection methods were introduced by him. Also, he lectured on the principles of quality control including Deming cycle. [Nam, 1995]

Juran defined quality as "fitness for the use" and quality control as "entire collection of activities through which we achieve fitness for use; in other words, carry out the company's quality function." He left for Japan in 1954 and assisted Japanese leaders in industry restruction for exporting such products that could compete in the world markets. Also, he helped the Japanese to adapt quality concept tools into a series of concepts that provided the basis for the overall "management process." He stated three fundamental managerial processes including planning, control and improvement for quality management. He advocated the "project team" approach since his belief was that such approach could cause an attention focus on the quality improvement. [Nam, 1995]

Crosby whose the best-seller was "Quality is Free" in 1979 started his occupation in manufacturing in 1952 at Croley Corp. in Indiana. He was so successful in reducing the manufacturing defects in the production by the use of the "Zero Defect" concept.

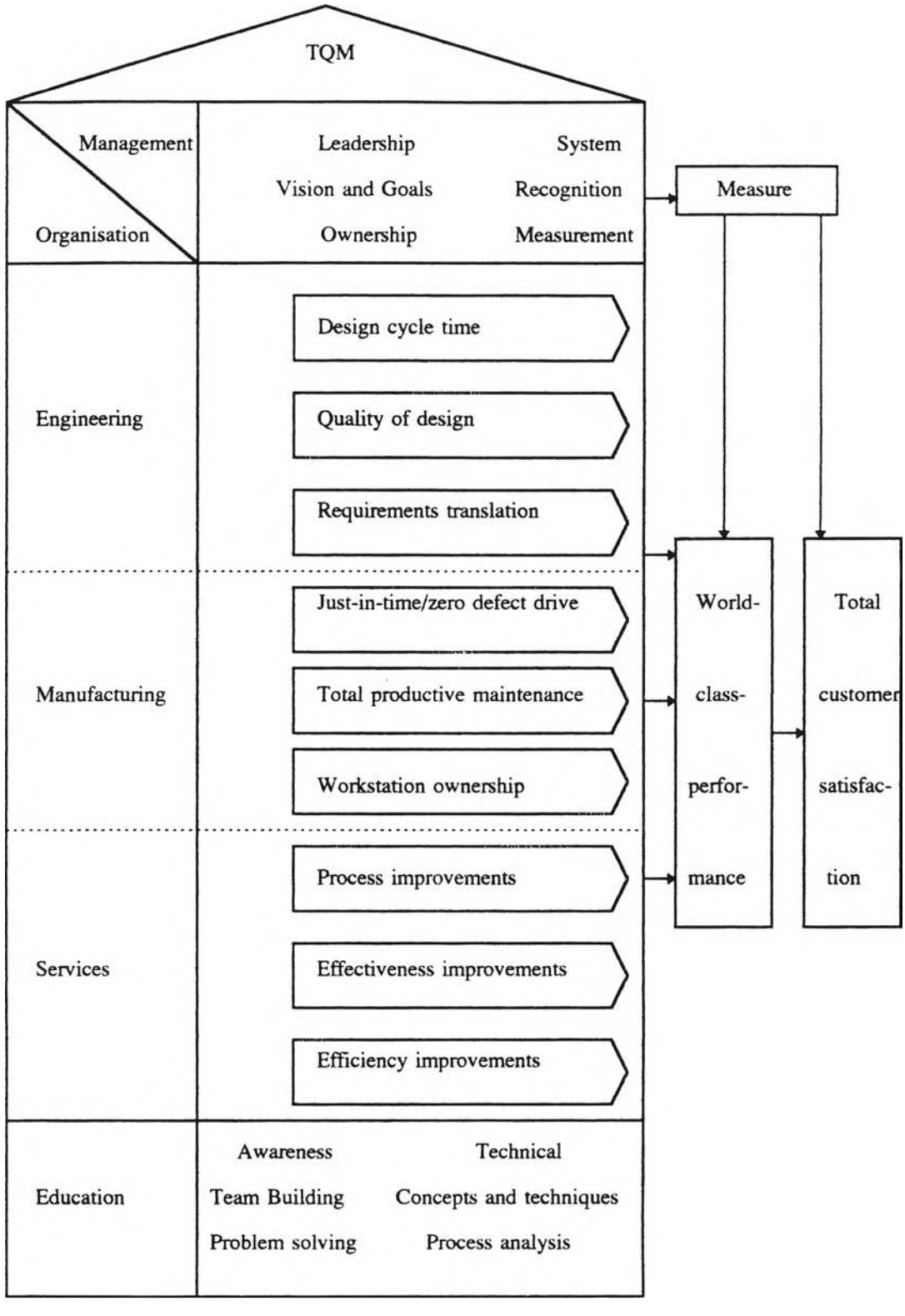
Feigenbaum, a former manager of the manufacturing operations and quality control for General Electric, has become so famous on developing an approach that the responsibility for quality extends well beyond the manufacturing. Currently being a quality consultant, he states that the achievement of quality in manufacturing cannot occur because of many reasons such as poor designs, inefficient distribution systems, incorrect marketing and inappropriate customer support services. His belief is, therefore, that everyone in the organisation must be totally committed to quality. This concept is world-widely known as total quality control (TQC) [Feigenbaum, 1960]. Moreover, Feigenbaum has developed another concept called the "cost of quality" which represents a means to quantify the benefits of adopting a total quality management (TQM) approach.

Ishikawa defines in 1960 "To practice quality is to develop, design, produce and service quality product which is the most economical, most useful, and always to satisfactory to the customers." He is one of the very first persons whose belief is that customer satisfaction is of most critical importance. However, timescales and financial objectives cannot be neglected as well.

TQM is a management philosophy that builds customer driven learning or organisations dedicated to total customer satisfaction with continuous improvement in the effectiveness and efficiency of the organisation and its process [Corrigan, 1994]. This definition describes TQM in a nonprescriptive way with a concentration on value-added activities directed at customer satisfaction in addition to the continuous improvement.

Like a house, TQM needs continual care and upkeep to remain viable. A "house of TQM," thus is the one in which each function continuously improves the efficiency and effectiveness of its process, depending on customers' needs and expectations. Figure 2.1 represents a typical house of TQM, of which foundation is education and roof is management. Each of key functions works to improve its process with the use of many different approaches in order to meet the goal of receiving world class performance. For instance, a design engineer improves a design and development process by considering design cycle time, design quality and so on. A manufacturing person improves his manufacturing process by using the just-in-time (JIT) and total productive maintenance (TPM) approach. Moreover, a service process is improved by a support service personnel through the process improvement. World-class performance is then generally recognised by customers. However, management must measure both of these two parameters (world-class performance and customer satisfaction) since they have been often changed with time.

Figure 2.1 House of TQM [Corrigan, 1994]



The Deming Prize was instituted in 1951 by the Union of Japanese Scientists and Engineers (JUSE) in order to recognise and appreciate W. Edward Deming's achievement in statistical quality control. It consisted of ten judgment criteria as follows:

1. Policy and objectives
2. Organisation and its operation
3. Education and its extension
4. Assembling and disseminating information
5. Analysis
6. Standardisation
7. Control
8. Quality assurance
9. Effects
10. Future plans

The Deming Prize is awarded to a company which meets a standard (based on scores received against each judgment criterion during the evaluation process). However, this does not mean the company that does not qualify becomes the loser of the contest. They can go on receiving a reevaluation process which is automatically extended (up to twice over three years). Such process will continue until the nonconforming issues are improved. [Bush and Dooly, 1989]

The Malcolm Baldrige National Quality Improvement Act was signed by President Ronald Reagan on August 20, 1987. The Act was a part of the national campaign to quality improvement of goods and services in the United States.

Named after the late secretary of commerce, the National Quality Award reflects the highest level of recognition for quality that an American company can receive. It has three purposes:

1. To promote awareness and understanding of the importance of quality improvement to United States' economy.

2. To recognise companies for outstanding quality management and achievement.

3. To share information on successful quality strategies.

This award program demonstrates a public-private partnership. An important part of such partnership is the willingness of the award winners to publicise their successful quality strategies. According to the award program, a "successful quality strategy" has three main features:

1. Integration with business strategy.

2. Active organisational leaning process tying together all corporate requirements and responsibilities--customers, employees, suppliers, and so on.

3. Multidimensional results contributing to an overall business improvement and competitiveness.

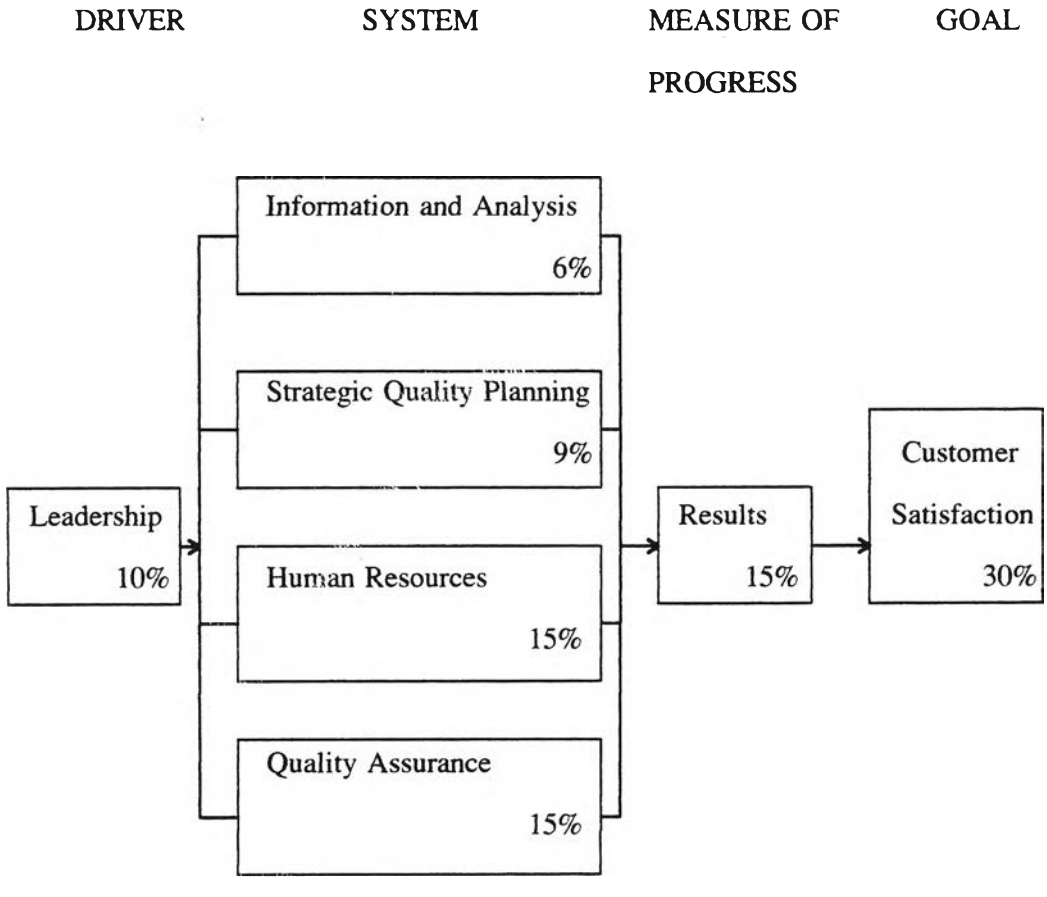
The Malcolm Baldrige Award comprises seven categories and their corresponding examination items. Such categories include:

1. Senior executive leadership
2. Information and analysis
3. Strategic Quality planning

4. Human resource development and management
5. Management of process quality
6. Quality and operational results
7. Customer focus and satisfaction

These seven categories belong to four basic elements including driver, system, measure of progress and goal as seen in Figure 2.2.

Figure 2.2 Relationship of National Quality Award Examination Categories 1990 [Decarlo and Sterett, 1990]



An applicant for the Baldrige Award is obliged to submit a report summarising its practices and results, corresponding to requirements in the examination items. Award applications are then reviewed in the four-stage process by a private sector, Volunteer Board of Examiners. Such process involves the following:

1. The first stage-multiple, independent, detailed review by at least 5 examiners.

2. The second stage-further refinement of top applications.

3. The third stage-top contenders being site visited (typically 2 to 5 days each) by a team of 6 to 8 examiners.

4. The fourth stage-final contenders receiving approximately a 500-hour review.

The ISO 9000 series of quality assurance standards was developed by the International Organisation for Standardisation in Geneva, Switzerland in 1987 [Steeples, 1994]. Its major purpose is to promote the development of standards and related activities which will facilitate an exchange of goods and services.

This series comprises five independent but interrelated standards: three address specific quality systems (ISO 9001, ISO 9002 and ISO 9003) and two address guidelines (ISO 9000 and ISO 9004). ISO 9000 is a road map for the use of the other four standards. ISO 9001 covers design, production, installation and testing. ISO 9002 covers production and installation. ISO 9003 covers final inspection and testing. And, ISO 9004 provides guidelines for development of a quality system.

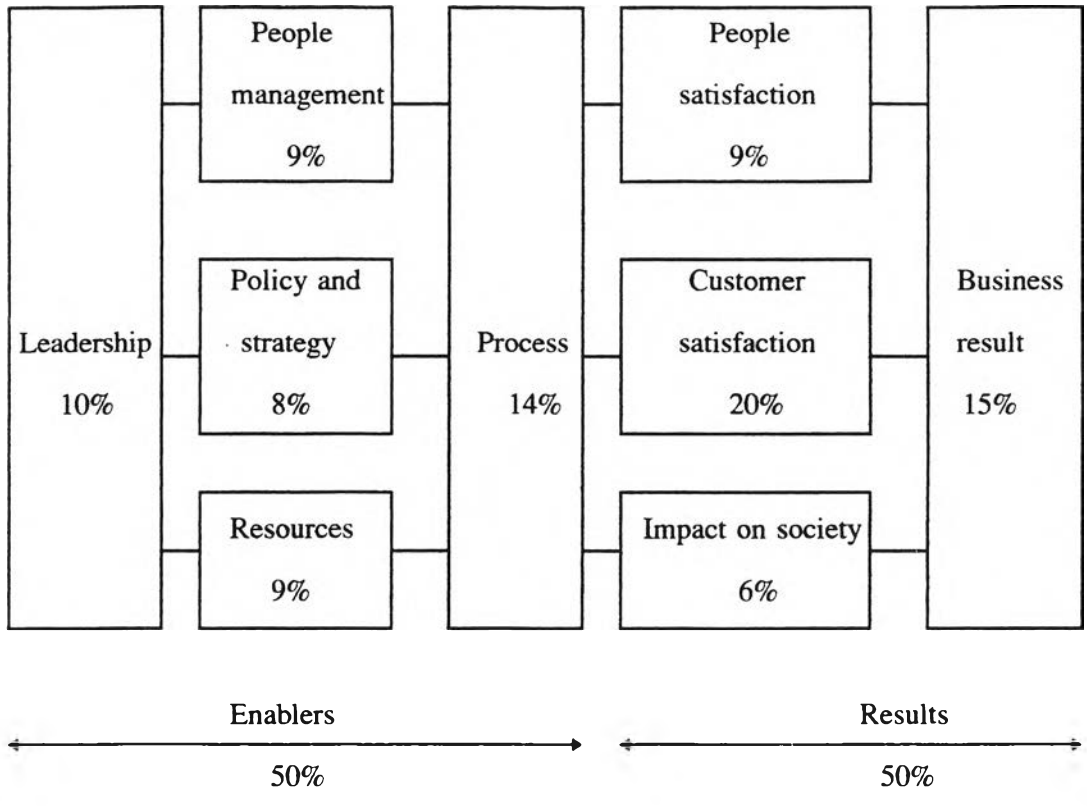
ISO 9000 registration is promoted as the passport required to business in the post-1992 global market and the only true way to TQM [Corrigan, 1994]. Different organisations usually register different ISO standards based on their business characteristics. For example, an organisation which design products and/or services on its own should adopt ISO 9001. A manufacturing organisation should adopt ISO 9002.

For the registration process, the applicant starts with submitting a quality system documentation for a review by the registrar. The auditor reviews the documents and identifies possible noncompliance. The applicant is then site-visited by the auditor team comprising two or three auditors. This takes about four days. Thus, a decision is made on whether a certification is to be granted or denied. If the certification is denied, the company has to make necessary changes for another site-visit. On the other hand, if certification is granted, the company will face periodic re-audits (typically, two per year) in order to maintain its good quality system.

In 1988, 14 large European multinational corporations formed the EFQM to promote the TQM principles in Western European countries. In 1991, EFQM, with the support of the European Commission, established two types of quality awards for firms: the European Quality Prize and the EQA. The former award is given to firms meeting the award criteria; whereas, the latter is presented to the most successful applicant.

According to the EQA Model (as seen in Figure 2.3), there exist two principal elements: the enablers and the results. Customer satisfaction, people (or employee) satisfaction and impact on society--the results--are achieved through leadership driving policy and strategy, people management, resources, and process--the enables--leading ultimately to excellence in business results. [Nakhai and Neves, 1994]

Figure 2.3 The European Quality Award Model [Nakhai and Neves, 1994]



Cupello has developed a new paradigm for measuring the TQM progress. There are four levels of TQM maturity: Playing, Demonstrating, Committed and Actualised. These can be easily remembered by playing off the so-called PDCA (plan-do-check-act). The Playing or P level of maturity refers to the organisations that are playing with or just beginning the TQM approach to see whether they really want to be involved. The Demonstrating or D level refers to the organisations that are demonstrating a meaningful of maturity improvement using the TQM process. For example, those organisations could make some initial process improvements by utilising cross functional teams or quality circles. The Committed or C level of maturity refers to the organisations that are committed to TQM process to the degree that employees know the difference being

attributable to the process. The Actualised or A level of maturity refers to the organisation that have actualised TQM; they are possibly considered to be world-class.

Figure 2.4 represents the measurement-maturity matrix the row headings reflecting the organisational level typically responsible for category of measurement against each level of TQM maturity listed across the top of matrix.

Figure 2.4 Measurement-maturity matrix [Cupello, 1994]

	Level of TQM maturity			
	P	**D**	**C**	**A**
Diagnostic	TQM assessment	Customer surveys Employee surveys	Supplier assessment	All four
Senior managers (Planning)		Strategic targets - internal - existing data	Strategic targets - external - new data	Paradigm shifts - new business - new customers
Middle managers (Screening)			Functional target - internal	Quality function deployment
Workers (Control)				Process capability targets for key products and processes

Eisen, Mulraney and sohal conducted a survey on quality management practices of a large sample of Australian manufacturing companies in 1991. The main purposes of this survey are as follows [Eisen, Mulraney and Sohal, 1991]:

1. To establish the extent to which Australian manufacturing companies adopt modern quality management practices.

2. To determine rationales for their non-adoption of such practices.

3. To identify barriers and impediments to the adoption of modern quality management practices.

The research methodology was based on a mailed questionnaire survey. Great emphasis of the research was placed on:

1. Survey population:

- sample classification by industry sector: textiles and footwear, mineral products, electronic components, fabricated metal products and more.
- sample classification by number of employees.
- sample classification by productivity.
- sample classification by location.

2. Quality management practices in terms of technical aspects:

- Percentage of the use of TQM, TQC, SPC, GCS, 100%inspection,sample inspection, batch inspection or other.
- Time duration of quality management practice use.
- Quality management practice gap.

3. Quality management practices in terms of philosophical aspects:

- Responsibility for quality: QC (Quality Control) department, all managers, all supervisors, all employees and other.
- Customer recognition.
- Incoming goods inspection; 100% inspection, sample inspection, batch inspection, nil and other.
- Supply of materials and components: all multiple supplied, some multiple supplied and all single supplied.

- Quality training: all employees, selected managers, selected others, all inductees and no training.
- Employment of consultants: used for quality practices introduction, used for training people and not used at all.

An Analytic Hierarchy Process (AHP) approach can be used either for the analysis and comparison of the quality of several telecommunication companies, or for the evaluation of alternate technology in telecommunication [Douligeris and Pereira, 1992]. An example representing this effort is a research, conducted by Douligeris and Pereira in 1992, on utilising the AHP approach to scientifically choose a telecommunication company that best satisfies the customers' needs. The three selected telecommunication companies are to be compared in terms of the quality of services offered. The research methodology is based on a pairwise comparison between several factors that affect the service quality in a hierarchical structure. Moreover, in the researchers' paper a specific mathematical formulation is presented and discussed extensively.

In summary, it is evident that there has been much attempt to develop the models for assessing the quality management systems and practices. However, a large number of researches in this field have been established in developed countries such as the European countries, the United states and Japan. These countries have already overcome some stages of production and quality management problems. In contrast, for developing countries not only level of production management and technology, but also level of awareness of quality management are low. This study shows an effort to assessing quality management system in Thailand, but, more specifically, in telecommunication company.