

The Implementation of Total Quality Management in Controlling the Cost of Manufacturing

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Abstract

Purpose - Total Quality Management (TQM) has received significant attention and interest from a large number of organizations around the world in various industries. These organizations have tried to embody TQM concepts in areas such as engineering and product design, marketing, R&D, procurement, production, personnel, and product inspection.

Research design, data, and methodology - This study presents an overview of the fundamentals of TQM and an in depth review of the obstacles to the successful implementation of TQM.

Results - In order to control the cost of manufacturing, the tracking of the cost of quality (COQ) allows companies to capture the actual overall cost incurred in producing a unit of product or service. The study explores the reasons why companies track the COQ and ways to address it.

Conclusions - Based on the results, COQ is one of the key performance indicators for making more accurate strategic decisions as well as a critical aspect of TQM. The study also presents a few popular quality improvement tools that have been widely used in organizations successfully implementing TQM.

Keywords: Total Quality Management, Cost of Quality, Cost of Poor Quality, Lean Manufacturing, Just In Time, 5S Method.

JEL Classifications: M1, M2.

1. Introduction

Quality is not a new or recent development. In fact, quality

has become an increasingly predominant feature of our lives. Nowadays people are constantly involved in the search for quality products, quality services and even abstract notions such as quality time with which to share with their partners and families. The existence of this desire for quality has caused industries and organizations throughout the world to attempt to develop a philosophy which can deliver customers the quality they require. Total quality management (TQM) is one such philosophy which aims to provide organizations with a recipe for success through customer satisfaction.

TQM has been widely accepted as ways and means for achieving excellence in quality in this new millennium by many companies around the world. Multitudes of businesses in manufacturing industry have already implemented or started implementing TQM for achieving quality excellence and improving competitive edge in the market place.

TQM involves management and control of quality through out the entire organization. In TQM, the marketing department collects the customer expectation data using market survey (from customer / dealers) and provides them to product development and design department. Product development and design department in turn design a selected variety of products to best match the needs and expectations of the target customers as provided by the marketing department and pass the drawings to manufacturing department for fabrication and assembly. Then, manufacturing department makes parts and assembles the products according to design specifications. The quality control department regularly monitors and inspect production and assembly processes to make sure that parts and assemblies are produced according to product design specifications. The packaging and distribution department's responsibility is to package and deliver the product to the customers, in a timely and efficient manner.

But why has TQM been so successful in some applications and not in others? Dr. William Edwards Deming, recognized as the father of modern TQM, offers this explanation: "There is no determination to do it. We have no idea what to do and how to do it, what the right thing to do is - we have no goal." He placed great importance and responsibility on management, at both individual and company level, believing management to be

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responsible for 94% of quality problems. His fourteen point plan is a complete philosophy of management that can be applied to small or large organizations in the public, private or service sectors.

Another TQM guru, Phillip Crosby, is best known in relation to the concepts of "Do It Right First Time" and "Zero Defects". He considers traditional quality control, acceptable quality limits and waivers of sub-standard products to represent failure rather than assurance of success. Crosby therefore, defines quality as conformance to the requirements which the company itself has established for its products based directly on its customers' needs. He believes that since most companies have organizations and systems that allow deviation from what is really required, manufacturing companies spend around 20% of their revenues doing things wrong and doing them over again. His four absolutes of quality are:

- a) Quality is conformance to requirements
- b) The system of quality is prevention
- c) The performance standard is zero defect
- d) The measurement of quality is the price of non-conformance

Joseph M. Juran, seen by many as the "father" of quality, a quality guru and the man who taught quality to the Japanese, established the quality trilogy – quality planning, quality control and quality improvement. Among the steps Juran advocated are:

- a) Build awareness of the need and opportunity for improvement
- b) Set goals for improvement and organise to reach them
- c) Carry out projects to solve problems
- d) Report progress
- e) Provide training
- f) Give recognition
- g) Communicate results
- h) Maintain momentum by making improvement part of the regular systems and processes of the company

The "80:20" rule – The Italian economist Vilfredo Pareto observed that twenty percent of the Italian people owned eighty percent of their country's wealth. Juran adapted the concept to quality improvement, stating that 80% of quality losses are affected by 20% of all root causes. He called that 20% 'vital few' and the rest the 'trivial many (or useful many)'. The concept, also called the Pareto Principle, is the logical basis for the Pareto Chart, one of the seven tools of Quality.

2. Materials and Methods

Greg Weiler(2004) conducted a survey to identify the current level of thinking about the economics of quality among CEOs and other top executives in four markets: manufacturing, service,

healthcare and education in the United States. The list included TQM, Six Sigma, Baldrige, the ISO 9000 series of quality management standards, quality circles and benchmarking. As expected, those in manufacturing had the highest degree of awareness or familiarity. The usage followed the same pattern with benchmarking and TQM being used most frequently with manufacturing in the lead. When asked what quality contributes, most of the respondents mentioned increased revenue through repeat business, referrals and customer loyalty, less rework, and savings on labour and materials. Another main point brought up by the author is on how companies actually measure the impact of quality improvement. Despite a variety of different measurement methods including customer satisfaction mail or telephone surveys, cost benefit analysis, trend analysis, audits, benchmarking, Six Sigma, tracking studies, returns on investment, bottom-line profitability and warranty returns mentioned by respondents, the author recognized that they did not seem to be using a great deal of sound statistical techniques to measure the impact of quality improvement. He only suggested such an approach for additional study without further elaboration or clarification.

Quek Eng Eng and Sha'ri Yusof (2003) investigated the current status of TQM implementation, focusing on the electrical and electronics sector in Malaysia in an attempt to gauge how far this sector has moved towards it. Attempts at finding significant differences between small and large companies' quality practices were made and revealed that, there was a significant difference of TQM practices of large and small companies. Management leadership, continuous improvement system, education and training proved to be rated among top priorities for successful implementation by large companies, compared to Small and Medium Enterprises (SMEs). In their investigation, they also found that supplier quality management is the least implemented criteria for both large and small companies. The study also highlighted the importance of TQM adoption in SMEs to meet future challenges in realizing the vision of world-class organizations. The survey methodology used is based on a total of eight constructs that felt to be important for TQM implementation and the five-point Likert scale with a score of 1 relating to 'strongly disagree' and 5 meaning 'strongly agree'. In addition, a zero was included in the scale as an option to indicate 'no opinion' or 'not applicable'. Even though the response rate was only 24.2%, the authors felt it was reasonable for this kind of survey. They also confidently concluded the significance of their findings as an indication on the extent of the achievement for Malaysian SMEs in their journey towards excellence. Their proposal for future research that concentrates on identifying a systematic approach towards TQM so that SMEs can sustain the changes in the new era of the global business environment is indeed far-sighted and timely.

Jamshed H. Khan (2003) presented his paper on the impact of TQM on Pakistani businesses. He argued that TQM implementation is the critical need for the survival of their businesses both locally and internationally. Competition from compa-

nies operating in different markets has increased as advancement in telecommunications and information technology have eliminated traditional barriers to entry (e.g. geographical and trade barriers). With increasing pressures from the international community to meet the guidelines of the World Trade Organization(WTO), the Pakistani Government will not be in a position to maintain protectionist policies for local industries. So he posted two questions in his article:

- a) Are we providing our customers the best value for their money?
- b) Are we competitive enough to compete for market share with the best producers in the world?

He then further emphasized the importance of TQM to foster a culture that is continuously oriented towards increasing customer satisfaction while minimizing the real cost of production. The four basic beliefs of TQM philosophy mentioned by him are: absolute customer focus, employee empowerment, involvement and ownership; continuous improvement, and the use of systematic approaches to management. He later reviewed the case study carried out by Hendricks and Singhal that empirically prove that TQM improves the financial performance of organizations. In order to gain maximum benefit from TQM, senior executives of organizations will have to fully understand and believe in the TQM philosophy. He stated that, "The systems and tools cannot promise significant or sustainable results without the visible commitment of the top management to the TQM philosophy"

Aidan Walsh, Helen Hughes and Daniel P. Maddox (2002) examined the practice of TQM philosophy within companies operating in Ireland with the objective of establishing whether, or not, TQM philosophy is suitable for adoption by organizations in Ireland. The data from the research indicated that TQM activities were practised throughout Irish industry. The approach adopted was to review all relevant literature and theory on TQM and the findings from desk research and exploratory questionnaires answered by representatives from mid-sized, and large, Irish based companies. In the literature review, the author mentions the benefits attributable to TQM, which are :

- a) the elimination of defects
- b) reduced scrap and rework
- c) reduced levels of cost
- d) increased levels of efficiency and productivity
- e) increased employee morale and motivation

The majority of respondents indicated that their TQM programmes were successful. It can be concluded that TQM philosophy is suitable for adoption by organizations operating in Ireland and that a TQM approach offers these organizations a platform for developing strategies that guarantee competitiveness and success. The author also acknowledged the importance for organizations to develop an effective quality strategy that builds on strengths and core competencies whilst minimizing any resistance that may be experienced to proposed changes. In his conclusion, he recommended several factors for the organization

to effectively implement and develop TQM.

Khurram Hashmi (year not specified) stated that TQM is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc) to focus on meeting customer needs and organizational objectives. The simple objective of TQM is "Do the right things, right the first time, every time". According to him, TQM must be practiced in all activities, by all personnel, in manufacturing, marketing, engineering, R&D, sales, purchasing, HR, etc. The key principles of TQM are: management commitment, employee empowerment, fact based decision making, continuous improvement, and customer focus. In the aspect of continuous improvement, it must deal not only with improving results, but more importantly with improving capabilities to produce better results in the future. There are three major mechanisms of prevention:

- a) Prevent mistakes (defects) from occurring (Mistake – proofing or Poka-Yoke).
- b) Where mistakes can't be absolutely prevented, detecting them early to prevent them being passed down (inspection at source or by next operation).
- c) Where mistakes recur, stopping production until the process can be corrected, to prevent the production of more defects (Stop in time).

He mentioned that in implementing TQM, a preliminary step to assess the organization's current reality to ensure it includes important preconditions to succeed. For organization with significant problems such as a very unstable funding base, weak administrative systems, lack of managerial skill, or poor employee morale, TQM would not be appropriate. In addition, a certain level of stress is desirable to initiate TQM. People need to feel a need for change. These forces include departures from tradition, a crisis or galvanizing event, strategic decisions, individual "prime movers" and action vehicles. He further outlined the basic steps proposed by Beckhard and Pritchard in managing a transition to a new system such as TQM: identifying tasks to be done, creating necessary management structures, developing strategies for building commitment, designing mechanisms to communicate the change and assigning resources. While I tend to agree with the author's remark that leadership styles and organizational culture must be congruent with TQM and all the current state of the organization must meet the preconditions as mentioned, to totally avoid or delay the implementation of TQM until favourable conditions exist might not be a proactive approach. In fact, the adoption of TQM principles will serve as foundation for the organization to expedite the transition.

Nayantara Padhi (year not specified) listed eight key elements for the successful implementation of TQM, namely: ethics, integrity, trust, training, teamwork, leadership, recognition, and communication. He further divided these elements into four groups according to their function. The groups are:

- a) Foundation –ethics, integrity and trust
- b) Building bricks – training, teamwork and leadership
- c) Binding mortar – communication

d) Roof – recognition

The author's structural and systematic approach in presenting these key elements provides brief guidelines to ensure the success of TQM in an organization. The motto of a successful TQM organization: "Lead by example, train employees to provide a quality product, create an environment where there is no fear to share knowledge, and give credit where credit is due." can be adopted by any organization who intends to gain maximum benefit of TQM.

Jessica Kennedy and Paul Hyland (2003) presented their paper for the Small Enterprise Association of Australia and New Zealand 16th annual conference on the comparison of manufacturing technology adoption in SMEs and large companies. The survey indicates that in general, SMEs have used advanced technologies less than larger firms in the past and received a lower payoff. To maintain their current importance in economic terms, the manufacturing sectors in both developing and developed economies must ensure that they can compete in areas other than price. In order to compete, manufacturers have invested substantial resources in advanced manufacturing technologies (AMT), improvement programs such as Kaizen and TQM, and process improvement such as just-in-time (JIT). This research maintains that there are fewer resources available to SMEs compared to larger firm in the adoption of AMT. It acknowledged the informal nature of smaller businesses and leadership of owner/managers can make implementation of TQM easier in small firms than in large. Nevertheless, the implementation approach differs from large companies. In implementing TQM, small companies put more emphasis on leadership, employee involvement and quality information whereas larger firms emphasize training, feedback, quality assurance, and supplier cooperation. The survey questionnaires was divided into four sections: a) strategies, goals, and costs, b) current manufacturing and integration practices, c) past and planned activities in manufacturing, and d) manufacturing performance, targeting at respondents in manufacturing with position as production manager or the general manager. Similar to the few literatures presented above, most firms agreed that their involvement in the quality activities generated a significant payoff and demonstrated higher future use especially in the ISO certification and TQM program. In comparison, the strategic use of improvement activities such as quality programs and Kaizen is much higher in large firms than in small firms regardless of whether they are based in developed or developing countries. Understandably, this may be related to the knowledge and capacities of SMEs or it may be that they have neither the financial resources nor people to invest in improving their processes and system. In order for us to understand this matter, further elaboration will definitely benefit the readers.

John Watson (2003) presented his study on the impact of TQM practices on the SMEs financial performance in Australia. According to him, the attitudes of SMEs towards TQM have often reported that managers perceive the lack of resources and

the cost of implementation as obstacles to its adoption. Furthermore, SMEs often implement TQM in response to external pressures rather than as the result of internally generated initiatives to improve quality or reduce costs. The major drawback faced by the author in examining the association between TQM and financial performance was the availability of financial data. To overcome this, the author obtained data from the Australian Bureau of Statistics Business Growth and Performance Survey conducted in 1995/6 with those SMEs which were legally required to participate in the survey and compelled to report their financial results. Based on a total sample of 3,776 firms, this study somehow found no evidence to suggest that adopting TQM practices improved key financial performance indicators. This is totally contradicted with the last few literatures reviewed above. The author realized this outcome could possibly due to a lack of "true" commitment by many SMEs to TQM because they implemented TQM not as part of a strategy to improve quality or reduce cost but in response to external pressures. Another alternative explanation was that the TQM adopting firms were those whose financial performance was lagging that of others in their industry and they implemented TQM in an attempt to improve their financial performances. Hence, further research shall be conducted to explain such scenario on the avenue of determining SMEs motivation or commitment towards TQM adoption. In addition, due to the costs associated with adopting TQM, time factor shall also be part of the consideration in analyzing the TQM adoption and its improvement in financial performance. Such phenomenon can be understood in the following literature.

Kevin B. Hendricks & Vinod R. Singhal (2000) presented empirical evidence on whether the criticism that TQM lacklustre impact on financial performance is indeed justified. Firstly, they discussed the ongoing debate on TQM ability to significantly improve financial performance. Second, they presented evidence on the financial results that publicly traded organizations have achieved from implementing TQM effectively. Third, they discussed how the financial results vary by organizational characteristics. His evidence is based on a study of nearly 600 quality award winners. Results from their study show that:

- No significant differences in performance during the implementation period
- Results for the post-implementation period indicate that quality award winners outperformed the benchmarks on almost every performance measure.
- The overall evidence indicates that firms that have an effective TQM program do better in terms of stock price performance when compared to appropriate benchmarks.
- Award winners also experienced higher growth and improve profitability as compared to the benchmark firms.
- The smaller winners did better than larger winners because many key elements of TQM such as teamwork, worker empowerment, and spirit of co-operation across functional departments are ready present to some extent in smaller firms. Additionally bringing change can be more difficult in larger firms.

Hence, it clearly shows that when TQM is implemented effectively, financial performance improves dramatically. The criticism that TQM has produced lacklustre economic gains is unfounded. The authors stressed that firms that want to implement TQM effectively must have patience as it requires a long time especially in changing the organization culture and employee mindset. Managers that embrace TQM for quick gains will be surely disappointed. However, the authors commented that the degree of gains from TQM will diminish as more and more firms in a particular market segment adopt TQM shall not be viewed as a drawback or business risk, but more rather than not, as a competitive advantage for them to engage in TQM implementation.

Arawati Agus, Suresh Kumar & Sharifah Latifah (2000) carried out studies in the manufacturing industry in Malaysia with the following objectives:

1. To determine the correlation of TQM practices with customer satisfaction.
2. To determine the structural contribution of TQM on customer satisfaction.
3. To determine the structural impact of customer satisfaction on financial performance in comparison with competitors.

The sampling frame in this study comprises public listed manufacturing companies in the Bursa Malaysia, formerly known as Kuala Lumpur Stock Exchange. From the survey, the authors concluded that the implementations of TQM can lead to the enhancement of customer satisfaction and ultimately improve the financial performance of manufacturing companies in Malaysia. The result indicated that with increasing pressure from the company's own customers for higher quality or their own self quality initiative, manufacturers are making greater demands on their suppliers with regard to the quality of incoming material, component parts and finished items. Surely, such emphasis can reduce scrap or rework, hence contributes significantly to increase level of productivity and efficiency. In the short term, superior quality leads to increased profitability and even the ability to charge a premium price relative to a firm's competitors. As quality increases, cost per unit invariably decreases, creating an environment for increased economies of scale within the firm and also in supplier firms. With the emphasis on TQM, process improvement occurs, and productivity increases through superior use of people and process. Finally, as quality increases, market share goes up, and ultimately sales and profitability would also be increased. This study managed to substantiate the valuable contribution of TQM on Malaysia manufacturing companies' financial performance. It also depicted the correlation of five major TQM practices, namely top management commitment, customer focus, supplier relationships, training and employee focus are paramount importance to the success of TQM. As an enhancement to such survey, they can further classify the sample of companies into different groups according to the level of quality implemented and correlate to their financial performance. Potentially, such findings will convince more companies in embracing a higher level of quality efforts in their operation.

Steven H. Hoisington and Elizabeth C. Menzer (2004) brought up a very interesting topic: failure of quality professional to demonstrate to management the value of the quality initiative in terms of its monetary impact. According to the authors, many of the current quality initiatives, including Six Sigma, lean and Baldrige, often cite a lack of management support or buy-in as the number one cause for any organization initiative to fail or be less effective than planned. However, another reason behind management's lack of support is that the quality professional likely did not express the benefits of the initiative in a manner management could relate to – usually financial performance. In principle, management in all types of organizations is becoming more and more reluctant to accept information, changes or new challenges without understanding the value they will have on the bottom line. This is especially true for quality related activities because they have traditionally been difficult to associate with the bottom line financial results. The authors stressed that quality professionals must understand how quality improvement efforts can be translated into financial benefits. Apart from the intuitive waste such as rework and scrap, intangible financial benefits of quality and their impact on the bottom line also need to be understood. Cost of poor quality (COPQ) is one approach to quantify the financial benefits of quality initiatives. Although a list of key financial terms are given in the article, no concerted effort is given to associate the quality improvement efforts with those key indicators.

Guy Malchi (2003) presented a pragmatic approach to increasing value through measuring the cost of getting it right the first time. He cited an example of a major pharmaceutical manufacturing facility achieved an 11% reduction in its COQ through the implementation of such programme. Starting from top-level management interviews, a plan was drawn up. One team member was assigned to take ownership of maintaining the system, whereas data collection for each of the indicators in the hierarchy was delegated to further data owner. Together the action team held monthly meetings to review all indicators, identify trends and generate ideas for cost reduction and completion of pending actions. According to the author, in addition to increasing efficiency and reducing operating costs, implementing a COQ measurement system can greatly improve a company's reputation and profit margin. It can also provide long-term investment value as a standardized scale for ongoing improvements of quality operations and coordinating efforts across numerous facilities. All in all, this author managed to highlight some key approaches in preparing for the COQ measurement system, and it could be enhanced if presented in a structured manner.

Jon R. Miller and John S. Morris (2000) understand the controversy for any organization to embark on quality improvement program without apparent economic support. According to them, the goal of any business firm should be to maximize shareholder value through increased profits, not to minimize the costs of doing business. They argued that improved quality often leads to improvement in market share or higher prices. So such

objective for companies to embark on quality improvement program if supported by sound economic reasoning requires an extension of the standard cost of quality (COQ) model. In the traditional cost of quality as mentioned by him, total quality cost is the sum of the cost of poor quality (COPQ) and the cost of achieving good quality (COGQ). As we increase quality, the sum of the two costs decreases till it reaches the optimal level of quality where the marginal cost of quality is equal to zero. Because of this, the traditional COQ analysis ignores an important component in the level of quality decision, which is the increase in market share or higher prices. An example given by him was the Harley-Davidson Motor Co. that had a reputation for poor quality performance managed to increase its market share from 20% to more than 46% in 1988 after embarking on a quality crusade in 1983 to dramatically improve the quality of its motorcycles. Therefore, the authors tried to reconcile this missing link in the traditional COQ model by associating it with the increasing revenue and external social benefit. It demonstrates as the firm increases quality beyond its optimum level, total cost of quality increases, but total revenue increases by an even larger amount, creating the potential for additional profit. While I tend to agree with the authors arguments, further elaboration on the opportunity saving on the hidden cost of poor quality will definitely give a broader perspective to the reader.

"What collection system should be used when starting a COQ system?" and "What are the advantages and disadvantages of each?" These are the questions that have been answered in a great extent in the article written by Gary Zimak (2000). The author realized that choosing the "right" tool/method can be the most difficult decision for most organizations and tried to provide a framework in his paper to help its readers to select the right method to receive the most benefit from a COQ system. Four methods are covered: the Traditional method, the Defect Document method, the Time and Attention method, and the Assessment method. The Traditional collection method uses data already existing within an organization, via the standard accounting and finance department records. This information may be obtained from time sheets, expense reports, purchase orders, rework reports, and other similar type of reports. The Defect Document method is sometimes used in conjunction with the Traditional method. It is linked to using the existing defect document/tracking system, with which most people in the organization are already familiar. The Time and Attendance method is one of the least utilized methods. Automated systems or manual time cards can be used together with a developed list of quality codes for employees to use when documenting their time. Lastly, the Assessment method is used as an initial stage of quality program to help estimate the organization's cost of quality. If the organization is in the initial stage, then it should focus its attention in the area of internal and external failure costs. If the organization is more mature, three-step approach is suggested that focus on the waste and non-value added cost, organization appraisal cost and prevention cost. His paper indeed provides not only the steps required to conduct the methods selected, the advantages and disadvantages elaborated can

help the organization to be more well-prepared and far-sighted in adopting a COQ system. This paper serves as a good reference for continue discussion later.

"An emerging need for guidelines and standards for TQM implementation forces countries to develop models for self-appraisal and for identifying and addressing quality issues". With this in mind, C.P. Kartha (2004) published a paper examining the relationship between ISO9000:2000 quality standards, QS9000, ISO/TS 16949 and the Baldrige criteria for performance excellence. Comparison, similarities and differences are also examined between Baldrige criteria and other quality standards. The content clearly shows that there are similarities as well as differences based on both focus and philosophy. Added requirements such as continuous improvement, emphasis on process approach and customer focus to QS9000 and ISO/TS 16949 certainly make them closer to TQM. The ISO/TS 16949 stresses the importance of linking information such as customer satisfaction measures, audit results; corrective and preventive action results and other relevant measures facilitate improvement. The focus on the Baldrige Award is competitiveness through increased customer satisfaction and improved overall operational performance. The focus of ISO 9000 registration is conformance to practices specified in the registrant's quality system. Quality is defined as customer-driven quality in the Baldrige Award whereas ISO 9000 has its operational definition of quality as conformity to documented requirements. The scope of Baldrige Award criteria is considerably broader and the documentation requirements for the ISO 9000 are generally resource intensive. According to the author, certification of these standards can be an excellent starting point for TQM implementation and especially imperative for organization to do business in a global environment.

Jiju Antony (2004) examined the pros and cons of six sigma and its future and links to statistical thinking. Six sigma as a powerful business strategy has been well recognized as imperative for achieving and sustaining operational and service excellence. Series of limitations for six sigma institutionalization are listed for future research opportunity. The one attracts attention most is what the author acknowledged that the significant start-up cost for institutionalizing Six Sigma into a corporate culture may discourage many small and medium enterprises from introduction, development and implementation of six sigma strategy. However, no further elaboration of such limitation by the author.

"One of the more familiar dilemmas in business today is how to implement Six Sigma in small and medium-sized companies". The problem arises when small and medium-sized companies solicit deployment proposals from Six Sigma consulting companies only to learn that the traditional Six Sigma implementation can require millions of dollars in investment, dedication of their best full time resources, and training of the masses. Terence T. Burton (2004) acknowledged this phenomenon well and hence, he proposed an alternative Six Sigma deployment model that al-

lows smaller and mid-sized organizations to implement at a pace where they can actually digest the methodology and achieve benefits, without the significant resources commitment and overhead structure of the traditional Six Sigma implementation approach. The 8-step process overview of the Six Sigma deployment and execution process recommended for small and medium-sized companies was proposed by him. According to the author, the proposed building block approach can be modularized so that the organization can quickly transition their Six Sigma resources to the next highest level of achievement. The real need to bring small and mid-sized companies into the Six Sigma fold can be satisfied with the right deployment model. Nevertheless, the author did not elaborate further what he meant by "the right deployment model".

Jayanta K. Bandyopadhyay and David A. Sprague (2003) attempted to describe how a TQM approach could be implemented for achieving supply chain quality management in manufacturing industry using automotive industry in the United States as an example. A supply chain includes a firm's internal functions which include all transformation processes, its upstream suppliers, and its downstream distribution channels reaching the end customers which include distributors and retailers. According to them, the supply chain management involves a collaborative strategy linking cross enterprise business operations for achieving a shared vision of the market opportunity and this shared vision in automotive industry has been improving the competitive edges, through cost cutting and continuous improvement of quality. All the determinant factors for a successful TQM implementation were covered briefly in this article namely:

- a) Top management commitment and TQM
- b) Total customer satisfaction and TQM
- c) Customer survey
- d) Product design and manufacturing and TQM
- e) Process engineering and TQM
- f) Quality control and TQM
- g) Outgoing inspection in TQM
- h) Work in progress inspection in TQM
- i) Receiving inspection in TQM
- j) Suppliers' quality audit and TQM
- k) ISO 9000 and QS 9000
- l) Third party registration and TQM

Several quality improvement methods such as Design of Experiments, Statistical Process Control, Failure Mode Analysis, Poka-Yoke, etc were also discussed. Nevertheless, one of the main problem solving tools that is getting more popularity nowadays was not mentioned at all, none other than the '6-Sigma' approach.

Steve L. Hunter (2003) stressed that product quality is one of the pillars that supports superior lean production. The real secret to securing good quality 100% of the time is to prevent a defect from occurring in the first place. The way to get down this road to 100 percent good quality is to instil in all workers that they are inspectors. They should have the tools and know

how to inspect work coming to them and inspect their own work before passing it down-stream. The author advocated the idea is to prevent a defect from occurring, rather than trying to find a defect after a product has been made. Several ideas given namely: Poka-Yoke, statistical quality control, integrated quality control and cellular quality control. Poka-Yoke is a Japanese word for defect prevention. The idea is to develop a method, mechanism or device that prevents the defect from occurring. There are many different tools for statistical quality control. The two most popular techniques are acceptance sampling and control charts which use a sample amount of data to draw conclusions about a larger amount of data. Integrated quality control is part of the manufacturing-based strategy that incorporates quality control at every level of an organization. It is extended to include vendors, suppliers and subcontractors to improve the quality of supplies and materials. Cellular quality control emphasizes cell workers control quality in their cells. The rule is make one, check one and move on one. The author also mentioned that cost of quality is the expense of doing things wrong. Defects must be found and corrected and such improvements can cost money. Failure to meet conformance standards costs money. He too emphasized that fastest and surest path to low-cost operations is to make a product right the first time, every time, thereby eliminating rework and scrap. This clearly shows that TQM is paramount important for the implementation of lean manufacturing which ensure the competitiveness of the organization.

Kathy Hill (2000), the Business Development Director of American Productivity and Quality Center (APQC) presented his paper on best practices and benchmarking and how to get started with your own improvement effort. Benchmarking helps a business focus on how to improve a process by exploiting best practices, not best performances. A best practice may not be the same for every organization because each has its own culture, technology, and resources. Best practices are those that drive best performance. If an organization studies only best performance, it will miss learning important strategic, operational, and financial information that could improve the process even more. Benchmarking and best practices can straighten the disjointed lines in our process, thus improving company profits and customer satisfaction. APQC uses a four-phase model for developing a benchmarking study –plan, collect, analyze, and adapt. The time frame for each phase depends on the topic, scope, and depth of the study.

Prior to any successful documentation of research paper, a well-planned and organised research methodology is inevitable. Although there is no single way of structuring a research methodology, the following main steps have been strategically outlined and followed strictly in order to fulfil the research objectives in a coherent and productive manner.

There are seven main steps in the methodology used in this research:

- Topic selection and understanding (week 1)
- Devising a research programme, time-management, planning

- & outlining techniques (week 1)
- Download literatures and review systematically and critically (week 1 - 3)
- Summarise statements and to synthesize academically (week 3 - 5)
- Use internet/web to support academic discussion (week 5 - 6)
- Final review and wrap-up (week 7)
- Carry out and receive peer assessment (week 7)

This topic selection reflects precisely my current profession in the automotive manufacturing quality assurance. Having been involved directly is an advantage for me to carry out such research in greater magnitude and breath.

It is important to set up clear objectives and desired results as well as time line starting from the beginning of the research project to ensure the progress is on track. The target set shall be specific, measurable, achievable, reasonable and time-based. This similar concept is equally important to the TQM implementation, where lot of time, the organization involved tends to look for short term gains rather than its long term impact. A total of seven weeks have been allocated to complete the whole project.

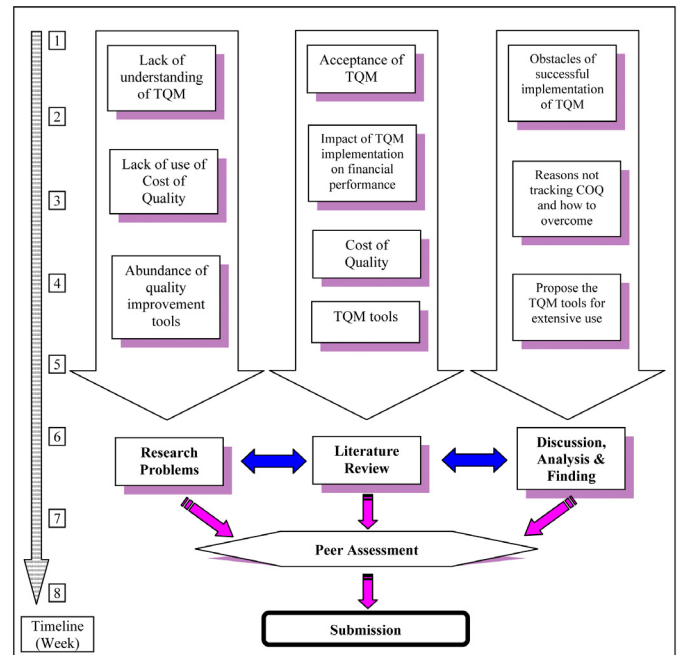
Nowadays, Internet has become a very efficient and effective research tools for researchers, students as well as educationists. Capitalizing on this technology, lot of related literatures such as journals, articles, case studies, and reports can be downloaded from websites namely: XanEdu MBA Research Engine, quality journals, Yahoo and Google search engines, etc. All literatures selected are less than five years to ensure relevancy and up-to-date information are presented.

In order to give critical review on those reading materials, it's important to classify them according to its scope and outlines so that it complies with the scope of this research. This also helps to avoid time wastage for reviewing unrelated materials. After classifying the materials, a more detailed review of those materials were conducted to the best of my understanding and ability in such that precise and constructive comments can be presented to the readers.

Analysis and findings are presented to the benefit of the readers to gain a better understanding towards TQM implementation. Once again, the ease of use of internet/web helps in great extends in supporting the academic discussion.

Special attention is given to the final draft of this research paper to ensure good grammar and accurate presentation layout. A copy of this research paper is also stored to 3.5 MB floppy disc before submission.

Last but not least, this final draft copy shall be given for peer assessment as proof-reading. Any grammatical error or formatting irrelevant shall be amended accordingly before submission.



<Figure 1> Research Framework

3. Discussion, Analysis and Findings

"What makes TQM work?" Since most would agree that the philosophy and principles of TQM are sound, instances of failed TQM initiatives have prompted lot of researches to direct their attention to problems associated with its implementation. Some focused on the obstacles to TQM. Others have narrowed their view to concentrate on specific barriers to TQM, such as organizational culture, employee factors, and ineffective project management. Some even emphasized the measurement of TQM outcomes, especially its impact on financial performance.

Hence this section of the paper would provide the author's contribution to summarise the findings and comments digested in the literature review. These will provide a better understanding to company which is about to adopt or is currently implementing TQM in their organization.

Depicted below are the major obstacles of a successful implementation of TQM:

- Lack of time to devote to quality initiatives
- Poor inter-organizational communication
- Lack of real employee empowerment
- Lack of employee trust in senior management
- Lack of a formalized strategic plan for change
- Lack of strong motivation
- View of the quality program as a quick fix
- Drive for short-term financial results
- Lack of leadership

- j) Lack of customer focus
- k) Lack of a company wide definition of quality

Failures occur because senior management tends to motivate change through top-down programs. Failure to solicit and receive feedback about potential gaps between their TQM rhetoric and the reality of implementation prevents senior management from learning how their own actions and policies may be responsible for the gap and making changes accordingly. Top down programs also undermine employees' commitment and their capacity to lead a TQM transformation. The missing ingredient in unsuccessful TQM transformation is the total quality management process for assessing and developing high quality management team at every level. Innovations like TQM are typically motivated by top management's desire to improve performance. However, if top management adopts TQM because other companies have, understanding of TQM and how it can be utilised to improve performance of the company will be low. If understanding is low, commitment will also be low and will lead to early abandonment. Their lack of understanding can easily lead them to rely on staff groups or consultants to drive the TQM program. This in turn leads leadership teams at the lower level to passively comply with the corporate TQM program for political reasons rather than out of conviction that TQM will improve their performance.

A study conducted on Malcolm Baldrige National Quality Award (MBNQA) winners found that difficulties in implementing TQM are rooted in three causes:

- a) the holistic change of corporate culture
- b) achieving and maintaining employee buy-in and acceptance of TQM
- c) integration with suppliers and customers

And the only factor that 100 percent of the MBNQA winners considered critical to the success of TQM was top management's commitment and involvement. Hence the success of TQM depends largely on management's ability to lead the organization's quality transformation. There are eight common management errors:

- a) not establishing a sense of urgency
- b) not creating a powerful enough guiding coalition
- c) lacking a vision
- d) not communicating the vision
- e) not empowering others to act on the vision
- f) not planning for short-term wins
- g) not consolidating improvements and producing more change, and
- h) not institutionalizing new approaches.

Ultimately, it is management's responsibility to plan for, lead, and effect the organizational change required for TQM success.

4. There are four categories of quality cost, namely:

- Prevention Cost

The costs associated with all activities designed to prevent defects in products. These include the direct and indirect costs related to quality training and education, pilot studies, quality circles, quality engineering's, quality audits, supplier capability analysis and new product reviews.

- Appraisal Cost

The costs associated with measuring and evaluating the product quality to ensure conformance. These include the cost of inspection, test or audit of purchases, manufacturing or process operations, and finished goods.

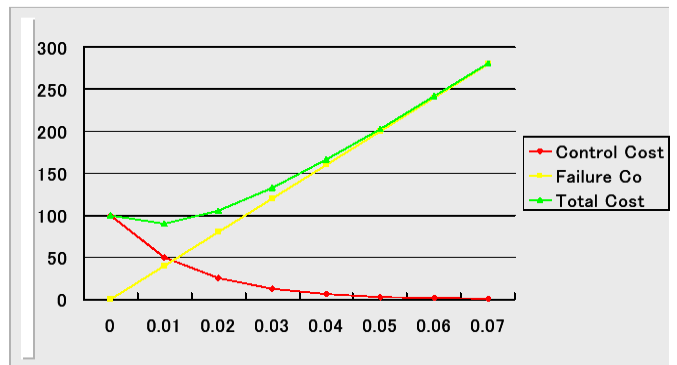
- Internal Failure Cost

The costs are associated with defects that are found prior to customer delivery. They include the net cost of scrap, spoilage, rework and overhead, failure analysis, supplier rework and overhead, failure analysis, supplier rework and scrap, re-inspection and retest, down time due to quality problems.

- External Failure Cost

The costs are associated with defects discovered after product shipment. These costs include warranty charges, customer complaint adjustments, product recalls, allowances, and product liability. They also include the direct and indirect costs such as labour and travel associated with the investigation of customer complaints, warranty field inspection, tests, and repairs.

Equation 1



<Table 1> Cost of Quality

The prevention and appraisal costs are known as conformance costs (or known as Cost of Good Quality or Control cost). And the internal and external failure costs are known as non conformance costs (or known as Cost of Poor Quality or Failure Cost). COQ can be classified into four groups of generic models. These are: P-A-F (Prevention, appraisal, failure) or Crosby's model, opportunity cost models, process cost models and ABC (activity based costing) models.

Drawing from the literatures reviewed, it's realised that relatively few companies will track quality cost. Why is this so ?

Reasons for not tracking COQ are as follow:

- Lack of management interest/support
- Company economic conditions or status
- Lack of knowledge
- Lack of adequate accounting and computer system
- Do not see the benefit of COQ

After knowing the reasons why most companies are not favourable in tracking COQ, presented below are some suggestions on how it can be overcome:

- Present the arguments for tracking COQ in a language that management understands – dollars.
- Focus arguments on the benefits to the organization – better decisions resulting from better identification of costs, and ultimately lower costs –can be effective in organization doing well and also in organization in crisis.
- Quality professional and operating personnel together identify activities and tasks that are quality driven and should be included in the cost of quality. This serves as a basis for addressing the process issues involved with designing and implementing accounting systems that can identify, track, and report the costs of quality in the operations of the firm.
- Activity Based Costing (ABC) is an alternative to a GAAP driven accounting framework. ABC addresses the issue of the relationships between the resources being used or consumed by activities being carried out by operations and the linkages between those activities and the products being created or produced. Quality can be viewed as one of the process-related activities that, using the ABC framework, can be identified and measured and assigned to cost objects such as processes, products or customers. The ABC can provide support for TQM.
- Education is the first step to creating the awareness. COQ is a methodology which focuses on the measurement of a specific performance issue. Properly integrated into a comprehensive and multi-dimensional measurement system, COQ can enable the organization to make better decisions and track the result of those decisions.

COQ program should be part of the TQM implementation especially in controlling the cost of manufacturing. While most people have misperception about COQ, the methodology is actually not complex and there are lot of published examples of best practices that can be used for formulating its own COQ measurement system and begin to harness the opportunity of reducing the real cost of their product.

There are abundant of quality systems, management systems or problem-solving tools available for any organization engage in quality improvement initiative to improve their competitive edge and at the same time, to reduce their cost of manufacturing. Discussed below are some of the tools that have been proven empirically that can help to improve the financial performance of

the companies which adopt TQM as their long term business strategy.

Quality systems are designed to provide both the support and mechanism for the effective conduct of quality related activities in an organization. It is a systematic means to manage quality in an organization. To name a few, ISO 9000: 2000 quality standard, QS 9000 and ISO/TS 16949 are those quality system widely used in the world.

ISO 9000 is a set of quality standards developed by the International Organization for Standardization (ISO), as a model for quality assurance standards in design, development, production, installation and service. ISO 9000: 2000 is the latest revision that addresses a number of issues in the old standards that created widespread dissatisfaction and criticism. It is based on eight principles that emphasise the core values and concepts of TQM. It uses process model approach and structures 21 elements into four major sections: management responsibility, resource management, product realisation and measurement, analysis and improvement.

QS 9000 is an extended version of ISO 9000 standards, developed by the Big Three automotive manufacturers (General Motors, Ford and Chrysler) in the US in 1994. Until the introduction of QS 9000, these individual manufacturers have imposed separate quality requirements on their supplier, each with its own set of demands. So they streamlined the separate requirements into one commonly used set of standards that virtually eliminated the varying demands and the wastefulness that accompanied them. There are three sections in the QS 9000 standards. The first section includes the exact text of ISO 9001. The second section covers production part approval (PPAP), continuous improvement, and manufacturing capabilities. The third section deals with customer specific requirements that are unique to General Motors, Ford and Chrysler.

ISO/TS 16949 is an ISO technical specification jointly developed by the International Automotive Task Force (IATF). It specifies the quality system requirement for the design, development, production, installation and servicing of automotive-related products. The goal of this standard is the development of a global management system that provides for continual improvement, emphasising defect prevention and the reduction of variation and waste in the supply chain. Item pharisees a process approach, commitment to quality by top management, increased emphasis on customer focus and continual improvement. In addition, there are customer specific requirements by individual manufacturers. This will eliminate the need for multiple certifications to QS 9000, VDA6, EAQF and AVSQ and will be recognised globally.

Since ISO, QS or ISO/TS requires an organization define and document the way it does business, compliance can provide the basic quality structure that can be improved further to achieve world class quality. It can be a good starting point for TQM

implementation. In fact, it serves as a subset of TQM overall requirements. Furthermore, most companies intend to penetrate the global market somehow or rather will be forced to obtain the certification as a mandatory requirement to do business. Therefore, it is foreseeable more and more companies will pursue ISO, QS or ISO/TS as part of their journey towards TQM.

Six Sigma is the fastest growing business management system. Centered around a powerful problem-solving and process-optimization methodology, Six Sigma is credited with saving billions of dollars for companies during the past ten years. In recent years, the main thrust of Six Sigma is the application of statistical methodologies and other tools to improve processes that are aligned with the overall needs of the business. Improvement and breakthrough results are accomplished through Define-Measure-Analyze-Improve-Control (DMAIC) methodology that is orchestrated by dedicated practitioners called Six Sigma Black Belts.

Like most change initiatives, a Six Sigma business strategy requires unwavering and consistent ownership and leadership by top management, especially the CEO. Many quality programs have failed or been abandoned by wasting valuable resources in people and funds because that commitment is missing. Drawing from some of those articles on Six Sigma implementation, below are those key success factors that any interested organization can reference to:

- a) Deployment plan: Implementation should be from the top of the organization. The leadership must be fully supportive and committed. The deployment should be thorough and detailed.
- b) Active participation of the senior executives: Senior executives will have participated in a training program designed to enable them to intelligently take part in project reviews. Their participation to address the class participants can energize the participants, tell them what is expected of them and give them a commitment of support from management.
- c) Project reviews: A regular project review imposes steady pressure on the BBs and GBs to drive their projects to a successful completion and closure and provides oversight to make sure they are correctly following the Six Sigma strategy and methodology.
- d) Technical support: Bring in the Master Black Belt (MBB). They are your best and brightest. Choose people who have demonstrated strong leadership skills under fire and ability to be a change agent.
- e) Training: Training program should be thorough but don't overwhelm people. Whatever training schedule is selected, be sure the BBs leave the room enabled. Pop quiz at the start of each training session to test the participant understanding of what they learned the previous day. If the ability to apply the training is not reflected in the project reviews, make adjustment in the depth and pace of the training programme.
- f) Communication: Make people feel a part of the program. Eventually, you will need all the employees to participate

in the program. BBs will lead the projects, but they will need the benefit of employees with intimate knowledge and experience to help plan and execute the projects.

- g) Project selection: Focus on critical to quality (CTQ) to ensure a noticeable difference when project completes and bring financial benefit to the business. Gather field quality data, benchmark critical processes and determine the cost of poor quality are part of the approaches in identifying a project.
- h) Project tracking: A good tracking system is a management tool that tracks the cumulative results, alerts you to projects that are stalled, leverages lesson learned, and maintain a history file to benefit future process owners.
- i) Incentive program: Do not let people feel that BB role is going to sidetrack them and they will fall behind their peers.
- j) Develop a supplier plan: While many businesses focus on their core competencies, a supplier with poor quality becomes a weak link. If we don't help our suppliers improve, the quality of the parts, materials, assemblies or services could be substandard to the rest of the product or services we supply our customer.

Lean is a manufacturing philosophy that shortens the lead time between a customer order and the shipment of the products or parts through the elimination of all forms of waste. Lean helps companies reduce costs, cycle times and unnecessary, non value added activities, resulting in a more competitive, agile and market responsive company. The reasons why lean manufacturing is a particularly important winning strategy today include the following:

- The need to compete effectively in the global economy
- Pressure from customers for price reduction
- Fast paced technological changes
- Continued marketplace focus on quality cost and on-time delivery
- Original equipment manufacturers' (OEMs) holding on to their core competencies and outsourcing the rest
- Ever increasing customer expectation.
- The need to standardize processes to consistently get expected results.

One of the main elements in lean manufacturing is reduction or elimination of waste. There are eight types of waste:

- a) Overproduction: make more or faster than required by the next process.
- b) Inventory waste: any supply in excess, whether it is raw material, work in process or finished good.
- c) Defective product: product requires inspection, sorting, scrapping, downgrading, replacement or repair.
- d) Over processing: extra effort that adds no value to the product/service.
- e) Waiting: idle time waiting for manpower, materials, machinery, measurement or information.
- f) People: people's mental, skill and experience not fully

utilised.

- g) Motion: any movement of people, tooling and equipment that does not add value to the product of service.
- h) Transportation waste: movement of parts or materials around the plant.

The continuous reduction or elimination of waste results in surprising large reduction in costs and cycle time. Statistical tools, including the Six Sigma DMAIC methodology can be adopted to attach such waste.

To ensure a successful implementation of lean manufacturing, the following techniques and tools can be used as the lean building blocks:

- a) 5S: (refer to 5S method for more information).
- b) Visual controls: all tooling, parts, production activities and indicators are in view so everyone involved can understand the status of the system at a glance.
- c) Streamlined layout: plant layout is designed according to optimum operational sequence.
- d) Standardized work: performance of task is consistent according to prescribe methods.
- e) Teams: emphasise on working in team.
- f) Quality at the source: inspection and process control is carried out by the operators so they are certain the product passed on to the next process is of acceptable quality.
- g) Point of use storage: raw materials, parts, information, tolling, work standards and procedures are stored where they are needed.
- h) Quick changeover: able to change tooling and fixtures rapidly.
- i) Pull and Kanban system: cascade production and delivery instruction from downstream to upstream activities.
- j) Cellular or flow: physically link and arrange manual and machine process steps into the most efficient combination.
- k) Total productive maintenance: maximizes overall equipment effectiveness.

Just-in-Time (JIT) is a US term coined to describe the Toyota production system, recognised as one of the most efficient manufacturing operations in the world. In many aspects, JIT resembles lean manufacturing.

Its emphasis on elimination of waste incorporates with series of elements as follow:

- a) Flexible resources: creates multifunctional workers with the ability to perform more than one task/job and general-purpose machines with the ability to perform several basic functions.
- b) Cellular layouts: creates manufacturing cells that comprise of dissimilar machines brought together to manufacture a family of parts.
- c) Pull production system: emphasises the supermarket approach and relies on customer requests to pull productions/components through the system.
- d) Kanban production: corresponds to a standard quantity of

production or size of container and contains such information as part number, description, type of container, unit load, preceding station, and subsequent station.

- e) Small-lot production: incorporates the production of small amounts at a time.
- f) Quick set-ups: incorporates SMED (Single minute exchange of dies) that focuses on the principles for quick set-ups.
- g) Uniform production: streamline the production requirements on the assembly line to reduce variability through more accurate forecasts.

The inherent benefits for the implementation of JIT are:

- a) Reduce inventory
- b) Improved quality
- c) Lower costs
- d) Shorter lead time
- e) Better relations with suppliers
- f) Better use of human resources

The 5S method provides a foundation for delivering high quality products and service in the right quantity at the right time to satisfy customer needs – a perfect starting point for companies to begin their journey towards lean manufacturing as well as intermediate step to emphasize the value of workplace organization and process discipline.

5-S is the acronym for five Japanese words Seiri, Seiton, Seiso, Seiketsu and Shitsuke. When translated these words literally mean Sort, Set, Shine, Standardise and Self-discipline, respectively. The Japanese have been widely practising 5-S technique and believe it can help in all aspects of life.

In 1995, an intensive questionnaire survey was performed in the UK and Japan. About 80 per cent of the Japanese companies had practiced 5-S as opposed to 40 per cent in the UK. The main overall finding was that Japanese 5-S practice was an important base for implementing TQM successfully. Lack of 5-S will lead to inefficiency, waste, low morale, poor quality, high costs and an inability to meet delivery terms. Related initiatives used by organizations practicing 5-S include Lean Manufacturing, TPM, ISO 9001/14001, Just-In-Time (JIT), Six Sigma, Environmental Management Audit Scheme, Investors in People and the EFQM Excellence Model. This confirms findings from the literature on the importance of synergy with existing improvement programmes. Benefits include better housekeeping, safety and working environment; improved quality, efficiency, stock accuracy and productivity; reduced waste, lead times and costs; smoother work flow; culture change; visual improvement; customer awareness; disciplined approach; empowerment and standardised operations.

So what is 5-S? In general, 5-S is defined as below:

- a) Seiri: Distinguish between what is needed and to be kept and what is not needed and to be discarded
- b) Seiton: Decide where things belong so that anyone can

find and use them easily.

- c) Seiso: Consider dirt and untidiness intolerable.
- d) Seiketsu: Standardise cleanup and ensure all techniques and methods are clear and understood.
- e) Shitsuke: Discipline and draws together the other four Ss ensuring they are used properly.

So, it is evident that 5-S is not just about keeping your house in order but also a matter of ensuring that it stays that way. This requires a culture of continuous improvement with the rigour of applied standardisation.

Xerox 1979, as it is known today, formally developed the benchmarking process. Over the years, it has become a study of processes and a significant strategic tool integrated to TQM. TQM is the wheel for improvement conducting an internal value adding activities for the end customer, whereas, benchmarking is the external activity aimed at identifying opportunities to ensure that the improvement wheel is turning in the right direction towards achieving high standards of competitiveness. Xerox defines benchmarking as "A continuous, systematic process of evaluating companies recognised as industry leaders, to determine business and work process that represent best practices, establish rational performance goals".

There are four essential types of benchmarking, namely:

- a) Competitive benchmarking: Comparison with primary competitors
- b) Functional benchmarking: Comparison with similar functions or processes within the same broad industry leaders or partners.
- c) Generic benchmarking: Comparison with similar functions or process regardless of type of industry.
- d) Internal benchmarking: Comparison within the set up of one's own corporation.

The four-phase model for developing a benchmarking study as suggested by APQC is as follow:

- a) Plan
 - Select the benchmarking team and establish the scope of the study.
 - Examine own process thoroughly.
 - Determine your process performance level and begin to identify potential partners.
- b) Collect
 - Develop database to store information collected from surveys as quantitative information.
 - Perform site visits to collect information.
 - Identify current practices which may need to be revisited, or view opportunity for improvement
- c) Analysis
 - Compare the quantitative results of your organization's process with that of your best-practice partner.
 - Identify gaps and develop a process to close those gaps and adapt their techniques to fit your process.

d) Implementation

- Implement the process, and monitor and report progress.
- Recalibrate and recycle the study in order to learn from continuous improvement.

Once again, to ensure a successful benchmarking program, senior management commitment is a must and they must acquire a deep understanding of the process to make a better-informed decision.

5. Conclusion

It is inevitable more and more companies will adopt TQM in this ever-increasing competitive world market. Moreover, incorporating TQM into strategic planning provides the best opportunity for a successful business venture. Increasing customer requirements, higher demand for quality of product or services, thinning profit margin due to global price competition, more stringent regulatory control, and so on continue to challenge all sort of businesses. Hence, controlling the cost of manufacturing is one of the key factors for sustainability and performance excellence. And to do that, TQM is the formula.

However, to implement TQM does not guarantee success as clearly shown in the review of literatures. Why?

It is reasonable and justifiable to argue that initiating a TQM program merely by recognising the importance of TQM and the success story of other companies, but without looking at why some companies failed, or not being able to select the appropriate quality improvement tools or management tools is likened to "A voyager who sails in the Pacific Ocean without appropriate navigation equipments, will one day lose his direction and confidence, run out of fuel, get extremely exhausted and run the risk of being swallowed by the ferocious waves"

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