Asian Academy of Management Journal. **6(2)**: 55-72 (2001)

COMPETING THROUGH QUALITY

Salleh Yahya
Lailawati Mohd. Salleh
Goh Wee Keat
Universiti Kebangsaan Malaysia

ABSTRACT

This paper provides information on the following quality practices in a Malaysian context: (1) general quality status, (2) application of quality tools and techniques, (3) implementation of TQM, (4) certification of ISO 9000, (5) practices of quality costing and (6) critical success factors of quality efforts. Cross-sectional data of 405 Malaysian companies is collected and analysed. Based on the results, a Quality Development Model designated for the implementation of a quality programme is formulated. This model comprises of four continuous improvement stages, namely: (1) assessment, (2) development, (3) deployment, and (4) review.

INTRODUCTION

Organisations have four strategies to compete in the market place namely quality, speed, flexibility, and cost. Among these four strategies, quality has many distinct dimensions and meanings. While IT, e-commerce, and knowledge management overshadow the critical need for quality, Dale et al. (2000) claim that the role of quality still bears significant competitive advantage for businesses and organizations. They have argued that "in both traditional and the current high technological markets, improvements to the design, build/assembly, quality, services and business will always be necessary".

Quality strategy could be pursued through Total Quality Management (TQM), ISO 9000 certification, continuous improvement, total preventive maintenance, six-sigma, and other quality approaches. Each of these approaches possesses its own distinct hallmark, and emerged due to the different needs of business communities. For instance, the concept of TQM emanated from the concept of Total Quality Control, and stresses on customer satisfaction. The emergence of the ISO series of quality certifications that emerged from the BS 5750 series is due to the need for one national quality standard. As for six-sigma improvement approach, it operates on the concept of identifying causes of variation and overcoming them (Dale et al. 2000).

Although the quality approaches mentioned above vary in their concept and approach to improve quality standards, they all require application of quality tools and techniques. These tools and techniques could be grouped into statistical and managerial tools. The first group operates on numerical data and mathematical calculations, while the second group operates on qualitative data such as ideas and opinions. Examples of statistical tools are Statistical Process Control (SPC), and the seven basic quality control tools proposed by Dr Kaoru Ishikawa. On the other hand, examples of managerial tools are quality function deployment, quality control circle and process decision programme chart.

Many researchers have claimed the effectiveness of quality approach in improving organisational performance. Studies on the adoption of TQM and its relationship with organizational performance have shown positive results (Prabhu et al., 2000; Solis et al., 1998; Terziovski and Samson, 1999). Questionnaire surveys on ISO 9000 certified companies have also reported favourable outcomes for ISO 9000 implementation (Buttle, 1997; Leung et al., 1999; Lipovatz et al., 1999). Dale et al. (2000) cited several cases of improvement in organizational performance due to the implementation of the six-sigma approach.

All favourable outcomes of quality approach is, however, hard to come by. Obstacles such as employees' acceptance, top management support, level of understanding pertaining to quality, resources, and poor internal control have been recorded by researchers that examined TQM implementation (Idris et al. 1996; Lakhe and Mohanty, 1994). Similar problems are also reported by studies on ISO 9000 implementation (Chin et al., 2000; McCullough and Laurie, 1995; Quazi and Padibjo, 1998). Furthermore, misinterpretation of ISO 9000 requirements and over-development of quality systems are some of the specific pitfalls of ISO 9000 preparation and implementation (Kim, 1994). On quality tools and techniques, the degree of complexity in operating them influences the extent of usage and effectiveness in improving quality performance (Chapman and Hyland, 1997; Lam, 1996).

This study aims to assess quality issues by using questionnaire surveys. This paper is organised as follows: section 2 describes the methodology of this study, section 3 documents the findings of the study, and section 4 presents the proposed Quality Development Model.

METHODOLOGY

Questionnaire survey was employed in this study to solicit the required quality information. In the questionnaire, six areas of quality information were addressed: (1) general quality status, (2) application of quality tools and techniques, (3) implementation of TQM, (4) certification of ISO 9000, (5) practices of quality costing, (6) critical success factors of quality efforts. The questions asked in each of these areas were:

1. General quality status
   - Are you aware of how your customer defines the quality of your product?
   - In the history of your organization, do you experience any quality problem?
   - Please indicate the percentage of quality problems in your organization that is related to people, machines, and raw materials.
   - Which of the following element(s) needs to be continuously improved: people, task, process, technology, and/or organization?

2. Application of quality tools and techniques
   - Please indicate the quality tools and techniques that are being used in your organization. (18 types of quality tools and techniques are listed in the questionnaire).
   - What kinds of problems are encountered during implementation of quality programs, use of quality tools and techniques?
   - What kind of statistical training is conducted to support application of quality tools and techniques?

3. Implementation of TQM
   - The benefits of TQM implementation?
   - How does TQM affect your organization's attitude towards customers, improvement in quality, and employee participation in quality improvement?
   - What kind of training has been conducted to support TQM implementation?
   - What are the reasons for not adopting TQM?

4. Certification of ISO 9000
   - The reasons for applying ISO 9000 certification.
   - Which elements or requirements of ISO 9000 are difficult to fulfil?
   - The extent of internal benefits derived from ISO 9000 certificate registration: scrap/rework, inter-company communications, departmental/cross functional co-operation, documentation, measurement system, cultural change, quality awareness, and prevention.

- The extent of external benefits derived from ISO 9000 certificate registration: customer satisfaction, market share, perceived quality, company's glory, competitive edge, time to market, and quality audits (external).

5. Practice of quality costing
   - Do you measure the cost of quality in your organization?
   - Objective of quality costing?
   - Elements that are measured under quality costs? (Respondents are asked to indicate which of the 19 elements listed in the questionnaire are being measured by their organisation).
   - Please indicate the difficulties faced in measuring and reporting quality cost.

6. Critical success factors of quality efforts
   - Please indicate the degree of importance of these factors for the success of quality management: top management, quality policies, role of quality department, training, product design, vendor quality management, process design, quality data, feedback and employee relations.

The questionnaires were mailed to 3291 companies in 1999, which were randomly selected from companies listed on the Kuala Lumpur Stock Exchange, FMM report (1999), and SIRIM list of ISO 9000 certified companies. A total of 405 sets of usable questionnaires were successfully retrieved in 2000, yielding a response rate of 12.3 percent. In terms of quality program adoption, 26.67% of the respondents implement both TQM and ISO 9000, 52.84% implement either TQM or ISO 9000, with the remaining 20.49% implementing other quality approaches. The breakdown of respondents in terms of paid up capital is (in Ringgit Malaysia): below 10 million (56.47%), 10 to 50 million (35.61%), and more than 50 million (7.91%). In terms of sectors, the distribution of respondents is manufacturing and processing (63.70%), electrical and electronic (23.46%), commodities (11.36%) and services (1.48%).

RESULTS

The results on overall quality status is summarised in Table 1. 82.70% of respondents are aware of their customers' quality needs for their products. Almost all of the respondents experienced some degree of quality problem. This is a critical issue because half of the respondents did not realise they had quality problems until customers complained. The source of quality problem comes mainly from human error, with an average percentage of 46.20. This is confirmed by the result for "elements that need to be improved", where 72.86% of the respondents indicate that people need to be continuously improved.

Table 1: General Quality Status

					Yes (%)	**No (%)**
Aware of customer's definition of quality?					82.70	14.80
Does your organization experience any quality problem?					92.00	8.00
Degree of quality problem						
Workers able to solve minor problems.					56.70	43.30
Management needs to solve problems.					54.70	45.30
Problems not identified until customers complain.					51.40	48.60
Problems cause major complaints from customers.					19.70	80.30
The percentage of quality problem associated with:					**Mean**	**S.D.**
People					46.20	0.24
Machines					24.96	0.19
Raw material					24.49	0.21
Element that needs to be improved:	**n.a.**	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**
People	0.25	0.50	0.75	5.78	19.85	72.86
Task	3.60	2.83	2.31	21.34	37.53	32.39
Process	0.50	0.25	3.53	17.13	28.97	49.62
Technology	2.01	0.50	5.28	18.59	24.87	48.74
Organization	1.78	1.52	6.60	21.07	36.04	32.99

Notes:
S.D.= Standard deviation, 5 = Need to be continuously improved to 1 = No need to be improved and n.a. = Not applicable

As for quality tools and techniques, with the exception of scatter diagram, it is found that tools such as the seven basic quality control tools, quality control circle, and SPC, are well accepted by respondents. In contrast, adoption of managerial tools is less encouraging compared to statistical tools, as documented in Table 2. The results of statistical tools training shows similar pattern with acceptance of quality tools, whereby training on the seven basic quality control tools and SPC is conducted by majority of the respondents. The major difficulty faced by respondents in applying the tools and techniques is a lack of knowledge in the tool employed, leading to the problem of them not understanding its usage and resisting using it.

Table 2: Application of Tools and Techniques

Tools	**(%)**
Pareto Analysis	63.54
Histogram Analysis	71.20
Check Sheet	89.92
Flow Chart	90.37
Control Chart	80.48
Scatter Diagram	28.28
Cause and Effect Diagram	60.45
Run Chart	24.00
Affinity Diagram	9.01
Interrelation Digraph	12.50
Tree Diagram	24.49
Prioritisation Matrices	18.26
Matrix Diagram	30.03
Process Decision Program Chart	27.67
Activity Network Diagram	15.34
Nominal Group Technique	13.35
Quality Control Circle	60.89
Statistical Process Control	73.22
Total Productive Maintenance	46.72
Statistical training on tools and techniques	**(%)**
Statistical	
SPC	30.53
7 basic QC tools	14.02
FMEA	3.43
6-sigma	1.87
DOE	1.87
Others	5.92
Technical	21.5
Management	
QCC	4.05
5-S	3.12
Others	13.71
Difficulties in application of tools and techniques	**(%)**
Lack of understanding	30.77
Resistance	11.54
Data	16.35
Analysis and Interpretation	6.73
Application	11.54
Resource constraint	4.81
Problems in SPC tools	8.65
Others	9.62

Based on the responses given by respondents who implemented TQM, majority of them took about two and a half years to fully incorporate TQM into their organization's operations. Approximately 70% of respondents indicated that their quality standards have improved significantly. About 66% and 62% of respondents indicate that implementation of TQM has significantly improved organization attitude towards customers, and employee involvement respectively. The training conducted to support TQM implementation is found to concentrate on three areas: understanding of quality and TQM concepts, quality tools and techniques, and operational skills (including managerial and processes). For respondents who did not implement TQM, the major obstacles identified were organizational constraints, employee attitude, and preference for other quality approaches. With regards to organizational constraints, many are still in the preparation process for TQM implementation due to constraints such as finance, human resource and expertise. Results on TQM implementation are summarised in Table 3a and Table 3b.

Table 3a: Implementation of TQM

The benefits of TQM implementation	**(%)**
Employees' benefits	
Empowerment	0.54
Involvement/commitment/teamwork/communication	
Skill & knowledge	3.26
Employees' better performance	2.72
Working environment	2.17
Quality awareness/culture	7.07
Firm's benefits	
Reduced defect rate	3.26
Increased sales/profits	4.35
Productivity	8.15
Improve quality	9.78
Control of quality/good quality management	4.35
Systematic management	5.43
Reduced waste/cost	9.24
Efficiency/effectiveness/productivity	7.61
Image/reputation	1.63
Process training	6.08
Team's ability	
Leadership	5.41
Teambuilding	3.38
Others	25.68

Table 3b: Implementation of TQM

Impact of TQM on organisation's attitude towards:	**Not applicable**	* [1]	[2]	[3]	[4]	[5]
	(in percentage)					
Customers	0.88	0.88	0.00	5.31	27.43	65.49
Quality	0.00	0.00	0.86	6.90	21.55	70.69
Employees	0.00	0.87	1.74	5.22	30.43	61.74
Reasons For Not Employing TQM	**(%)**					
Constraints						
Financial	3.95					
Other quality method	8.77					
Criticism						
Too costly	1.32					
Not applicable/suitable/practical	4.39					
Not effective	0.88					
Not necessary	4.39					

Note:
* [1]=not at all, [2]=less significant, [3]=moderately significant, [4]=almost significant, [5]=very significant)

The main reasons for introducing the quality assurance system ISO 9000 are due to internal drive for organisational improvement, external pressure (customers, market, business requirement) and combination of both reasons. In terms of ISO 9000 implementation, seven elements are found difficult to satisfy: Corrective and preventive actions, Design control, Management responsibility, Statistical techniques, Process control, Document and data control, and Quality system. In contrast, these three elements are easier to implement: Inspection and test status, Packaging, preservation, and delivery, and Inspection and testing. The main internal benefits driven from ISO 9000 implementation are more systematic documentation, greater quality awareness, and improvement in measurement system. As for external benefits, these items are identified: improved customer satisfaction, higher perceived quality, and competitive edge. The details of ISO 9000 implementation results are documented in Table 4.

Table 4: Certification of ISO 9000

Degree of difficulty in satisfying elements of ISO 9000	*Mean	S.D.
Management Responsibility	2.67	1.18
Quality System	2.64	1.06
Contract Review	2.42	1.05
Design Control	2.85	1.14
Document and Data Control	2.65	1.12
Purchasing	2.38	1.01
Control of Customer-Supplier Product	2.44	1.08
Product Identification and Traceability	2.37	1.07
Process Control	2.66	1.07
Inspection and Testing	2.32	1.04
Control of Inspection, Measuring and Test Equipment	2.36	1.04
Inspection and Test Status	2.22	1.04
Control of Nonconformity Product	2.56	1.04
Corrective and Preventive Action	3.04	1.10
Handling, Storage, Packaging, Preservation and Delivery	2.29	0.98
Control of Quality Records	2.35	1.13
Internal Quality Audits	2.52	1.07
Training	2.55	1.07
Servicing	2.39	0.96
Statistical Techniques	2.66	1.07
Internal benefits of ISO 9000 implementation	***Mean**	**S.D.**
Reduced scrap/rework expenses	3.80	1.00
Enhanced inter-company communications	3.87	0.87
Improved departmental/ cross functional co-operation	4.04	0.85
Better documentation	4.44	0.72
Improved measurement system	4.13	0.79
Positive cultural change	3.88	0.88
Greater quality awareness	4.25	0.75
Increased prevention activities	4.03	0.85
(Cronbach alpha=0.7852)		
External benefits of ISO 9000 implementation	***Mean**	**S.D.**
Improved customer satisfaction	4.43	0.75
Increased market share	3.79	1.07
Higher perceived quality	4.27	0.81
Glory for the company	3.93	1.09
Competitive edge	4.25	0.85
Quicker time to market	3.47	1.07
Reduced quality audits	3.02	1.18
(Cronbach alpha=0.8382)		
(* The mean scores are calculated from responses on a 5-point Likert scale with 5=most important to 1=less important, S.D. = standard deviation)		

Assessment of quality cost is practised by 48.64% of the respondents (Table 5). The main purpose of quality costing is to benchmark existing quality standards, and minimise unnecessary quality cost to achieve greater efficiency. Items used by a majority of the respondents to measure quality cost are testing, work-in-process, and finished goods inspection, scrap, rework, and customer complaint handling. However, items, which are less popular, include quality planning, quality engineering, preventive maintenance and raw material inspection. The basic difficulties faced during quality costing are quantifying intangible costs, data availability and accuracy, internal (employees, departments) and external (customers, suppliers) support, and heavy workload.

Table 5: Practice of Quality Costing

Re-testing	59.39
Customer complaint handling	75.63
Warranty replacement and repair	58.38
Raw material inspection	57.36
Product recall	54.82
Lawsuits	28.93
Objective of Quality Costing	**(%)**
Benchmarking	12.55
Control & monitoring	9.09
Prevention & solution	4.33
Part of quality program/effort	3.03
Prevention & solution	4.33
Part of quality program/effort	3.03
Data analysis (managerial purpose)	6.06
Reduce cost	11.69
Reduce wastage, rework and reject	8.66
Reduce failure cost (internal and external)	1.30
Improvement of performance & quality	12.55
Quality product with reasonable cost	4.33
Productivity and efficiency	3.03
Increase sales/profits	3.03
Detect causes and identify needed areas of improvement	4.76
Cost justification/costing	11.26
Customer concern	4.33

Table 5: Practice of Quality Costing (continued)

Elements measured in Quality Costing	**(%)**
Quality planning	55.33
Quality engineering	50.76
Preventive maintenance	69.04
Supplier quality assurances	58.38
Training and improvement programs	66.50
Raw material inspection	68.53
Calibration	65.99
Testing	73.10
Work in process and finished goods inspection	69.54
Quality audits	60.91
Scrap	72.59
Rework	78.17
Bottleneck and down time	49.75
Difficulties in Quality Costing	**(%)**
Data collection	19.69
Data accuracy	15.75
Late information/feedback	2.36
Quantifying the cost	22.05
Subjectivity of cost definition	7.87
Staff commitment	2.36
Communication & co-operation between departments	6.30
Communication & co-operation of suppliers/customers	4.72
Understanding & experience of staff in quality costing	3.94
Time constraint/consuming	7.09
Additional/extra work needed	3.15

The most critical factor of quality approach implementation is support from top management. Quality policies that provide clear direction and guidance to employees is also another factor. This is followed by (in descending order of importance) training, feedback and employee relations, and role of quality department. Results in Table 6 suggest that human factors bear significant weight in determining the success of quality initiatives, as shown in the mean scores.

Table 6: Critical Success Factors of Quality Improvement

	Mean*	Standard Deviation
Top Management	8.64	0.95
Quality Policy	7.83	1.52
Role of Quality Department	7.37	1.78
Training	7.81	1.34
Product Design	6.85	2.08
Vendor Quality Management	6.85	2.00
Process design	7.12	1.98
Quality Data	7.06	2.00
Feedback and Employee Relation	7.38	2.01
(Cronbach Alpha=0.8579)		

DISCUSSION

The survey results reveal human error as the main cause of quality problem. These problems are detected only when customers make their complaints. This also signals the lack of interaction and feedback between producers and customers. Realising the need to overcome quality problems, most respondents have carried out some programs or other to achieve higher quality standards and performance.

For respondents who implemented TQM, focus is placed on educating the employees on TQM and quality concepts. The outcomes of implementation have generally been favourable. Studies by Peak (1993), Prabhu et al. (2000), Sun (1999), and Terziovski and Samson (1999) have also registered positive outcomes of TQM implementation. However, some of the respondents preferred other quality approaches, especially quality assurance system of ISO 9000, an internationally recognised quality certificate. The implementation of ISO 9000 has also improved several areas of organisational performance. Similar findings have also been derived from other studies (see Jones et al., 1997; Lipovatz et al., 1999; Quazi and Padibjo, 1998).

Although quality initiatives have been adopted by majority of the respondents, the use of quality tools and techniques seems less encouraging. The seven basic quality control tools, SPC and QCC are used extensively, but this is not the case for other managerial tools. Studies of Chapman and Hyland (1997) and Lam (1996) also exhibit similar results. We view this outcome as the result of ease of learning and using the tools and techniques. According to Straker (1995), the ease of learning and applying process for each quality tools has significant influence on the usability of a tool. It may be that the seven basic quality control tools and SPC are easier to learn and apply if compared to

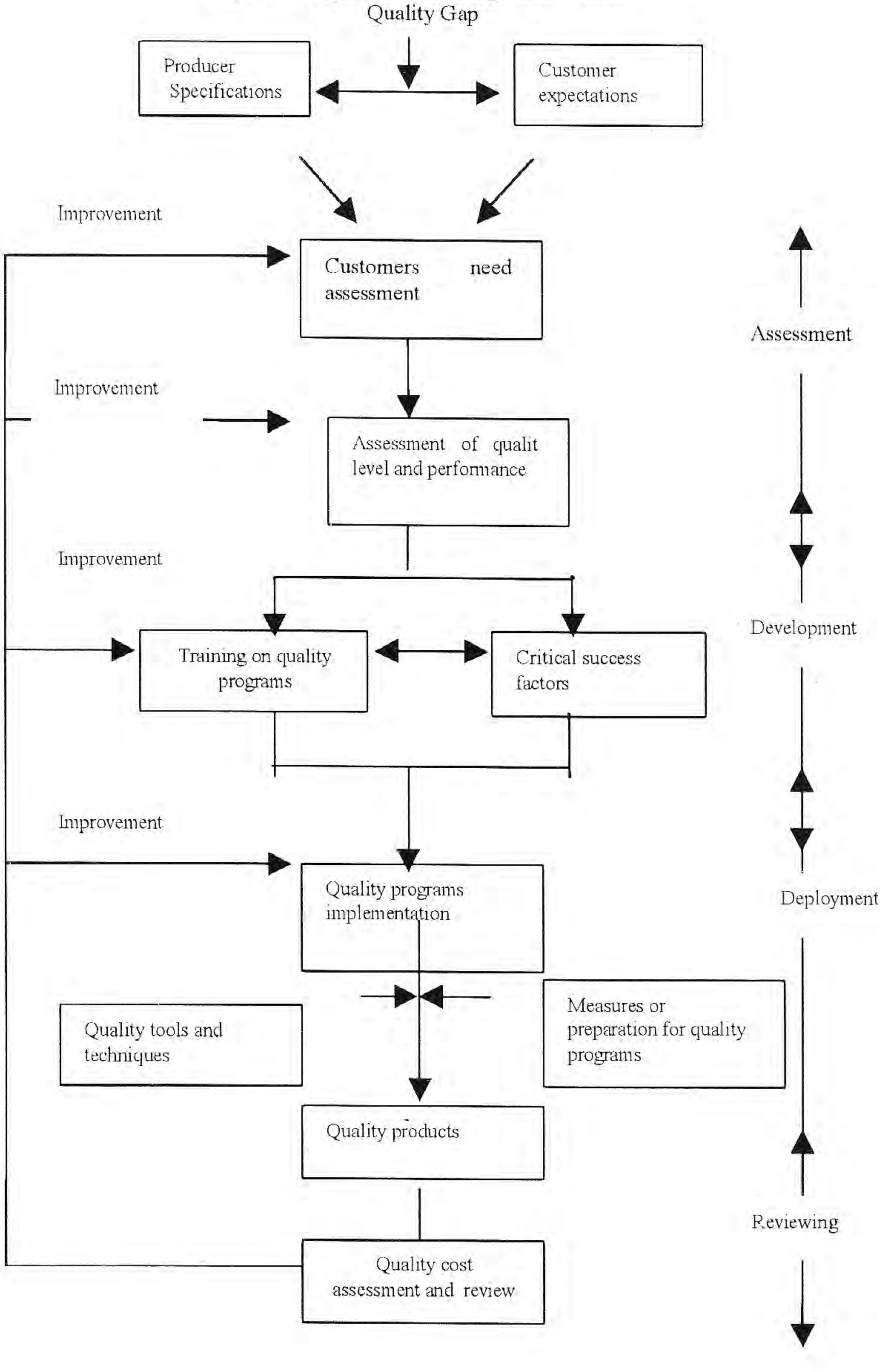
managerial tools such as quality function deployment, which has lead to prevalence of basic QC tools. It could also be that majority of Malaysian firms concentrate more on control of operations and processes through identification of special variation. This is reflected on items measured for quality cost, where appraisal costs is selected and quantified. To summarise, conformance to specification is the mainstream of quality practice in Malaysian firms.

The experience of TQM, ISO 9000, or other quality approaches, has made managers realise that support from the top management is crucial in adopting and sustaining any quality initiatives. Apart from that, formulating quality polices should be drawn up before formal implementation of quality approach is introduced, as it helps orchestrate employees to act in a synchronised ways during implementation of quality initiatives. Also right and sufficient employee and manager training need to be undertaken properly. After the preparation stage, feedback from employees should be gathered consistently to address any difficulties encountered during the process of implementing quality plans and programs.

Quality Development Model

Based on empirical findings derived from this study, a model of quality adoption program comprising of four stages could be proposed. They are Assessment, Development, Deployment, and Reviewing. This model will be known as Quality Development Model (QDM). It will highlight areas that need polishing before the formal implementation of the quality initiatives. Figure 1 shows the whole building block of QDM.

Figure 1: Quality Development Model



Following the QDM, producers (including manufacturers and service providers) who intend to take on any form of quality initiatives should first solicit their customers' needs and wants, and appraise their performance from the customers' perspective. This stage is critical, as apart from attaining a quality standard and expectation level, producers must also capture the precise quality direction of their customers. A quality gap will occur if there is divergence between quality direction and performance of producers with customers. If a quality gap exists, it is then necessary for the producers to implement quality improvement program to reduce the gap immediately. The above activities are carried out at the Assessment stage of QDM.

Before any attempt of a formal quality program implementation, some groundwork should be done in the Development stage of QDM. First, producers should ensure that adequate resources (time, finance, technology) are available for a quality program implementation. Then, the top management should exhibit their determination in implementing the quality program. Open communication between top management and employees should be established to gain employees' commitment. Another important element that must be attended to by the quality-interested company is the quality policies and guidelines. When both policies and guidelines are formulated and communicated to all employees and managers, producers could proceed with the training on quality concepts, and the tools and techniques.

For producers who wish to employ TQM, the courses and training conducted should cover TQM concepts, and managerial and teambuilding skills. As for applicants of ISO 9000 series of standard, the focus of training must be placed on understanding the entire quality assurance system, and its relation with the organization system and processes. This is because the survey results of ISO 9000 implementation reveal that requirements that are highly associated with quality systems tend to exhibit a higher degree of difficulty to be achieved.

On the training of quality tools and techniques, it should cover mathematical courses that are essential to operation of quality control tools, and also the concept of managerial tools to managers and supervisors. The preparation for quality costing should cover these areas: the concept of intangible cost and its measurement, data collection procedures, and skills related to departmental co-ordination and co-operation.

When all the preparation work is done, the producers could then begin the quality program implementation. In this Deployment stage, producers must attend to the feedback of employees periodically, to see if there are any flaws in the design of quality improvement plans and programs. Co-operation of quality department, top management, and employees is necessary to ensure smooth transition from normal daily operation to quality-oriented operation and procedures. Supervision on application of tools and techniques is another exercise that should not be neglected. Finally, producers should also ensure that sufficient attention is given to the critical success factors identified earlier.

After the implementation of a quality program, assessment and review of organizational operation and performance is needed. In this Reviewing stage, existing organizational operations and performance are to be assessed and compared with previous performance levels along with the review on the progress and implementation of quality initiatives conducted. If there are any setbacks identified in any steps or processes from the previous stages (Assessment, Development, and Deployment), appropriate adjustments should be made. These adjustments would depend on the situation occurring in companies that have implemented quality programs.

CONCLUSION

This study has indicated various status, aspects and procurement of quality. From the information gathered a Quality Development Model focusing on competing through quality is then established. It is believed that the four stages of QDM proposed, which represents a continuous flow of quality improvement process, will remove much of the quality barriers away and bring quality success into organizations. As such, most of the possible benefits from the execution of quality initiatives, such as better understanding of customers, improvement in quality performance, improved employee involvement, and more systematic documentation, can be derived. It would also be fair to say that the general framework of QDM proposed is applicable to all manufacturing and service providers in their quest for better quality.

REFERENCES

Buttle, F. (1997). ISO 9000: marketing motivations and benefits. International Journal of Quality & Reliability Management. 14(9), pp. 936-947.

Chapman, R.L. and Hyland, P.W. (1997). Continuous improvement strategies across selected Australian manufacturing sectors. Benchmarking for Quality Management &Technology. 4 (3), pp. 175-188.

Chin, K.W., Poon G.K.K. and Pun K.F. (2000). The critical maintenance issues of the ISO 9000 system: Hong Kong manufacturing industries' perspective. Work Study. 49(3), pp. 89-96.

Dale, B.G., Williams, R.T. and van der Wiele, T. (2000). Marginalisation of quality: is there a case to answer? The TQM Magazine. 12(4), pp. 266-274.

Idris, M.A., McEwan, W. and Belavendram, N. (1996). The adoption of ISO 9000 and Total Quality Management in Malaysia. The TQM Magazine. 8(5), pp. 65-68.

Jones, R., Arndt, G. and Kustin, R. (1997). ISO 9000 among Australian companies: impact of time and reasons for seeking certification on perceptions of benefits received. International Journal of Quality & Reliability Management. 14(7), pp. 650-660.

Kim, Y. (1994). ISO – Making companies competitive. Quality in Manufacturing. November-December, pp. 26.

Lakhe, R.R. and Mohanty, R.P. (1994). Concepts, evolution and acceptability in developing economies. International Journal of Quality & Reliability Management. 11(9), 9-33.

Lam S.K. (1996). Application of quality improvement tools in Hong Kong: an empirical analysis. Total Quality Management. 7 (6), pp. 675-680.

Leung, H.K.N., Chan, K.C.C. and Lee, T.Y. (1999). Costs and benefits of ISO 9000 series: a practical study. International Journal of Quality & Reliability Management. 16(7), pp. 675-690.

Lipovatz, D., Stenos, F. and Vaka, A. (1999). Implementation of ISO 9000 quality systems in Greek enterprises. International Journal of Quality &Reliability Management. 16(6), pp. 534-551.

McCullough, L. and Laurie, A. (1995). ISO 9001: after registration, then what? Proceedings of ANTEC Annual Technical Conference. 3.

Prabhu, V., Appleby A., Yarrow, D. and Mitchell, E. (2000). The impact of ISO 9000 and TQM on best practice/performance. The TQM Magazine. 12(2), pp. 84-91.

Quazi, H.A. and Padibjo, S.R. (1998). A journey toward total quality management through ISO 9000 certification – a study on small-and medium-sized enterprises in Singapore. International Journal of Quality & Reliability Management. 15(5), pp. 489-508.

Solis, L.E., Subba Rao, S., Raghu-Nathan, T.S., Chen C-Y and Pan S-C (1998). Quality management practices and quality results: a comparison of manufacturing and service sectors in Taiwan. Managing Service Quality. 8(1), pp. 46-54.

Straker, D. (1995). A Toolbook for Quality Improvement and Problem Solving. Englewood Cliffs: Prentice Hall.

Sun, H-Y. (1999). The patterns of implementing TQM versus ISO 9000 at the beginning of the 1990s. International Journal of Quality & Reliability Management. 16(3), pp. 201-214.

Terziovski, M and Samson, D. (1999). The link between total quality management practice and organisational performance. International Journal of Quality & Reliability Management. 16(3), pp. 226-237.