# Organisational Management of Quality and Its Importance: a Case of a Telecommunication Firm in UK

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## 1. Introduction

It is well known that total quality management (TQM) is the best quality management tool to improve the quality of product or service outputs. Quality approaches to management have been evolving over this century, beginning with Taylors (1947) scientific management. In the 1930s, Shewhart(1931) advocated improving work processes; after World War II, Deming and Juran(1986) helped the

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Japanese apply methods of quality control to all business functions of a company. TQM found its contemporary articulation in Feigenbaums book, Total Quality Control(1983). In the past decade, total quality (TQ) approaches to management have found application in a variety of U.S. industries.

The basic elements of TQM form the infrastructure for quality improvement; there are customer satisfaction, top manager commitment, strategy, team work, communication, supplier management, education and training, process management. Although the quality management system was well constructed and implemented, it failed to manage the soft areas like employee's attitudes, awareness, top manager's commitment, and the quality perception difference between tiers of management or between departments. These soft elements require the support of "hard" ones which require measurement, monitoring and improvement. According to Black(1994), these "hard" elements include process measurement, planning, system, design, quality costs, and customer feedback.

Some surveys was therefore required to investigate the employee's view of the TQM system. It was hoped that the results would supplement those emanating from a quality cost study, thereby motivating employees. This step can be more helpful after the quality management system has taken root in the factory in order to inform the concept of TQM to all employees ranging from top manager to operators or inspectors.

In order to motivate all employees to participate in a TQM programme, the employee's perception of the TQM activity needs to be studied in the factory. As far as the particular process or system problems are concerned, employees generally know them in detail, which is main reason to survey them.

This article identify the relative importance of critical factors of TQM to measure employee's perception toward the TQM system in an organisation. It will compare employee's perception for each attributes and the overall variables for quality measurement.

## 2. Conceptual approach of quality management

Quality has become a very important and popular word over recent years. For example, quality innovation, quality management, quality control, quality engineering and quality of life etc. are synonymous with survival in today's competitive market place (Garvin, 1988).

Juran and Gryna (1988) defined quality as "fitness for purpose" in other words, quality is assessed by the user, not the manufacturer, dealer, installer or maintenance engineer. Crosby's(1979) definition is "conformance to requirement". Since requirements can be specified in such standards as specification and procedures, Crosby's definition can be helpful in clarifying the quality responsibilities of employees(Juran and Gryna, 1988). Asher(1990) and Aubrey and Zimbler(1983) tend to follow Crosby's definition in applying quality costs in service industries. Asher's definition(1990) is "to continuously satisfy agreed customer requirements first time every time", and Aubrey's(1983) is "the degree to which a service conforms to predetermined standards".

But Garvin(1988) insists that quality should be defined differently in individual industry, and Harrington(1987) and Dotchin & Oakland(1992) argue that quality needs to have a more detailed definition by understanding the following three factors, the particular organisation as a whole, the procedure relating to specific activities and functions within the organisation, and the state of maturity and experience of the groups concerned.

Despite the difficulty in defining quality, it is obvious that quality is to do the correct things and do things right in all processes or activities first time, every time. It pursues the effectiveness and efficiency of every activity carried out in an organisation. It also aims to satisfy internal customer's requirements as well as those of external customers.

TQM comprises a group of ideas and techniques for enhancing competitive

performance by improving the quality of product and processes. The techniques and philosophy of quality management can be traced to Shewhart's(1931) seminal book. TQM has been rapidly disseminated through Japan, North America, and Europe since 1980s. But the Japanese companies had applied and developed in the preceding twenty-five years (Grant et al, 1994).

TQM is a new quality management tool far removed from traditional inspection, quality control and quality assurance. It pursues the quality of the product itself by focusing on managing the quality of the company as a whole. Therefore it is applied to all parts of a business, which requires a clear vision, prevents barriers between departments, invests in education, puts more emphasis on prevention rather than detection of quality problems, and maintains excellent customer relations.

The most basic idea of TQM is that everyone in an organisation makes an effort to satisfy the requirements of his/her internal and external customers. The commitment should start with top management. Following this, many other elements such as strategy, education and training, process management, continuous improvement, teamwork, and customer satisfaction, etc. should be incorporated into the basic structure of TQM. These elements are mostly attributed to quality gurus' philosophy about quality improvement.

Although methods to apply TQM differ from one company to another and from one country to another, TQM commonly centres around satisfying customer's requirements at the highest condition through continuous improvement. Wilkinson(1992) viewed TQM as a dichotomy of soft e.g. customer awareness, human resource management and hard e.g. SPC(statistical process control), quality systems issues while Motiska and Shilliff(1990) perceived leadership, procedures, data and information handling, on-going audits and performance measurement as the basic principles.

Quality improvement should occur in both hard/objective and soft/subjective technology areas to real benefits. Visible figures alone should not be used as a

business decision-making tool, for example short term financial data known as one of Deming's seven deadly diseases(Deming, 1986) but invisible ones should also be considered. A measurement system should also be established without damaging co-operation, participation, customer satisfaction, employee morale and leadership directed at continuous quality improvement.

Initially Desai and O'Brien(1983) used an open-ended questionnaires to determine variables which influence quality, the respondents opinion on each variable, the approaches used in measuring quality, and the quality improvement mechanisms. But in fact the employee's perception of quality management was initially studied by Saraph et al (1989). Since then, few perception studies have been performed. Badri(1994) applied his model to UAE(United Arab Emirates). Black and Porter(1995) developed a slightly different model from the previous two, mainly reflecting Baldridge Award (1993). And Clark et al(1994) studied management's perception of quality issues from the strategic viewpoint.

Talley(1991) emphasised the importance of considering effectiveness and efficiency when establishing quality measurements. He indicated four comments including to involve personnel in the design and deveploment of the measure and to use a family of indicators when developing measurement tools, especially within a white-collar organisation.

Quality gurus all recognise the importance of measurement to track progress and ensure quality improvement according to an established plan. They emphasise the use of the direct measures for evaluating performance because of the ease in establishing a standard. But an appraisal system should be used as a means to control its processes and not the workers (Newall and Dale, 1991).

According to Moss(1989), a correct appraisal system can be used by individuals or teams to diagnose problems and as a motivating and reviewing process. Meanwhile, Deming (1986) insisted that despite their advantages the method and type of data collection may hinder the successful development of a TQM culture.

## 3. Critical factors for quality measurement

The academic studies into TQM have been increasing to date, there are however few publications which organised and synthesised the various sets of critical factors proposed by different researchers. Saraph et al(1989) were prominent in this respect, developing general quality measurement factors relating to different companies including both manufacturing and services. Eight critical factors were constructed from the review of eight quality gurus' literature as an operational measure of quality management. These factors were developed using data collected from 162 general managers and the quality managers of 89 divisions of 20 service and manufacturing companies.

Badri et al(1994) applied Saraph et al's model with much lager sample size, whose survey was performed in a total 424 companies in UAE. A high-level division manager, quality staff manager, or the president participated to that study. The study proved that Saraph et al's model was a reliable and valid measure of the critical factors of quality management and successfully implemented in the different environment from USA. Black and Porter (1995) have extended Saraph et al(1989)'s methodology by using factor analysis to group scientifically the relative items under each critical factor. They then determined the relative importance of those items.

In the similar method, Yavas(1995) structured 24 variables into eight factors. Employee's perceptions of the dimensions of quality were studied by pay groups, major departments, and quality improvement team participation. It was noted that a significant number of employees did not agree that management had a high comment to quality. Derrick et al (1989) surveyed a cross section of top management, middle management and line worker in variety of industries, including manufacturing, services, construction and chemical industries.

Kasul and Motwani(1994) categorised eight critical factors into primary and

second group according to their importance. The relationship between two groups was investigated which can be used for strategic management. The top priority was on management commitment, the second on quality conformance, equipment or technology, and customer service, the last on the remainder.

A slightly different survey of employee quality perception was undertaken by Clark et al (1994) combined both Garvin (1987) and Parasuraman et al(1985, 1988) to investigate the Board's perceptions. The Garvin's model was used for the strategic TQM practices and the Parasuraman et al's for dimensional perspectives of customer quality respectively.

The research results were compared in Table 1. As seen in Table, management commitment and quality policy, quality measurement, process management, and employee management revealed to be essential factor in all publications. Contrary to this, cost management is rare except for Derrick et al(1989), Yavas(1995) and Kasul and Motwani(1994). Internal and external customer and supplier are only an independent factors in Yavas (1995). Kasul and Motwani(1994) included three particular factors considering the manufacturing company; equipment and technology, faculty control, and lead time. It is noted that the remainder is similar between each publication.

<Table 1> Comparison of critical factors in TQM

| Saraph | Black | Yavas (Derrick) | Kasul | MBNOQ |
|---|---|---|---|---|
| The management and quality policy | Corporate quality culture, Strategic management | Management commitment Organisation commitment | Management commitment | Top management's commitment and involvement |
| The role of quality department and communication | Teamwork structure, Communication of improvement information | Communication | | |
| Education and training | | Information and training | | |
| Quality data and reporting | Quality improvement measurement systems | Technical measures | Quality | Developing quality measures and goals |
| | | Internal/external customer and supplier | | |
| Process management | | Specifications, Performance testing | | Implementation of SPC in the production facility |
| Supplier quality management | Supplier partnership | | | Implementing new supplier relationships |
| Employee relations | People and customer management | Human resources, Employee commitment | | Participative management |
| Product /service design | Operational quality planning | Product | | Customer involvement, Use of concurrent engineering |
| | External interface management, Customer satisfaction orientation | | Customer service | Customer service |
| | | Cost | Value-added emphasis Equipment and technology Facility control Lead time Material policy | |

# 4. Methodology

## 4.1 Questionnaire Design, Sampling and Data Collection

A questionnaire was required to determine how employees perceive the TQM system carried out in the factory as a means of promoting quality improvement. It was divided into three parts and the ratio scaling approach used to collect the perception data.

Part I concentrated on questions which would identify or categorise respondents; they included their department, position title, working career, type of worker and involvement in quality improvement teams. All employees were thought to be eligible respondents unlike other publications which included only quality managers or general managers. Confidentiality was remained.

Part II was designed to measure 56 elements divided into nine critical factors of TQM using an interval response scale. This instrument uses five-point scales in order that employees are able to indicate the degree or extent which they perceive of each item of the TQM system (1 = very low, 2 = low, 3 = fair, 4 = high, 5 = very high).

A pilot survey was carried out to refine the questionnaire and enhance its reliability. The author randomly selected 25 managers, team leaders or employees from different Departments. Copies of the questionnaires were sent by post. An interview was arranged to validate the questionnaire. It focused on checking which variables were irrelevant, duplicated or obscure. The Quality Department played a key role in this because they were familiar with the overall quality management system. Some wording was changed in factors 3 and 6 as a result of this survey. Twenty elements were reported as being duplicated or irrelevant so they were deleted.

Following the pilot study the questionnaire was amended and distributed to employees during one of the visits to the factory in December 1996. The number

of respondents was determined from the number of employees and the tier of management. Around 130 questionnaires were distributed throughout the factory on the first day of the visit and the completed ones collected one day later. The director and quality manager urged the employees to cooperate with the survey.

Completed questionnaires(78) were 60 %. This high response rate was primarily the result of the personal involvement in data collection of a quality engineer. There sometimes was explained directly how to complete the questionnaire including the nature and purpose of the study. 41.03 percent of individuals completing questionnaires belonged to production areas and the remainder to non production areas. Respondents were composed of managers or team leaders(19.23 %), engineers(21.79 %), inspector, technician, machine operator and repairman(25.64 %). Others (e.g. secretary, accountant, purchasing) were held by 33.33%. In working career, 10 years of career was 58.97 percent and the remainder 41.03 %. Direct worker was 32.05 %. Members of the present quality improvement were held by 26.67% of total respondents.

## 4.2 Scale Reliability Analysis

The reliability of the results was evaluated using internal consistency which means the degree to which items in a set of measurement items are homogenous. It can be estimated using a reliability coefficient such as Cronbach's alpha, a commonly used indicator for assessing the reliability of measurement instruments employing interval scales (Peter, 1979). Coefficient alpha estimates the proportion of variance of responses due to common factors. The coefficient is computed for a scale based on a set of items or any subset of the items. It therefore identifies the subset that has the highest reliability coefficient. A satisfactory alpha value supports a view that the data are interpretable (Cronbach, 1951).

Alpha values of 0.60 or more indicate a reliable measurement instrument for data to be used in basic research. In applied research, Nunnally(1967) recommended that

a reliability of 0.90 is the minimum that should be tolerated and a reliability of 0.95 should be considered the desirable standard.

By using SAS (Statistical Analysis System) an internal consistency analysis was performed separately for the items in each of the nine critical factors. Table 2 reports the sets of measurement items associated with the nine factors, the reliability coefficients associated with the scale, and the reliability associated with the scale before a certain item is dropped. Reliability was slightly increased although some items were deleted and therefore all elements are maintained for further analysis. Table 2 shows that the maximised reliability coefficients ranged from 0.821 to 0.926, indicating that some scales are more reliable than others. This relatively strong coefficient alpha value indicates a high degree of internal consistency of the instrument (Churchill, 1979).

High internal consistency is a necessary condition for construct validity, which means that data for proposed measures are related to the same construct. In this study, this construct would be measures of operational performance. A high degree of internal consistency supports the reliability of individual measures and indicates the extent to which independent but comparable measures of the same construct of a given object agree(Churchill, 1979).

<Table 2> Internal consistency analysis for critical factors

| Factor | Original item numbers | Number of items | Items deleted (by number) | Alpha |
|---|---|---|---|---|
| Management commitment and quality policy | 1-8 | 8 | - | 0.9133 |
| Quality department and communication | 9-13 | 5 | - | 0.8205 |
| Equipment and material management | 14-19 | 6 | 18 | 0.8472 |
| Training | 20-24 | 5 | - | 0.8890 |
| Quality data and reporting | 25-28 | 4 | - | 0.8661 |
| Internal customer and supplier | 29-35 | 7 | 33 | 0.9038 |
| Process management | 36-44 | 9 | 38, 39 | 0.8721 |
| Supply quality management | 45-51 | 7 | - | 0.9210 |
| Employee relations | 52-56 | 5 | - | 0.9258 |

## 4.3 Detailed item analysis

Nunnally's method(1967) was used to evaluate the assessment of items to scales. The method considers the correlation of each item with each scale(Badri et al, 1994). Specifically, the item-score to scale-score correlation are used to determine if an item belongs to the scale as assigned, belongs to some other scale, or if it should be eliminated. If an item does not correlate highly with any of the scales, it is eliminated. Any specific scale is the average of all items belonging to the scale(Saraph et al, 1989).

Each item was evaluated using Nunnally's method after reliability test, four items nos. 18, item 33, item 37, and item 39 were deleted. These were: preventive maintenance of equipment, need to cross-train employees mastering more than one job, use of advanced statistical techniques, and automation of inspection, review or checking of work. Following this, a second analysis was applied using the same method. It was concluded that all items were appropriately assigned to Scales. Since the detailed item analysis results were satisfactory on the second iteration.

## 4.4 Validity

Content validity refers to the extent to which an empirical measurement reflects a specific domain of contents(Carmines and Zeller 1979), and is assessed using expert opinion and informed judgement. The measures were examined for their consistency with the operations management and organisational research literature, and they were analysed for meaning and clarity during interviews with managers conducted during pilot testing of the instruments.

Construct validity refers to the fit between the measure of a construct and the underlying concept it was intended to measure(Cook and Cambell 1979). Factor analysis was used to test for the existence of one or more underlying or latent factors associated with each scale. The existence of a single factor within a scale

provides support for the measurement of a single underlying concept.

A measure has construct validity if it measures the theoretical construct that it was designed to measure. The construct validity of each critical factor measure was evaluated by factor analysing the measurement items for each of the nine critical factors. The initial Factor Method in SAS-PC was utilized for this purpose. This approach examines the relationships between a large number of variables and determines whether or not the information can be summarised in a smaller set of components which are relatively independent and interpretable(Yavas, 1995).

<Table 3> Summary of separate factor matrices for each construct

| Construct | Item loading range for factor 1 | Eigenvalue | Percentage variance explained by factor 1 |
|---|---|---|---|
| 1 | 0.6818 - 0.8735 | 5.0012 | 62.51 |
| 2 | 0.6756 - 0.8167 | 2.9194 | 58.39 |
| 3 | 0.7091 - 0.8641 | 3.1686 | 63.37 |
| 4 | 0.7702 - 0.8739 | 3.4559 | 69.12 |
| 5 | 0.7825 - 0.8846 | 2.8630 | 71.57 |
| 6 | 0.7819 - 0.8689 | 4.0929 | 68.21 |
| 7 | 0.6041 - 0.8402 | 3.9635 | 56.62 |
| 8 | 0.6994 - 0.8739 | 4.7402 | 67.72 |
| 9 | 0.8096 - 0.9317 | 3.9113 | 78.23 |

Factor analysis with varimax rotation was used through the principle components procedure. The resulting factor loading matrices after Varimax rotation are displayed. The meaning of each factor is achieved by collectively viewing these variables with a loading of 0.5 or more as a single "super variable". From this analysis, the factor matrices showed that they were unifactorial except for the process management items; that is, the items in the nine measures formed a single factor as shown in Tables 3. Therefore this can be used as tentative evidence of construct validity for these nine measures.

# 5. Results

## 5.1 Analysis for Individual Factor and Variables

The employee's overall perception is determined by the combined perception of each constituent variable. Employees produced an average score of 3.53 as their overall importance of the TQM activities. Table 4 summarises the mean score and standard deviation for each individual factor. Three factors (numbers 2, 5 and 7) have a relative low ratings while two (factors 1 and 6) have a comparatively high value over 3.60.

<Table 4> Descriptive statistics for individual factors

| Factor | No of respondents | Mean | Standard deviation |
|---|---|---|---|
| Management commitment and quality policy | 71 | 3.66 | 0.89 |
| Quality department and communication | 69 | 3.48 | 0.86 |
| Equipment and material management | 62 | 3.51 | 0.89 |
| Training | 64 | 3.52 | 0.89 |
| Quality and reporting | 68 | 3.42 | 0.92 |
| Internal customer and supplier | 65 | 3.64 | 0.88 |
| Production process management | 59 | 3.38 | 0.84 |
| Supply quality management | 58 | 3.55 | 0.87 |
| Employee relations | 67 | 3.57 | 0.97 |

Table 5 lists variables with both the highest and lowest scores by each factors. In the highest group, variables with an average score of almost 3.53 were included. Inclusion of quality goals and policy in the company business strategy got the highest mean score (3.92). Accuracy of inventory management, specific work-skills training given to employees, and clarity of specifications provided to the suppliers are over 3.80, which shows good importance in material management, training, and supply quality management.

When it comes to the lowest group, there are many areas to be less valued in

the importance of quality management. Training in statistical techniques was the worst of all the variables(2.96). Also, Use of the basic statistical techniques to control processes is recognised to be less important to manage their TQM. Reduction of the set-up time of equipment in process was not valuated more positively to consider quality management. Timeliness of the quality data collected for performance measures was not be evaluated highly, and coordination or communication between departments also appeared a low score relatively.

<Table 5> List of variables with highest/lowest score by factors

| Variable | Factor | Score |
|---|---|---|
| Variables with highest score | f1. Inclusion of quality goals and policy in the company business strategy | 3.92 |
| | f2. Communication between management and employees | 3.79 |
| | f3. Accuracy of inventory management | 3.80 |
| | f4. Specific work-skills training given to employees | 3.86 |
| | f5. Change of quality strategy etc. based on the analysis of quality data | 3.58 |
| | f6. Understanding internal customers needs or requirements | 3.74 |
| | f7. Amount of system audit | 3.61 |
| | f8. Clarity of specifications provided to the suppliers | 3.86 |
| | f9. Feedback provided to employees on the quality performance | 3.75 |
| Variables with lowest score | f1. Management participation in the quality improvement process | 3.58 |
| | f2. Coordination or communication between departments | 3.30 |
| | f3. Reduction of the set-up time of equipment in process | 3.28 |
| | f4. Training in the basic statistical techniques | 2.96 |
| | f5. Timeliness of the quality data collected for performance measures | 3.28 |
| | f6. Reviewing and improving regularly for working activities | 3.51 |
| | f7. Use of the basic statistical techniques to control processes | 3.03 |
| | f8. Involvement of supplier in the product development process | 3.44 |
| | f9. Effectiveness of quality improvement programmes | 3.45 |

5.1.1 Management commitment and quality policy

Eight statements were presented concerning management commitment and quality policy. As all individual statement scores were greater than 3.0 and the overall mean score was 3.657, this would suggest that the prevailing management style is oriented towards achieving quality improvement and establishing the

correct environment for it.

Only three variables(2, 6 and 8) had an average score of over 3.7 showed a good performance in total quality management practice. Management gained a high score in supporting long term quality improvement strategies or training to achieve them, considering it as a way to increase profits, reflection of quality goals or policy to business strategy. Unfortunately two variables 7 and 3 show a relatively low average score of close to 3.5. These variables are an evaluation of the management 's quality performance and employee's participation in setting/planning of quality goals. In total this proves that the factory shows quite good management commitment and quality policy which form the base of TQM but needs some improvement in the real implementation of TQM establishing, evaluating and utilising quality policy.

It suggests that there is possibly a need to change the prevailing, current quality management style. To convince staff that implementing TQM is in progress, managers will need to consider actions such as establishing formal goals for TQM, monitor the performance against these goals to get feedback from their analysis. To be totally effective, managers also have to place more emphasis of dialogue with their staff as the basis for establishing consistent quality standards across all departments.

5.1.2 Quality department's role and communication

Respondents were asked to comment on five statements concerning the quality department's role and communication. The individual mean scores were all in excess of 3.3 except statement 3, with the overall mean of 3.484. All variables showed good scores more than 3.0. There are good practices for autonomy of quality department, communication between different levels(management and employees) and quality department's access to top management of each department.

Some low scores were produced in using quality staff as a consulting resources,

co-ordination or communication of quality information between different departments. These indicate that communication in the factory was perceived as inadequate. Communication inside the quality department is well performed but there are departmental barriers to conveying quality information outside. Improvements are therefore needed. The analytic result require further improvement in utilising quality staff as a consultant or messenger to support, motivate and facilitate TQM movement in the factory.

5.1.3 Equipment and material management

Six statements were presented concerning equipment and material management. All the individual statement scores were greater than 3.0 and the overall mean score was 3.513. Inventory management scored 3.8. Low scores were given for reduction of the set-up time of equipment, for material handling, and process automation. There were slightly higher scores in reduction of cycle time for each department's process. This reveals that the basic structure is a little weak in managing set-up time, material handling, and process automation. Appropriate action should be taken to reduce set-up time and also process should be automated to process cycle times where possible.

In general, inventory management is well performed but material handling or management should be reviewed between the different departments. It may be incurred due to some barriers of communication between departments. The relevant departments or processes should carry out better process management through, for example, data and process analysis based on internal customer and supplier relationship in order to overcome these problem areas.

5.1.4 Education and training

Five statements were included on training, on most of which had a mean score of $> 3$ except one under 3 and generated an overall mean score of 3.519. This suggests that more education and training should be undertaken on their accurate demand analysis when considered important in quality improvement.

This group also revealed a relative average performance in all items except statistical training. But statistical training is revealed a low score for basic techniques as histograms and control charts. TQM and quality-related training also had an average score below 3.5. From this analysis, it can be seen that more training is needed for the soft areas such as TQM and quality-related areas along with the fact that they greatly contribute quality mind to be spread around the factory.

5.1.5 Quality and reporting

Respondents were asked to comment on four statements concerning quality and reporting. The individual mean scores were over 3.0 all without a big difference between statements, the overall mean score was 3.035. This shows a low performance in the current practice of quality and reporting. Quality data should be collected as timely and correctly as they can be utilised and their processing and analysis improved. Both timeliness and precision of quality data are important especially when they are used to evaluate manager or employee as well as department relating to their current job performance. A chain relationship is supposed to exist among quality data management, quality policy making and education of statistical tool. Approximate training of statistical tools may raise quality of data, which can be used in employee's evaluation and developing quality policy.

5.1.6 Internal customer and supplier

The issues relating to internal customers and suppliers were covered by seven statements describing how well employees satisfy their internal customers. Overall, the current importance shows very high mean scores. It means that employees conceptually understand their internal customer and supplier, and teamwork is emphasised and encouraged for quality improvement. Analysis of data is required on a regular basis to review and improve working activities thereby eliminating wasteful or unnecessary procedures.

The study suggests that more effort be put into the management of internal customers as a means of improving working quality in the department. The effective delivery of high quality outputs may be inhibited either by the apparently limited knowledge which exists about the nature of working outputs required by other departments or the lack of clear critical performance measures related to their internal customer. To overcome this obstacle, managers should seek more useful information on whether both the needs and expectations of internal customers were met, perhaps through performance measurement and analysis.

5.1.7 Production process management

This aspect was covered with seven statements, three of which yielded a low mean score relatively and generated an overall mean score of 3.385. It would appear that statistical tools were not considered importantly as seen a mean score 3.0.

Inspection and quality audit are perceived well, especially final inspection, quality audit and system audit which are carried out better. In-coming inspection lags behind other inspection. This means that the factory is emphasising final inspection as a way to improve quality of product. This suggests that TQM is not being recognised fully because there is more reliance on final inspection than process control.

5.1.8 Supply quality management

Respondents were asked to comment on seven statements concerning supply quality management. Again individual mean scores were in excess of 3.5 except involvement of supplier in the product development process, and the overall mean was 3.55. Also, the long term relationship with supplier showed a low mean score. It means that is not well recognised in supply management. The factory uses advanced material or supply management using concepts similar to MRP or JIT. In particular, JIT require longer term relationships with reasonably few dependable

suppliers. A review should therefore be performed on the supply rating system, the choice and maintenance of a few dependable suppliers, supplier involvement in product development, etc.

5.1.9 Employee relationship

Respondents were asked to comment on five statements about employee relationships. Their high scores would suggest that a great deal of effort must be focused on improving the management/staff relationship. In particular, they are thought importantly the amount of feedback provided to them on their quality performance, and the extent of continuous quality awareness by them. A quality improvement programme should be reviewed relating to their effectiveness in each department by considering subject, budget, manpower, content of programme, etc. It is recommended that employees should be responsible for the quality of their working activities and be recognised for both high performance and good quality. A quality awareness performance should be implemented using specific motivation factors such as job security, empowerment and teamwork.

## 5.2 Response Differences by Each Factors

This investigates whether employee's perception toward each variable is different. It will explain the causes of differences in the target organisation. It also focuses on how perceptions can be aligned to improve productivity and competitiveness of the company. If employees have different concepts of quality each other, it will be difficult to resolve quality problems or develop an organisation-wide emphasis on quality. Furthermore it will enable the factory to establish a quality improvement strategy to reduce the perception difference between each tier of management.

T tests of difference in response means were conducted for the 56 interval scale questions both between management and employees, and between production and non production departments. Difference in response means for nine factors in two

categories are summarised in Table 6.

Only three variables showed difference between production and non-production departments; internal customer and supplier, production process management, and employee relations. All of them production departments had the more great number of significantly different response means. Production Departments are recognising more importance in such areas as expected. This means that the differences must be considered to practise any survey both production and non-production.

<Table 6> Comparison of production/non-production department and management/employee

| Variable | Department | | | Position | | |
|---|---|---|---|---|---|---|
| | Production Mean | Nonproduction Mean | t | Management Mean | Employee Mean | t |
| Management commitment and quality policy | 3.70 | 3.63 | 0.73 | 3.71 | 3.62 | 0.67 |
| Quality department and communication | 3.63 | 3.37 | 0.20 | 3.56 | 3.42 | 0.52 |
| Equipment and material management | 3.67 | 3.37 | 0.19 | 3.69 | 3.53 | 0.14 |
| Training | 3.65 | 3.41 | 0.27 | 3.35 | 3.51 | 0.95 |
| Quality and reporting | 3.58 | 3.30 | 0.23 | 3.55 | 3.32 | 0.31 |
| Internal customer and supplier | 3.86 | 3.48 | 0.08* | 3.68 | 3.61 | 0.74 |
| Production process management | 3.65 | 3.16 | 0.02** | 3.36 | 3.41 | 0.81 |
| Supply quality management | 3.71 | 3.45 | 0.27 | 3.57 | 3.53 | 0.87 |
| Employee relations | 3.88 | 3.65 | 3.34 | 3.50 | 0.01*** | 0.52 |

*p < .10 **p < .05 ***p< .01

Another T test was tried about difference between management and employees. But there are never any significant difference between two groups. This means that the same measurement can be used to study the management and employees without any change or consideration. Accordingly it can be concluded very

important to consider Departments, i.e. production and non-production than each tier of management in TQM measurement

# 6. Discussion

## 6.1 Implication for Management

This study can supply practical implications to management because TQM critical factors and their sub-elements are more clearly known and understood and their current importance for practice was surveyed in the organisation. Because the TQM variables with the mismatched perception between departments are identified, management is able to investigate the relative causes and amend their TQM system. If the dominant elements which affect the overall TQM performance is identified, then management can focus on such elements and their activities which have an impact on the company's TQM performance. Management can plan these dominant elements into the TQM system. This is of importance since resources can be utilised effectively and efficiently. Management can train the relative personnel to elements with poor performance. Management can gain better control, co-ordination and monitoring of the TQM system, since the critical fail-points are identified.

Measurement of the critical factors of quality management permit managers to better understand quality management practices. It enables to develop and test theories of quality management, and to examine certain hypothesis concerning quality management. Therefore, this also can help decision makers identify those areas of quality management where improvement should be made. Furthermore, comparisons of different organizations or divisions can help to prioritize quality management efforts.

## 6.2 Implication for Further Research

Quality improvement needs certain changes from the previous system, which necessarily result in resistance to quality efforts. These changes affect both the workforce and management. Some of the workforce may fear that quality result in taking greater profit from themselves. This can generate bad relation with union. Therefore it is necessary to form the culture to understand the meaning of quality uniformly and right. Different levels of the organisation need to agree what contribute a quality performance, a quality product or a quality process. Derrick et al(1989) insisted that quality improvement will be failed without this.

When there is employee's incorrect understanding of TQM system, it is difficult to change the reality without influencing employee's belief about their quality management in an organisation. Therefore studying employee's perceptions is important in establishing a TQM strategy. Confidentiality also is especially vital in studying employee perception because employees will not speak out if they believe that what they say will return to haunt them.

When operation personnel at the different levels are included, the more advantage may be gained when considering that TQM requires all employees participation in any organisation. Different perceptions of the quality dimensions can be expected among the various industry, company, department or management levels even in one company. Employee's quality perception needs to be connected with customer's one to bring about more advantage. An empirical study should be conducted with sufficiently large sample size which make the results more reliable. Additional or quantitative research can be supplemented to uncover the causes underlying the key problem areas or gaps identified by previous studies.

## 7. Conclusions

Information from the results provides a basis for effective and efficient self-assessment procedures. Several practical tools are offered for the collection of data within the organisation. These tools can be used to assess both an organisation's TQM performance and its member's understanding of the approach. They can be used to diagnose areas for improvement or training and education.

The views of importance on the critical factors for quality management are given in this study. Clearly, these results should be considered specific to the company that was surveyed. Replications are needed in other companies as well as in other industries. Finally, and perhaps more importantly, the present study can be extended beyond one company if one can include objective and/or perceptual data from other stakeholders such as customers and suppliers.

The researchers believe that both the high score factors such as management commitment and quality policy, internal customer and supplier, and employee relations and the low score factors such as production quality management, quality and reporting, and quality department and communication are critical to total quality management. It is hoped that this information will prove useful in the development of quality management policies and practice programs in the manufacturing industry.

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# Appendix

## *The Initial Items Used for Measuring the Critical Factors of Quality Management*

This appendix contain the items contained in the original research instrument. The items noted by an asterisk (*) were eventually dropped to improve the reliability of the instruments.

### *Factor1. Management commitment and quality policy*

1. Extent to which management assumes responsibility for quality performance
2. Extent to which management supports long-term quality improvement by providing the relating tools and resources
3. Degree to which management participates in the quality improvement process
4. Extent to which each department has specific objectives (goals and plans) for quality performance
5. Extent to review quality issues in management meetings
6. Degree to which management considers quality improvement as a way to increase profits
7. Extent to which employees participate in setting quality goals and plans within the department
8. Extent to which quality goals and policy are reflected in the company business strategy

### *Factor2. Quality department and communication*

9. Autonomy for the quality department to stop production if outputs do not meet quality standards
10. Utilisation of quality staff professionals as a consulting resource
11. Amount of co-ordination or communication between your department and other departments

12. Communication between management and employees.
13. Quality department's access to divisional top management

***Factor3. Equipment and material management***

14. Reduction of the set-up time of equipment in your process
15. Reduction of the cycle time in your process
16. Reduction of material handling
17. Accuracy of inventory management
18. Preventive maintenance of equipment
19. Automation of the process

***Factor4. Training***

20. Extent to investigate and review training needs
21. Specific work-skills training given to employees
22. Training in the TQM concept
23. Training of employees to implement quality improvement programme
24. Training in the basic statistical techniques (such as histograms and control charts)

***Factor5. Quality data and reporting***

25. Timeliness of the quality data collected for performance measures in the department
26. Availability of quality data (error rates, defect rates, scrap, defects, etc.) in the department
27. Extent to which quality data are used to evaluate management
28. Extent to which quality strategy or improvement plans/targets is changed based on the analysis of quality data.

***Factor6. Internal customer and supplier***

29. Reviewing and improving working activities regularly in the department
30. Measuring internal customer's satisfaction with metrics produced in the

department

31. Understanding internal customer's needs or requirements in the department
32. Making improvements or cost saving suggestions to management
33. Need to cross-train employees mastering more than one job
34. Defining and identifying critical processes in your department
35. Extent to which teamwork is encouraged in your department

***Factor7. Process management***

36. Use of acceptance sampling to accept or reject inspection lots
37. Use of the basic statistical techniques such as histograms and control charts to control processes
38. Use of advanced statistical techniques such as design of experiments and regression analysis to control processes
39. Extent to which inspection, review or checking of work is automated
40. Amount of incoming inspection, review or checking
41. Amount of in-process inspection, review or checking
42. Amount of final inspection, review or checking
43. Amount of quality audit
44. Amount of system audit

***Factor8. Supply quality management***

45. Thoroughness of the supplier rating system
46. Reliance on reasonably few dependable suppliers
47. Amount of technical assistance provided to the suppliers
48. Involvement of supplier in the product development process
49. Extent to which longer term relationships are offered to supplier
50. Clarity of specifications (requirements) provided to the suppliers
51. Extent to which suppliers have programmes to assure quality of their products

***Factor9. Employee relations***

52. Extent to which quality improvement programmes are implemented in the department
53. Effectiveness of quality improvement programmes in the department
54. Amount of feedback provided to employees on their quality performance
55. Extent to which quality awareness building among employees is ongoing
56. Extent to which employees are recognised for superior quality performance