CRITICAL FACTORS OF QUALITY MANAGEMENT USED IN RESEARCH QUESTIONNAIRES: A REVIEW OF LITERATURE

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ABSTRACT

This paper examines the emergence of critical factors of quality management in the development of quality management research questionnaires. A review of literature shows that 27 different critical factors or constructs were developed and used by established researchers in the field. Out of these, 8 most popular critical factors have been identified – top management support, quality information availability, quality information usage, employee training, employee involvement, product/process design, supplier quality and customer orientation. This paper suggests that the critical factors of quality management be standardized so that a sound comparison can be made between research findings of studies conducted in various countries of the world.

Key words: critical factors, quality management, research, questionnaires.

INTRODUCTION

As businesses step into the Information Technology (IT) ruled global market, the ability to produce a better product than the competitor becomes a great challenge. As Feigenbaum (1994, p.78) had expressed, "Changing a company, from a 'make-it-cheaper-and-quicker past' to a 'make-it-better future' is perhaps the most demanding task of managers and engineers today".

Total Quality Management (TQM) and ISO 9000 are the current Quality Management Systems that most firms implement to navigate their route to a 'make-it-better future'. When the firms concerned "make-it-better", then they are able to 'perform' to make profitable investments. Quality management systems such as ISO 9000 and TQM help firms to better organize and coordinate their operations by documenting their processes, defining responsibilities of employees and by putting in preventive measures to prevent errors.

Researchers who conceptualized quality management practices and developed reliable research instruments such as questionnaires made significant contributions towards advancement of research in this area. Critical factors of quality management are important in the development of these questionnaires. The objective of this paper is to identify the most commonly used critical factors of quality management. These same critical factors can

then be used by researchers and practitioners in Malaysia and different parts of the world to evaluate the implementation of quality management in organizations.

This paper is divided into 4 sections. The first section provides an introduction to quality management systems. The second section presents a review of the critical factors of quality management developed and utilized by established researchers while the third section presents a discussion of the 8 most popular critical factors of quality management. The last section discusses the integration of the most commonly used critical factors of quality management into the transformation process model.

QUALITY MANAGEMENT SYSTEMS

This section provides an introduction to Total Quality Management (TQM), ISO 9000 and the ISO 9000-TQM link.

Total Quality Management

ISO 8402:1994 as cited by Juran and Godfrey (1999, p.11.24) defined TQM as "… management approach of an organization centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to the society ..."

Dahlgaard and Kristensen, (1994, p.5) defined TQM as 'to obtain total quality by involving everyone's daily commitment'. They stressed that TQM involves customers and suppliers, in addition to mass production and statistical methods.

Some of the Quality Gurus who contributed their own Quality philosophies in TQM are Edward Deming, Joseph Juran, Philip B. Crosby, and Armand V. Feigenbaum and Ishikawa (e.g., Deming's Fourteen Points, Juran's Triology, Crosby's Fourteen Steps and Ishikawa's Six Principles).

Yusof and Aspinwall (2000) reviewed some existing TQM implementation frameworks. The researchers' discussions point towards a major issue – Quality Gurus such as Deming, Crosby and Juran did not actually develop any implementation frameworks. They documented some guidelines for managers to follow, which were more of a prescription for companies to act upon. Some of the followers of these Gurus have moved a step forward and developed frameworks for adopting TQM. Oakland's Implementation framework (1993), Dale's UMIST framework (1995) and Kanji's pyramid model (1996) are various derivations of the Gurus' principles. Kanji's pyramid model (1996) with his four-stage implementation procedure is the first to provide a systematic way to implement TQM.

ISO 9000

The ISO 9000 standards were first introduced in 1987 by the International Organization for Standardization based on the BS 5750 series. A major revision to the ISO 9000 standards was made in the year 2000 and this is known as ISO 9000:2000 (ISO 9001:2000, 2000). With this revision, the importance placed on documented procedures was reduced while

customer satisfaction and leadership by top management began to play a much bigger role (Heizer & Render, 2008).

The assessment criteria used in ISO 9000 can be compared to the Malcolm Baldrige National Quality Award (MBNQA).   There are seven categories of assessment in the Malcolm Baldrige National Quality Award (MBNQA) which are:-

  (a)   Leadership
  (b)   Information and analysis
  (c)   Strategic planning
  (d)   Human resource development and management
  (e)   Process management
  (f)   Business results
  (g)   Customer focus and satisfaction

The ISO 9000-TQM Link

Ho (1995) identified the relationship between TQM and ISO 9000 by using a Venn diagram (Figure 1).

Figure 1. The Venn Diagram Showing the Link Between TQM and ISO 9000 (Adapted from Ho, 1995)
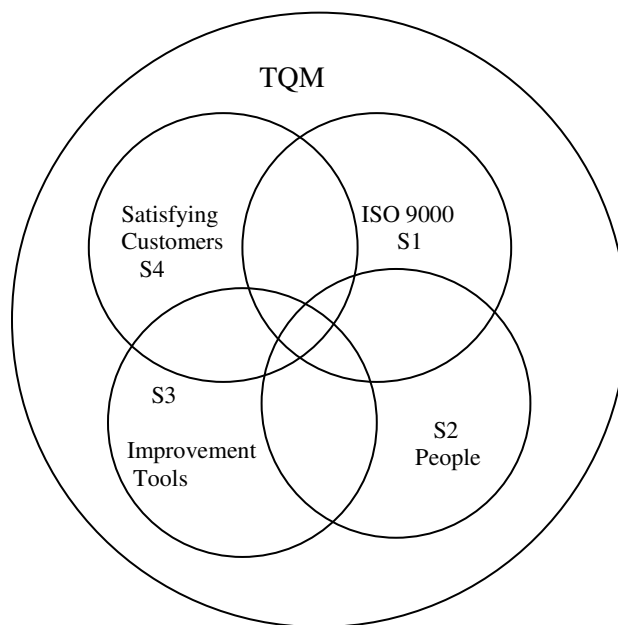
Ho recommended that ISO 9000 be used as a route to TQM. He suggested that once a firm fully implements ISO 9000, it could achieve TQM in a systematic manner. Kolarik (1995, p.830) supported this. He suggested that any organization aiming for ISO 9000 certification should consider the requirements of ISO 9000 standards and incorporate them into their TQM programs.

CRITICAL FACTORS OF QUALITY MANAGEMENT

This section presents a review of the critical factors or constructs of quality management developed and utilized by researchers.

The Development of Critical Factors of Quality Management

Ahire, Golhar and Waller (1996) defined constructs as latent variables, which cannot be measured directly. However, critical factors or constructs can be measured indirectly from their manifestations. For example, customer focus is a critical factor that cannot be measured directly. However, when a company is customer-focused, manufacturing managers will be aware of the results of customer satisfaction surveys. Thus, manufacturing managers being aware of customer satisfaction surveys can be one of the manifestations of the critical factor customer focus.

The development and validation of critical factors of quality management have been reported by established international researchers – Saraph, Benson and Shroeder (1989), Flynn, Schoeder and Sakakibara (1994), Ahire, Golhar and Waller (1996), Black and Porter (1996), Zeitz, Johannesson and Ritchie Jr. (1997), Joseph, Rajendran and Kamalanabhan (1999) and Rao, Solis and Raghunathan (1999).

According to Sila and Ebrahimpour (2003), the critical factors of quality management were first utilized by Saraph *et al.* in 1989. Saraph *et al.* (1989) developed a quality management instrument, identifying 8 critical factors of quality management. These factors are top management support, quality reporting (which includes quality information availability and quality information usage), employee training, employee involvement, product design, supplier quality, process management and role of quality department. Sila and Ebrahimpour (2003) highlighted that the same critical factors were later used by Motwani, Mahmoud and Rice (1994), Badri and Davis (1995) and Quazi, Jemangin, Kit and Kian (1998). These researchers had reported the instrument used by Saraph *et al.* as valid and reliable (Motwani *et.al.,* 1994; Badri *et al*., 1995; Quazi *et al*.,1998 as cited in Sila & Ebrahimpour, 2003).

Flynn *et al.* (1994) developed 7 critical factors of quality management while Ahire *et al*. (1996) developed 12 critical factors. In addition, Black and Porter (1996) developed 8 critical factors of quality management, Zeitz *et al*. (1997) developed 7, whereas Joseph *et al.* (1999) developed 10. Rao *et al.* (1999) made a significant contribution by developing and validating a measurement instrument for international quality management research which consisted of 13 critical factors of quality management. Table 1 is a summary of the critical factors developed by the 7 groups of researchers mentioned above.

A total of 27 different critical factors of quality management were developed and utilized by the 7 groups of established researchers who conducted research in different parts of the world. However, researchers in the field are unable to make a good comparison of the research findings in various countries due to the disparity in the critical factors used in the research instruments. This notion is supported by Sila and Ebrahimpour (2003).

One or more researchers have discussed each of the critical factors shown in Table 1. Each researcher, in his or her notion, discussed the properties of each critical factor. Out of the 27 different critical factors developed by the researchers mentioned in Table 1, 8 were found to be the most popular critical factors; that is, 4 or more than 4 groups of researchers developed and utilized these critical factors in their research. These 8 critical factors, ranked from the highest level of popularity to the lowest level of popularity are: -

(a) Top management support
(b) Quality information availability
(c) Quality information usage
(d) Employee training
(e) Employee involvement
(f) Product/process design
(g) Supplier quality
(h) Customer orientation

THE EIGHT MOST POPULAR CRITICAL FACTORS OF QUALITY MANAGEMENT

This section presents a discussion of the 8 most popular critical factors of quality management developed and utilized by the 7 groups of researchers.

Top Management Support

The first and strongest critical factor of all is top management support, a theme emphasized by Deming (Deming, 1986, as cited in Zeitz, Johannesson, & Ritchie, 1997) and repeated by many other researchers.

Strong commitment from the top management is vital in quality management. Rao *et al*. (1999) described this critical factor as the top management's commitment in providing active and timely support to build quality awareness, leading to higher quality performance. Most of the other researchers consented to this notion (Saraph *et al*., 1989; Flynn et al., 1994; Ahire *et al.*, 1996; Zeitz *et al*.,1997; Joseph *et al*., 1999). However, Black and Porter (1996) did not include this critical factor in their study. Instead, they introduced another critical factor, corporate quality culture, which is about encouragement of a company-wide culture committed to quality improvement. As top management support plays a significant role in encouraging company-wide culture that is committed to quality improvement, the critical factor 'top management support' is preferred by most researchers.

Table 1. Critical Factors of Quality Management Developed and Utilized by Researchers

		Saraph, Benson, & Shroeder, 1989	Flynn, Schoeder, & Sakakibara, 1994	Ahire, Golhar, & Waller, 1996	Black & Porter, 1996	Zeitz, Johannesson, & Ritchie Jr., 1997	Joseph, Rajendran, & Kamalanabhan 1999	Rao, Solis, & Raghunathan, 1999	Frequency
1.	Top Management Support *	●	●	●		●	●	●	**6**
2.	Quality Information Availability*	●	●		●		●	●	**5**
3.	Quality Information Usage*	●		●		●	●	●	**5**
4.	Bench Marking			●				●	2
5.	Strategic Quality Planning							●	1
6.	Employee Training *	●		●			●	●	**4**
7.	Employee Involvement*	●	●	●	●	●	●	●	**7**
8.	Process/Product Design *	●	●	●			●	●	**5**
9.	Supplier Quality*	●	●	●	●	●	●	●	**7**
10.	Corporate Quality Culture				●				1
11.	Strategic Quality Management				●				1
12.	Customer Orientation*		●	●	●	●		●	**5**
13.	Process Management	●	●		●				3
14.	Quality Improvement System				●	●			2
15.	Role of Quality Department	●					●		2
16.	Internal Quality Results							●	1
17.	External Quality Results							●	1
18.	SPC Usage			●					1
19.	Employee Empowerment			●					1
20.	Product Quality			●					1
21.	Supplier Performance			●					1
22.	Operational Quality Planning				●		●		2
23.	Supervision					●			1
24.	External Interface Management				●				1
25.	Quality Citizenship							●	1
26.	Quality Policy						●		1
27.	Technology Utilization						●		1

Note: ● The critical factor was developed and utilized by researchers

* The most popular critical factors i.e. Frequency is equal to 4 or more than 4.

Quality Information Availability

A proper flow of quality information directs an organization to improved performance (Takeuchi & Quelch, 1983, as cited in Flynn *et al.,* 1994). According to Hayes (1981), provision of timely and accurate information about the manufacturing process is important to control the process and reduce defective products. Immediate problem-solving keeps the process in control. Pertinent quality information from workers, suppliers and customers must be accessible to the top management as well as to employees to allow effectual decisions on quality matters (Rao *et al.,* 1999).

All the researchers mentioned in Table 1, except for Ahire *et al.* (1996) and Zeitz *et al.* (1997), took into consideration quality information availability as one of the critical factors of quality management. Although quality information availability was not included as one of the critical factors of quality management in Ahire's study (Ahire *et al.,* 1996) quality information usage was considered as one of the critical factors of quality management. The study evaluated quality information usage based on 6 items, namely

    (a) Availability of the cost of quality data to managers
    (b) Visual display of quality information
    (c) Visual display of quality performance versus goals
    (d) Transmittal of defects information to specific work stations
    (e) Availability of scrap data
    (f) Availability of rework data

A careful analysis of these 6 items shows that they are more relevant in measuring quality information availability. Therefore Ahire's study (Ahire *et al.,* 1996) actually used quality information 'availability' and not quality information 'usage'.

Quality Information Usage

Quality information usage is an important feature of quality information management. Even though quality information is available, only the effective use of it leads to quality improvement. As pointed out by Rommel (1996), the capability to provide information to employees, where needed and when needed for timely reaction, is the foundation of excellent information management.

Rao *et al. (*1999) suggested 3 items to measure quality information usage. They suggested that quality information usage be measured by looking at the extent to which quality data is used by

    (a) Top management in decision making
    (b) Middle management in planning and controlling
    (c) Hourly workers in their operations

Employee Training

4 out of the 7 studies shown in Table 1 had included employee training as one of the critical factors of quality management. Training is an efficient way to increase workers' ability to perform better than the lowest level required (George & Jones, 2005, p.60) while an organization which fully utilizes the skills of its workers' ability is on its way to achieving organizational effectiveness. Training employees in quality concepts and tools increases the effectiveness of quality improvement activities which require employee involvement. In other words, training contributes to successful implementation of quality management systems in a firm. As pointed out by Rao *et al. (*1999), training has become a prerequisite to achieving world-class manufacturing status.

Employee Involvement

Employee involvement is defined as 'to empower employees, to provide them information, to upgrade their knowledge and to provide remuneration for quality performance' (Oliver, 1988, as cited in Rao *et al.,* 1999, p.5). Stoner, Freeman and Gilbert (1995, p.277) defined empowerment as 'the act of providing authority, knowledge and resources to individuals so that they can achieve work objectives'. Among the 7 groups of researchers (as mentioned in Table 1), only Ahire *et al.*(1996) identified 2 different critical factors of quality management – employee involvement and employee empowerment. All the other researchers used only employee involvement as a critical factor. Abiding by Oliver's definition, all the researchers mentioned in Table 1, except for Ahire *et al.* (1996), had considered empowerment as part of employee involvement.

Process/Product design

The aim of product design is to develop a product that meets the demands of the market with a competitive advantage. According to Rao *et al.* (1999), when a product is designed in such a way that it is unproblematic to manufacture, the manufacturing process variance is reduced. The researchers mentioned that the design of a production process is inter-related to the design of a product. Therefore, Rao *et al.* (1999) had developed this critical factor – process /product design. Process/product had also been identified as one of the critical factors of quality management in 4 other studies shown in Table 1. The terms used by the researchers are different but all of them have included process and product design in the scope of the critical factors. The terms used by the researchers are shown in Table 2.

Table 2. Terms Used by Researchers for the Critical Factor, Process/Product Design

Researchers	Terms Used
Saraph, Benson and Shroeder,1989	Product/Service Design
Flynn, Schoeder and Sakakibara, 1994	Product Design
Ahire *et al.* 1996	Design Quality Management
Joseph, Rajendran and Kamalanabhan, 1999	Product Design
Rao, Solis and Raghunathan, 1999	Product/ Process Design

Supplier Quality

Supplier quality is an important dimension of quality management as defective incoming materials and parts lead to process and product quality problems. Leonard and Sasser (1992) found that purchased materials and parts often become the major contributors to quality problems (Leonard & Sasser, 1992 as cited in Flynn *et al.,* 1994).

    Maintaining good supplier relationship is acknowledged as a key factor in maintaining competitive advantage. Many companies adopt the 'supplier partnership' perspective to achieve higher quality and faster response to market needs. This approach emphasizes a stable relationship with few dependable suppliers who can ensure high-quality supplies and uphold flexibility to changes in product specifications and delivery schedules (Stevenson, 2007, p.533).

    All the 7 research groups shown in Table 1 have identified supplier quality as a critical factor of quality management. Rao *et al.* (1999) developed a scale of 6 items to measure the effectiveness of a supplier quality management system:

  (a) Importance placed on quality of purchased parts versus price
  (b) Extent to which the company depends on a few reliable suppliers
  (c) Level of technical support to suppliers

   (d) Level of involvement of supplier in the company's product development process
   (e) Level of emphasis on long-term supplier relationships
   (f) Clarity of specifications given to suppliers

Customer Orientation

The main objective for a product or service design is to satisfy the customer while making a reasonable profit. Customers are the driving force for product and service design. A customer-oriented or a customer-focused organization maintains its competitive advantage. In a customer-oriented organization, customer satisfaction influences all the company's actions (Doll & Vonderembse, 1991, as cited in Rao *et al.,* 1999). As customer expectations are dynamic, an organization needs to survey customer expectations regularly and modify its operations accordingly (Shepatuk, 1991, as cited in Ahire *et al.,*1996). The availability of customer complaint information to managers and the extent of the use of customer feedback to improve product quality reveal the level of customer focus in an organization.

    The next section presents the integration of the 8 most popular critical factors of quality management into the transformation process model.
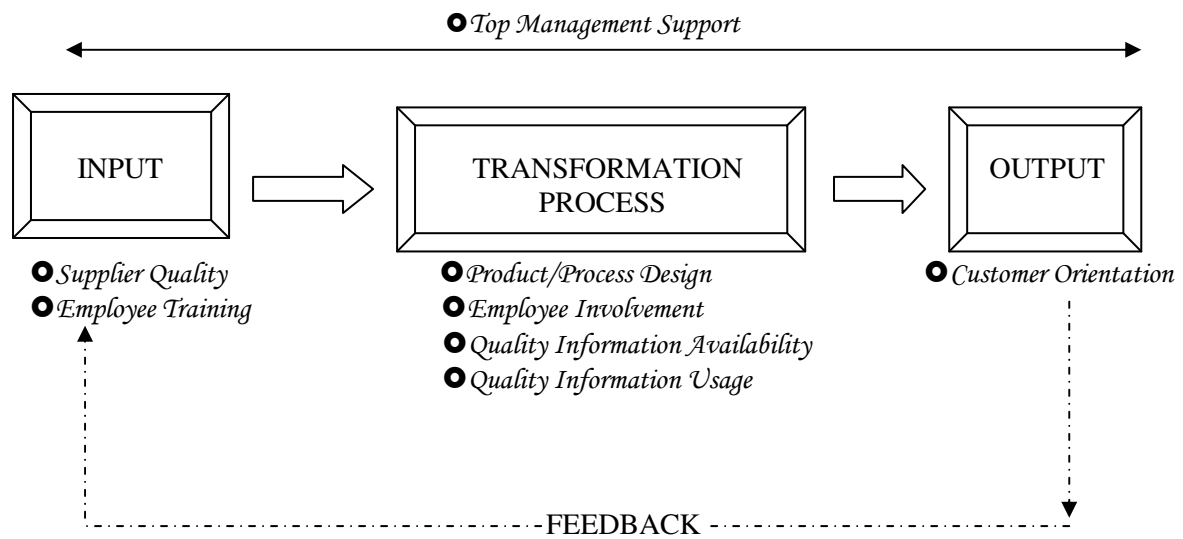

ASSIMILATION OF CRITICAL FACTORS OF QUALITY MANAGEMENT INTO THE TRANSFORMATION PROCESS MODEL

Research instruments such as questionnaires consisting of critical factors of quality management were developed and utilized by researchers and used in international quality management research. The researchers developed and utilized these critical factors of quality management, based on theoretical, practitioner and empirical literature. Researchers and practitioners in the field of quality management will be able to better understand the importance of these critical factors of quality management when the critical factors are assimilated into the transformational process model. When a transformation process definition is employed, the critical factors of quality management can be viewed as inter-related critical factors that stimulate quality performance. The 8 critical factors of quality management used in Figure 2 are the most popular critical factors identified from 7 studies shown in Table 1.

    Supplier quality and employee training are the 2 critical factors of quality management that affect the inputs of the transformation process, i.e., material and staff. Material, information and customers are considered as 'input transformed resources' while facilities and staff are considered as 'input transforming resources' (Slack & Chamber, 1998, p.9).

    The critical factors of quality management that affect the transformation process directly are product/process design, employee involvement, quality information availability and quality information usage. A customer-oriented organization will produce outputs that meet the customers' expectation. That is why the critical factor 'customer orientation' is placed at the output stage in Figure 2. Feedback from customers, in the form of complaints and market research results, are normally used to improve the process and product. In other words, the feedback goes back into the transformation loop as shown by the dotted line. Top management support is crucial in ensuring the successful implementation of quality management throughout the organization. Top management support is essential in creating a quality culture within the organization. Therefore top management support is crucial at every stage of the transformation process. This is shown in Figure 2.

    As explained in Figure 2, the most common critical factors of quality management underlie operational decisions. A quality management system that includes these critical factors will ensure quality from design stage right up to delivery stage. The use of these 8 critical factors in research to evaluate the implementation of quality management system in an organization will mean that the crucial areas in quality management are covered in the research. If different researchers use the same critical factors to evaluate implementation of quality management, it would be easier to make comparisons between their research findings.

Figure 2. Critical Factors of Quality Management Integrated into the Transformation Process Model

○ *Top Management Support*

INPUT → TRANSFORMATION PROCESS → OUTPUT

○ *Supplier Quality*
○ *Employee Training*

○ *Product/Process Design*
○ *Employee Involvement*
○ *Quality Information Availability*
○ *Quality Information Usage*

○ *Customer Orientation*

FEEDBACK

CONCLUSION

Researchers in the area of quality management have used different combinations of critical factors or constructs to design questionnaires to measure quality management practices in different parts of the world. The inconsistency in the critical factors developed and used by international researchers makes it difficult to make good comparisons of the research findings.

This paper identified 8 critical factors of quality management as the most commonly used critical factors among researchers. The 8 critical factors of quality management are top management support, quality information availability, quality information usage, employee training, employee involvement, product/process design, supplier quality and customer orientation. All 8 critical factors have been developed and utilized by the researchers concerned – Saraph *et al.* (1989), Flynn *et al.* (1994), Ahire *et al.* (1996), Black and Porter (1996), Zeitz *et al.* (1997), Joseph *et al.* (1999) and Rao *et al.* (1999). Based on the literature reviewed, it is recommended that the critical factors of quality management used in research questionnaires be standardized so that a sound comparison can be made between research findings of studies conducted in various countries of the world. The utilization of the same critical factors in research questionnaires will lead to a standardized method of evaluating the implementation of quality management in organizations. In line with this notion, the 8 most common critical factors of quality management identified in this paper can be used by researchers and practitioners who intend to study or evaluate the implementation of quality management in organizations.

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