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Critical success factors in small and medium enterprises: survey results

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Introduction

Studies, to date, on critical success factors (CSFs) for total quality management (TQM) implementation have largely centred on the experiences and perceptions of large companies rather than small and medium enterprises (SMEs). They could very well be similar for both sectors, but it is difficult to say without any concrete evidence. This paper discusses the results of a survey (in the form of a postal questionnaire(on CSFs, conducted in UK automotive SMEs.

The paper begins with general descriptive statistics of the respondents, the quality initiatives implemented, and the level of understanding and knowledge of TQM that they have. It is followed by reliability and validity tests conducted on the CSF instrument. The final section presents an analysis of the perception of level of importance and extent of practices of the CSFs. Tests of significance were performed to investigate any differences between the levels of importance and practice, and on the level of importance and practices of companies accredited to QS 9000 against those that were not. The paper culminates with a discussion and the general conclusions from the survey together with some proposed future research directions.

Study methodology

The questionnaire developed in this study consisted of three main sections: the background of the company; the level of knowledge of TQM; and, finally, the CSFs. The first section was intended to determine fundamental issues, including types of product made, whether a certified quality system was held, the level of TQM adoption and, also, confirmation that the company responding was indeed an SME. The section on TQM perception consisted of 15 general statements about the subject matter, derived mainly from the literature and believed to encompass all major elements of the philosophy. Respondents were asked to rate their level of agreement to certain statements on a five-point Likert scale from '1' 'Strongly disagree' to '5' 'Strongly agree', with the middle denoted as 'Neutral'. It was hoped that this would give an indication of the level of knowledge and understanding of TQM.

The major part of the questionnaire comprised the CSF section derived from previously

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developed instruments. New factors were introduced to reflect the SMEs' situation, and 10 major factors believed to be crucial for SMEs were proposed (Yusof & Aspinwall, 1999). For each of the factors, a number of elements or statements were carefully formulated and respondents were asked to rate two aspects. The first was the level of importance they placed on each, and the second the extent to which they thought it was currently practised in the organization. For the importance section, the scales ranged from '1' 'not important at all' to '5' 'very important'. The rating for the extent of practice was given as '1' 'very low' to '5' 'very high'. In addition, a scale of '0' was provided to allow for those respondents who did not know or were unsure of the answer. A final question was included that asked respondents to give, in their opinion, the five most critical factors for implementing TQM. This would give an overall picture of which ones they believed were the most important from an SME's point of view. The target respondents for the survey were the Managing Directors and Quality Directors/Managers, since they are directly involved in the process and have first-hand knowledge of quality implementation in these small businesses. The survey also focused on suppliers to the automotive industry, where experience in implementing quality initiatives was quite mature. It was crucial that the perception of critical factors comes from those who have a good understanding and working experience of TQM, and the automotive sector was thought to fit this criterion.

The survey instrument was piloted and improvements made as a result (Yusof & Aspinwall, 1999), with the final instrument comprising 58 elements. Completing the pilot study enabled the full survey to be launched as planned. The target participants for the survey were chosen from the *SMMT Motor Manufacturers Directory* (1998) and included those SMEs with fewer than 250 employees. Only those involved in manufacturing were selected since the final objective was developing an implementation framework for this sector. Telephone calls were made to confirm the size and involvement in manufacturing in instances where the information provided in the directory was insufficient. Finally, the questionnaire was distributed to a total of 194 companies, each of which met all the criteria established.

Survey results

The response rate was a little over 22% (even after reminder letters were sent, which did not actually provide any additional responses). A response of 20–25% is normal for mailed questionnaires and the 22 % obtained in this study was felt to be a reasonable one considering the fact that the *SMMT Directory* (an authoritative representation of the automotive industry only) was used in selecting the companies. Statistical analyses were carried out using the SPSS Version 8 (1997) statistical package and will now be described.

Respondents' background

The first aspects to be investigated were the general background of the respondents, company size, the products manufactured, the quality initiatives implemented and the number of years of implementation. Figure 1 shows the distribution of the types of products manufactured by the respondent companies. As can be seen, they are quite diverse and range from metal-based parts through electrical/electronics, to plastic and rubber components.

In an attempt to discover whether the respondent company had actually embarked on a TQM programme or not, a question was included which required the companies to indicate what quality activities they had implemented-a list of major initiatives was given (see Table 1). Seventeen of the respondent companies (about 40%) had implemented all 10 initiatives listed, indicating that they were quite advanced in their quality programme. The initiatives that

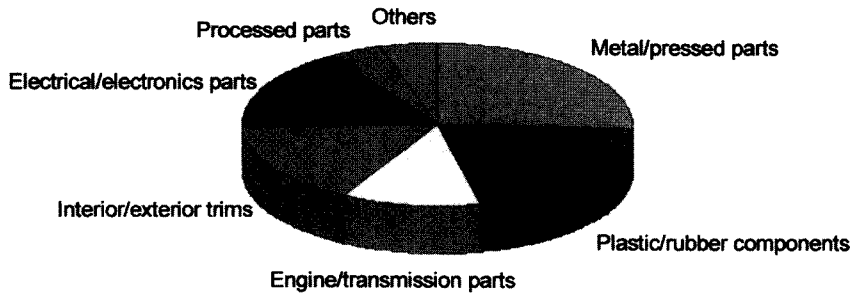

Figure 1. *Types of products manufactured.*

Table 1. *Types of quality initiatives implemented—overall*

Quality initiatives	Yes	%
Setting up a Quality Department	36	83.7
Applying statistical process control	32	74.4
Development of a quality system	42	97.7
Employee involvement to improve quality	41	95.3
Establishing measures of quality progress	40	93.0
Developing strategies for total quality	31	72.1
Business process improvement	30	69.8
Supplier involvement programme	28	65.1
Customer satisfaction initiatives	31	72.1
Cultural change programme	29	67.4

were implemented by the vast majority of the respondent companies were the development of a quality assurance system (97.7%), employee involvement to improve quality (95.3%) and establishing measures of quality progress (93%). The three least implemented were initiating supplier involvement programmes (65.1%), cultural change programme (67.4%) and business process improvement (69.8%). It was surprising to find that 16% of the respondents had not set up a Quality Department. In small businesses, it is important to have a quality function, or something similar, that could act as the catalyst for further commitment to total quality, and to make the CEO aware that 'quality' is vital for the organization. It was also surprising that a quarter of the respondents were not applying statistical process control (SPC), especially since this sector is generally considered to be quite advanced in the use of this technique. The average number of years over which the respondent companies had implemented TQM was 7.6, which is higher than one recent study reported for small manufacturing firms in Ireland, where the corresponding figure was less than 5 (Ismail & Hashmi, 1999).

With reference to having a certified quality system, all but one company had one in place. Almost 70% of the respondents had ISO 9002 certification and only 18 held the more stringent QS 9000 standard, even though it has become almost mandatory for the industry. An interesting feature was felt to be a comparison between these two groups in terms of TQM adoption, since it is believed that QS 9000 is very much closer to the principles of TQM than the current version of ISO 9000. When looking at the number of years certified, the average came to almost 6, with the longest being 19 years, probably to BS 5750. Fifty-one per cent of the companies had actually held their certification for at most 5 years. This was surprising; one would have expected it to be longer, since the ISO 9000 series was first published in 1987, more than a decade ago. Most of the companies embarked on TQM a

little over 7 years ago and this figure is nearly the same as that for implementing and gaining certification to a quality systems standard. Perhaps most of these companies used certification as a vehicle and a starting point for their TQM efforts.

Level of understanding and knowledge on TQM

In order to investigate the level of understanding and knowledge of the respondents about TQM in general, 15 statements were presented, ranging from the philosophy of TQM, through the techniques, to cultural aspects. The respondents were asked to indicate their level of agreement with each one on a scale of 0 to 5. Table 2 shows the mean score for each statement. Some pertinent points are immediately apparent. It is understood that:

- management leadership is important for the success of new change initiatives
- teamwork and participation are necessary ingredients for cultivating a continuous improvement culture
- training and education are important elements for TQM implementation
- quality system standards will not, on their own, ensure high-quality products and services.

On the other hand, there is some uncertainty as to the level of understanding with regard to:

- customers being the driver for improvement efforts
- quality improvement can only be conducted if proper policies exist

since the mean score for these statements was low by comparison. It is widely accepted that customers must drive improvement efforts in an organization. Without customers, the

Table 2. *Mean score for each statement*

Statement	Mean
1. TQM is a management philosophy and practice to ensure effective and efficient use of all available resources	4.23
2. TQM aims to make customers the focus of a business	3.95
3. Teamwork and participation are important for achieving a continuous improvement culture	4.72
4. TQM helps ensure problems are prevented through effective management decisions and operating systems	4.23
5. Customers drive the improvement efforts in all affected business processes	2.79
6. Business performance measurement (including product/service quality level, customer and employee satisfaction levels, delivery time) must be given the same priority as financial measures (profit/loss, etc.)	4.02
7. Training and education are vital elements when adopting TQM	4.70
8. Quality systems standards such as ISO 9000 will not on their own ensure high-quality of products and services	4.63
9. Statistical techniques (such as statistical process control, design of experiments, etc.) are important to ensure consistency of products and process quality	3.86
10. Quality improvement can only be conducted when proper policies are in place	3.67
11. Supplier involvement is vital in supporting quality improvement	4.16
12. Management leadership, commitment and support determine the success of new change initiatives	4.63
13. Management must provide adequate resources in every aspect of the business	4.40
14. A work environment which is conducive to improvement is created through management-worker partnerships	4.26
15. Initiatives such as Kaizen, suggestion schemes, quality circles, etc. will motivate employees to participate in quality improvement	3.84

business will certainly not exist. Also, improvements to be made must be based upon sound policies and established procedures. For example, the QS 9000 standard has a specific requirement for putting in place proper procedures for continuous improvement. Without this, the efforts to continuously improve quality can eventually lead to failure.

These 15 statements form the basis of an assessment of TQM understanding and as such can serve as a tool to allocate a 'score' to each company. It could be interpreted as the higher the score, the better the understanding, but not necessarily the better the practice.

The overall mean score was a little over 62 points, with 42% of the companies having scored above this. One standard deviation (SD) below the mean gives a score of 56. Companies scoring below this were assumed to have little understanding and knowledge of TQM, while those scoring between 57 and 68 inclusive (± 1 SD from the mean) have 'average' understanding and those scoring at least 69 have 'very good' understanding. The results showed that 12% of the respondent companies had a 'low' understanding of TQM, 70% had an 'average' understanding and the remaining 18% a 'very good' understanding. Very few of these companies appeared to have a good understanding of TQM, and this could affect implementation outcomes.

Validation of the critical success factors: Reliability and validity test

Before presenting the CSF results, this section will look at the validation process of the survey instrument. Reliability and validity tests on the instrument were conducted following the approach adopted by Saraph *et al.* (1989). In the case of reliability analysis, Cronbach's alpha (α) model, which measures internal consistency, was employed. Its value refers to the degree to which items (elements) in a set are homogeneous (Measuring Scales: SPSS Manual, 1997; Cronbach, 1990). Basically, it determines whether or not the questionnaire measures success factors in a useful way. Additionally, it determines the extent to which items within a factor (or construct) are related to each other, and it helps identify problem items (elements) that should be excluded from the scale so as to improve reliability.

The other aspect of ascertaining the soundness of the instrument is validity testing. This comprises content, construct and criterion-related validity. Content validity is not numerically determined but based on judgement (Cronbach, 1990; Nunnally, 1978). In the case of construct validity, the most common approach is to factor analyse each construct or factor to check for unifactoriality. Finally, criterion-related validity involves ascertaining the instrument usability in determining future criterion resulting from the use of the instrument for test purposes.

Internal consistency analysis

Using the SPSS reliability analysis procedure, an internal consistency analysis was performed separately for the items of each critical factor; the results are shown in Table 3. Of the original eight items for the critical factor 'Management leadership', the elimination of item F1.5 'Management solve problems on systems' increased the alpha value to 0.8421. Alpha would also be improved if item F6.1 'There is a system for job advancement in the company' were deleted from the human resource development factor. As can be seen, the alpha values range from 0.7729 to 0.9011, indicating that all the scales are acceptable. Alpha values greater than 0.7 are suggested as being adequate for testing the reliability of factors (Nunnally, 1978). From the results obtained, it can be concluded that this instrument has high internal consistency and is therefore reliable.

Table 3. *Internal consistency results*

Factor	Critical success factors	No. of items	Alpha value	Items for deletion	Alpha if item deleted
F1	Management leadership	8	0.8334	F1.5	0.8421
F2	Continuous improvement system	5	0.7729	None	0.7729
F3	Measurement and feedback	6	0.8212	None	0.8212
F4	Improvement tools and techniques	5	0.7821	None	0.7821
F5	Supplier quality assurance	6	0.8550	None	0.8550
F6	Human resource development	7	0.8323	F6.1	0.8499
F7	Systems and processes	6	0.7786	None	0.7786
F8	Resources	4	0.8411	None	0.8411
F9	Education and training	6	0.9011	None	0.9011
F10	Work environment and culture	5	0.8606	None	0.8606
		Total: 58			

Content validity

Content validity is always subjectively evaluated by the researcher (Cronbach, 1990). In the case of this instrument, an extensive review was made of the literature regarding quality management and SMEs, which resulted in being able to elicit elements and factors relating to the particular sector. In addition, the survey was piloted to quality experts and practitioners who verified its content. The factors in the instrument followed closely those developed previously by authors such as Saraph *et al.* (1989) and Ahire *et al.* (1996) some were common factors and very similar to their instruments, such as management leadership and commitment, training and quality techniques. According to Nunnally (1978), an instrument has content validity if it contains a representative collection of items and if sensible methods of test construction were used. It is strongly believed that the section on CSFs of this survey instrument has content validity as it was well received by the pilot respondents.

Construct validity

The method employed for testing whether the instrument had construct validity was factor analysis. Each critical factor was evaluated by factor analysing the measurement items for each of the 10 constructs using the 'practice' data. In the analysis, each factor was assumed to be a separate construct (Saraph *et al.*, 1989). The analysis was carried out using the SPSS Data Reduction-Factor Analysis Procedure (1997), and the steps provided by Tabachnick and Fidell (1989) and Owlia (1996).

The first run proved to be unsatisfactory since, of the 10 factors, five were unifactorial and the remainder bi-factorial. The results were analysed to check for elements which had a low correlation with others, and a low factor loading which provided candidates for removal for the secondary factor analysis. A secondary factor analysis was performed on those factors that were found not to be unifactorial. Elements that did not have a strong correlation with the component, as well as those having low communalities (i.e. proportion of the variance of that variable that can be explained by the components), were eliminated. This resulted in all factors being unifactorial; the summary is given in Table 4.

Having conducted this analysis, the survey instrument for the CSFs has been validated for construct validity. Even though the first set of results was not satisfactory, all the remaining factors were eventually proven to be unifactorial.

Table 4. *Final results of factor analysis*

Factor	Critical success factors	Item loading for component 1	Eigenvalue	% Variance explained by component 1	Obtained by deleting
F1	Management leadership	0.621–0.859	3.517	59	Elements 1.5 and 1.6
F2	Continuous improvement system	0.613–0.851	2.741	55	–
F3	Measurement and feedback	0.658–0.853	2.342	59	Elements 3.1 and 3.4
F4	Improvement tools and techniques	0.540–0.914	2.529	63	Element 4.5
F5	Supplier quality assurance	0.722–0.842	3.496	58	–
F6	Human resource development	0.761–0.805	3.521	59	Element 6.1
F7	Systems and processes	0.637–0.845	2.698	54	Element 7.4
F8	Resources	0.735–0.909	2.724	68	–
F9	Education and training	0.748–0.901	4.045	67	–
F10	Work environment and culture	0.728–0.900	3.295	66	–

Criterion-related validity

Criterion-related validity is concerned with the extent to which a measuring instrument is related to an independent measure of a relevant criterion. Previous researchers have used criteria such as product quality level (Ahire *et al.*, 1996; Badri *et al.*, 1995), business outcomes (Quazi & Padibjo, 1998) and average of quality performance and customer satisfaction in a business unit (Saraph *et al.*, 1989). In the case of this instrument, since no criterion was initially designed into the survey, the section on TQM perception was used for this purpose. In a way, the criterion for or the resultant effect of successful TQM implementation results in a good understanding of TQM.

Multiple regression was used to determine whether the critical factors were related to TQM understanding and knowledge. The 'average score' for each company was used as the dependent variable, while the mean importance placed by the company served as the independent. The mean importance was used instead of practice because it was felt to be a better indicator of understanding. If a company attaches great importance to a certain factor then it is likely that they understand it and possess knowledge of its importance. Practice does not reflect or show knowledge since it is more of the 'reality' that exists in the company. The *R*-square value (coefficient of determination) resulting from this analysis was 0.368 when all the factors were included. Attempts to remove some of the factors did not improve the coefficient at all. Even though the value only reflects moderate correlation between predictor and dependent variable average score, it did reflect some predictive validity.

Results of CSF study

Perception on importance

Having conducted the reliability and validity tests, the various means for the perception of importance and practice were analysed. First, an overall mean for each factor was obtained to look at the level of importance perceived by the respondents; the results are shown in Table 5. The values range from 3.88, between 'neutral importance' and 'important', to 4.45, which is close to 'very important'. When these critical factors were arranged in order of magnitude, *Management leadership* and *Measurement and feedback* were perceived to be the two most critical ones, while *Supplier quality assurance* and *Improvement tools and techniques* were the two least important.

Table 5. *Mean importance and practice perception with ranking*

Factor	Description	Importance mean	Rank	Practice mean	Rank
F1	Management leadership	4.4543	1	3.7512	2
F2	Continuous improvement system	4.1163	7	3.3488	8
F3	Measurement and feedback	4.4496	2	3.8178	1
F4	Improvement tools and techniques	3.8872	10	3.1337	10
F5	Supplier quality assurance	4.0155	9	3.2558	9
F6	Human resource development	4.0952	8	3.4264	7
F7	Systems and processes	4.2097	5	3.7209	3
F8	Resources	4.1434	6	3.6802	4
F9	Education and training	4.3178	3	3.6628	5
F10	Work environment and training	4.2977	4	3.5291	6

Extent of practice

Another aspect investigated in the critical factor section was the level or extent of practice of each. The means for each factor are shown in Table 5 and, as can be seen, the perception of practice is lower than that of importance in every case. The values range from 3.13 to 3.81, which corresponds to a 'moderate' level of practice (3 to 4 on the Likert scale). *Measurement and feedback* and *Management leadership* were the two highest critical factors, while *Supplier quality assurance* and *Improvement tools and techniques* were the bottom two—the same as the perceived importance results. What does this indicate? Possibly, this shows that some effort needs to be focused on developing these companies' ability to incorporate supplier quality assurance and the proper use of improvement tools and techniques into their continuous improvement programme. In fact, the ranking of the extent of practice, shown in Table 5, puts the factor *Continuous improvement system* eighth. In order for TQM to flourish, a system for continuous improvement must exist together with the appropriate utilization of quality tools and techniques to support it. Without them the initiative will almost certainly fail.

Another area explored was the importance and practice perceptions of the QS 9000- versus the non-QS 9000-certified companies for all the critical factors. The results are shown in Table 6.

Table 6. *Comparison between QS 9000 and non-QS 9000 companies—mean importance and mean practice*

		Mean Importance		Mean Practice	
Factor	Description	QS 9000	Non-QS 9000	QS 9000	Non-QS 9000
F1	Management leadership	4.6200	4.3350	3.8849	3.6650
F2	Continuous improvement system	4.3111	3.9760	3.5667	3.1920
F3	Measurement and feedback	4.6111	4.3333	3.9444	3.7267
F4	Improvement tools and techniques	4.1444	3.7020	3.4111	2.9340
F5	Supplier quality assurance	4.1852	3.8933	3.3611	3.1800
F6	Human resource development	4.2778	3.9638	3.4841	3.3848
F7	Systems and processes	4.3333	4.2600	3.7778	3.6800
F8	Resources	4.1065	4.1700	3.5556	3.7700
F9	Education and training	4.3889	4.2667	3.6574	3.6667
F10	Work environment and culture	4.3444	4.2640	3.5000	3.5500

Non-QS 9000 = 25 companies.
QS 9000 = 18 companies.

Significance test on difference of means

It is apparent that while the companies placed a high degree of importance on certain factors, the extent to which they were practised differed. A test was carried out to discover whether there was any significant difference between the level of importance and the extent of practice for each factor individually. This was done on an overall basis (i.e. all the respondents together), and then for those companies certified to the QS 9000 standard and those not certified.

In order to conduct the tests, the following hypotheses were set up.

(1) To test for a significant difference between the importance and practice means:
H_o: $\mu_1 - \mu_2 = 0$, i.e. there is no significant difference between the two means;
H_1: $\mu_1 - \mu_2 \neq 0$, i.e. there is a significant difference between them.

(2) To test for a significant difference in the extent of practice between QS 9000 and non-QS 9000 companies:
H_o: $\mu_1 - \mu_2 = 0$, i.e. there is no significant difference between QS 9000 company practices (on each of the TQM critical factors) and non-QS 9000 companies;
H_1: $\mu_1 - \mu_2 \neq 0$, i.e. there is a significant difference between the practices of QS 9000 and non-QS 9000 companies.

(3) To test for a significant difference in the perceived level of importance expressed by QS 9000 and non-QS 9000 companies:
H_o: $\mu_1 - \mu_2 = 0$, i.e. there is no significant difference between perceived importance of QS 9000 companies (on each of the TQM critical factors) and non-QS 9000 companies;
H_1: $\mu_1 - \mu_2 \neq 0$, i.e. there is a significant difference between the perceived importance of QS 9000 and non-QS 9000 companies.

The first test involved a paired comparison *t*-test, while the other two were analysed using an ordinary comparison *t*-test. SPSS-Compare Means Procedure was employed in both instances (Cramer, 1998; Ferguson & Takane, 1989; MacRae, 1998). The first *t*-test showed that there was a significant difference between perceived importance and the extent of practice for each factor by the companies (see Table 7). In other words, the importance placed by the companies on all the critical factors has not been pop popd into practice, i.e. the companies know the importance of the TQM factors but have failed to execute them to any great extent. With regard to the ordinary comparison *t*-test between the QS 9000 and the non-QS 9000 companies, it was anticipated that the level of practice for each factor would differ. However,

Table 7. *Paired sample statistics for mean importance and practice*

Factor	Mean importance	Mean practice	*p*-Value	t_{calc}	Results
Management leadership	4.4543	3.7512	0.000	8.782	Sig.
Continuous improvement system	4.1163	3.3488	0.000	7.921	Sig.
Measurement and feedback	4.4496	3.8178	0.000	6.825	Sig.
Improvement tools and techniques	3.8872	3.1337	0.000	6.571	Sig.
Supplier quality assurance	4.0155	3.2558	0.000	6.804	Sig.
Human resource development	4.0952	3.4264	0.000	6.409	Sig.
Systems and processes	4.2907	3.7209	0.000	5.939	Sig.
Resources	4.1434	3.6802	0.000	4.995	Sig.
Education and training	4.3178	3.6628	0.000	6.430	Sig.
Work environment and culture	4.2977	3.5291	0.000	6.904	Sig.

$t_{critical}$ value at 0.05 level of significance with 42 degrees of freedom = 2.0189.

Table 8. *Ordinary comparison statistics for QS 9000 versus non-QS 9000 companies for mean practice*

Factor	Mean Practice		p-Value	t_{calc}	Results
	QS 9000	Non-QS 9000			
Management leadership	3.8849	3.6550	0.193	1.325	Not sig.
Continuous improvement system	3.5667	3.1920	0.100	1.683	Not sig.
Measurement and feedback	3.9444	3.7267	0.272	1.113	Not sig.
Improvement tools and techniques	3.4111	2.9340	0.048	2.036	Sig.
Supplier quality assurance	3.3611	3.1800	0.498	0.684	Not sig.
Human resource development	3.4841	3.3848	0.669	0.431	Not sig.
Systems and processes	3.7778	3.6800	0.627	0.490	Not sig.
Resources	3.5556	3.7700	0.409	-0.835	Not sig.
Education and training	3.6574	3.6667	0.967	-0.042	Not sig.
Work environment and culture	3.5000	3.5500	0.835	-0.210	Not sig.

$t_{critical}$ value at 0.05 level of significance with 41 degrees of freedom = 2.0199.

Table 9. *Ordinary comparison statistics for QS 9000 versus non-QS 9000 companies for mean importance*

Factor	Mean Importance		p-Value	t_{calc}	Results
	QS 9000	Non-QS 9000			
Management leadership	4.6200	4.3350	0.032	2.220	Sig.
Continuous improvement system	4.3111	3.9760	0.051	2.007	Not sig.
Measurement and feedback	4.6111	4.3333	0.083	1.776	Not sig.
Improvement tools and techniques	4.1444	3.7020	0.050	2.017	Not sig.
Supplier quality assurance	4.1852	3.8933	0.109	1.639	Not sig.
Human resource development	4.2778	3.9638	0.056	1.965	Not sig.
Systems and processes	4.3333	4.2600	0.670	0.430	Not sig.
Resources	4.1065	4.1700	0.794	-0.263	Not sig.
Education and training	4.3889	4.2667	0.499	0.682	Not sig.
Work environment and culture	4.3444	4.2640	0.700	0.388	Not sig.

$t_{critical}$ value at 0.05 level of significance with 41 degrees of freedom = 2.0199.

in the event it was found that only one factor, *Improvement tools and techniques*, showed a significant difference. This reflects the main difference between the QS 9000 and the ISO 9000 standards, whereby the former includes a continuous improvement element which requires evidence of the application of the improvement tools and techniques such as SPC, advanced quality planning, etc. This is considered an important finding since this factor is crucial for TQM success. None of the other factors showed a significant difference. The results are summarized in Table 8. The results for the last test on perceived importance between QS 9000 and non-QS 9000 companies indicated no significant difference in the perceived level of importance for all factors except *Management leadership*. The QS-9000 certified companies placed a high level of importance on this factor due to the fact that a greater emphasis is placed on the need for continuous improvement in QS 9000, therefore the need for management commitment is important. Table 9 summarizes the test results.

Most critical factors for TQM implementation

Finally, respondents were asked which of a list of 11 factors (see Table 10) they considered to be the five most critical for implementing TQM. The top two were:

Table 10. *The 11 listed most critical factors*

No.	Most critical factors
1.	Leadership and support from top management
2.	Providing effective and appropriate training for employees
3.	Measuring results and performance
4.	Conducting continuous improvement
5.	Adopting a quality assurance system (e.g. ISO 9000)
6.	Sufficient financial resources
7.	Providing relevant training for senior management/staff level
8.	Favourable work environment and culture
9.	Selective application of tools and techniques
10.	Involving suppliers in improvement activities
11.	Desirable human resource practices

- *Leadership and support from top management.* The respondents unanimously agreed that this was a very critical factor, as evidenced from the literature.
- *Providing effective and appropriate training for employees* had the support of 74% of the respondents.
- The remaining three factors of the top five were: (a) *measuring results and performance* (67%); (b) *conducting continuous improvement* (58%); and (c) *adopting a quality assurance system* (44%).

A number of observations can be drawn from the responses. The second most critical factor, employee training, indicates that training is crucial for changing the prevalent working attitude and culture of the employees towards a new thinking, the thinking for quality. Employees must also be equipped with the necessary skills and tools to conduct continuous improvement. The results show that 'conducting continuous improvement' actually ranks after 'employee training'. In a sense, training must be conducted first before any quality improvement activities are undertaken. Figure 2 shows a Pareto diagram of the rankings.

'*Measuring results and performance*', which came third, is important for evaluating and monitoring the achievements of the TQM efforts. It is a bit surprising to find that *desirable human resources practices* was not seen as a more important critical factor by the companies, especially when it is crucial to have policies that ensure 'people satisfaction' and because, in addition, TQM demands a focus on internal customers. Reasons for the low level of importance could not be ascertained at this stage, but would be worth exploring in the future. The most critical factors (MCFs) highlighted in this section are very much in agreement with the results obtained for the mean importance perceived by the companies. It is believed that the similarities seen here are not coincidental, but they reflect the reality of this particular sector of the industry. The similarities seen thus far will be discussed in the next section.

Discussion

A summary of the responses from the four main questions addressed in the survey, i.e.

(1) What quality initiatives have been implemented?
(2) Which of the following are the five MCFs for TQM implementation?
(3) What is the extent of practice for each of the factors?
(4) What is the level of importance for each of the factors?

is shown in Tables 11 and 12.

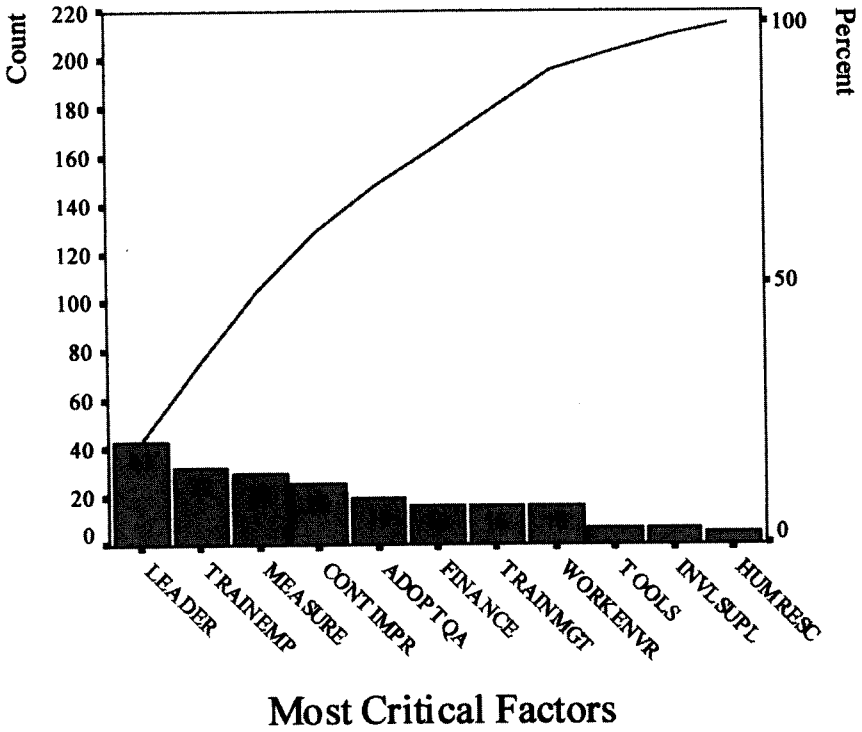

Figure 2. *Pareto Diagram of Most Critical Factors.*

Table 11. *(a) Ranking of most critical factor*

Most critical factor	Percentage agree
Leadership and support from top management	100
Providing effective and appropriate training for employees	74.4
Measuring results and performance	67.4
Conducting continuous improvement	58.1
Adopting a quality assurance system (e.g. ISO 9000)	44.2
Sufficient financial resources	37.2
Providing relevant training for senior management/staff level	37.2
Favourable work environment and culture	37.2
Selective application of tools and techniques	16.3
Involving suppliers in improvement activities	16.3
Desirable human resource practices	11.6

Table 11. *(b) Mean importance of critical factors*

Critical success factors (ranked from highest to lowest)	Mean importance rating
Management leadership	4.4543
Measurement and feedback	4.4496
Education and training	4.3178
Work environment and culture	4.2977
Systems and processes	4.2907
Resources	4.1434
Continuous improvement system	4.1163
Human resource development	4.0952
Supplier quality assurance	4.0155
Improvement tools and techniques	3.8872

Table 12. *(a) Summary of quality initiatives*

Quality initiatives implemented	% Responded
Development of a quality system	97.7
Employee involvement to improve quality	95.3
Establishing measures of quality progress	93.0
Setting up a Quality Department	83.7
Applying statistical process control	74.4
Customer satisfaction initiatives	72.1
Developing strategies for total quality	72.1
Business process improvement	69.8
Cultural change programme	67.4
Supplier involvement programme	65.1

Table 12. *(b) Mean practice of critical factors*

Critical success factors (ranked from highest to lowest)	Mean practice level
Measurement and feedback	3.8178
Management leadership	3.7512
Systems and processes	3.7209
Resources	3.6802
Education and training	3.6628
Work environment and culture	3.5291
Human resource development	3.4264
Continuous improvement system	3.3488
Supplier quality assurance	3.2558
Improvement tools and techniques	3.1337

The 'MCFs' and the 'mean importance' relate to what the companies perceived as crucial for the successful implementation of TQM. From Tables 11 (a) and (b), it is clear that there are some similarities. First, management leadership is a priority for TQM implementation. Second, measurement and feedback to gauge performance is a CSF. Third, providing effective and adequate training for employees supports the importance of the education and training factor. Finally, adopting a quality assurance system corresponds to the systems and processes factor.

At the other end of the list (i.e. the least important or less critical) were the improvement tools and techniques and supplier involvement. It may be that the companies perceived that suppliers could come in at a later stage in the TQM process, when many of the internal improvements had been accomplished, but involvement is definitely needed. The tools only provide a means of achieving improvement and should not to be used 'just for the sake' of it.

Another important area investigated was which quality initiatives had been implemented and the extent to which they were practised. These two aspects relate not to importance but to the actuality of the quality programmes. The responses are summarized in Tables 12(a) and (b). Two similarities are the high level of practise of measurement and feedback/ establishing measures of quality progress and the development of a quality system(s) and processes. This is in line with the results for the importance or critical factors needed for TQM implementation where both of these emerged as key elements. It would be interesting to investigate the kinds of measures currently being used and to compare them with those found by Kanji and Yui (1997) and Kanji and Wong (1999).

It is also important not to overlook the areas lacking in terms of practice such as continuous improvement system, supplier quality assurance and application of tools and techniques. Why they are low could be an area to explore in the future; it may be that SMEs lack the necessary technical know-how and human resources, and so the tendency is to relax on this 'difficult' area of techniques and statistical tools.

It is believed that there are four areas which form the critical core for TQM implementation in this sector. They are:

- management leadership;
- measuring results, progress and performance;
- appropriate training for employees;
- adopting a quality assurance system.

On the other hand, the areas that actually need more attention from these companies are those having low practice levels, i.e.

- continuous improvement system;
- improvement tools and techniques;
- supplier quality assurance.

Conclusions

The results from a survey conducted on CSFs for TQM implementation in SMEs have been presented in this paper. A reliability and validity analysis on the survey instrument was conducted and concluded that it was a fairly reliable and valid measure. The internal consistency test showed it was a reliable instrument, while varying results were obtained for construct and criterion-related validity tests. Overall, some level of validity was evident, especially since most of the factors were based upon a previously developed instrument and thoroughly tested for reliability and validity. Future work could investigate a better criterion measure, probably one which relates to objective data such as customer satisfaction level or index, or actual quality results, or scores from a self-assessment process, to gain better validity, especially in the case of criterion-related validity.

The analysis revealed the lack of practice in areas including *Continuous improvement system*, *Supplier quality assurance* and *Improvement tools and techniques*. One important factor, i.e. *Improvement tools and techniques*, showed a significantly different level of practice (at the 5% level) between companies certified to QS 9000 and those not certified to the standard. Another major finding was the significant difference (at 5% level) that exists between the means of perceived importance and those of level of practice on all the factors. The companies surveyed had not really put into place those activities they perceived to be important. The findings from this small survey related to CSFs are crucial for TQM implementation in SMEs. It can be said that those for SMEs were not the same as for large companies, especially when the instrument had been modified to meet SME characteristics (see Yusof & Aspinwall, 1999), as evident from this survey.

Future research can concentrate on refining and further validating the instrument developed here through applying it in different manufacturing sectors, such as food processing, chemical, electronics, etc. Comparisons could then be made across these different manufacturing sectors. Another possible area to develop is the quantification of these CSFs into an 'extent of practice index' in a company to gauge the level of performance on a time-based approach, such as year on year. The results from this index could pinpoint areas that need attention and improvement.

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