
An Evaluation of the Effects of Quality Improvement Activities on Business Performance

Quality
Improvement
Activities

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Introduction

The developments in the management of quality during the 1980s led increasingly to the international adoption of the principle of business improvement through total quality management (TQM). With the maturing of the approaches to TQM in the 1990s, organizations have sought to refine their TQM methodologies and in particular to identify those quality activities which most directly affect business performance. The research challenge in this area has been to identify the relationships which exist between organizational characteristics, quality improvement activities and business performance indicators.

This article describes the findings from research undertaken at Liverpool University on the prime effects of total quality management (TQM) and other quality activities on business performance. This information was used to develop a TQM quality activity model which can:

- (1) assist organizations in the selection and targeting of quality activities to specific problems and opportunities;
- (2) provide organizations with a greater understanding of how quality activities are likely to affect their organization;
- (3) encourage the implementation of quality activities.

The article begins by describing the research method used to investigate the effects of quality activities on business performance. This includes a description of the classification system developed to classify the effects of quality activities on business performance. This is followed by a description of the most important research investigations and findings. The article concludes by bringing together the findings to provide a general guide to the effects of quality activities.

An important term used throughout the article is the term "quality activity". This is a generic term which describes a distinguishable tool or method used for quality improvement. These activities range from control charts to ISO 9000 to

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TQM. TQM is considered to be a quality activity which is composed of many quality activities.

Note that the research findings within this article are from a wider research programme which resulted in the development of a framework to assist in the implementation of TQM, see Mann[1].

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Research Method

In this section an overview of the research method will be given, followed by a description of the research tools (questionnaires and structured interviews) and the Business Performance Classification System.

The research method is summarized by Figure 1. This shows the first stage of the research (box 1) was to develop a Business Performance Classification System. This system would help in determining the research tools to use and

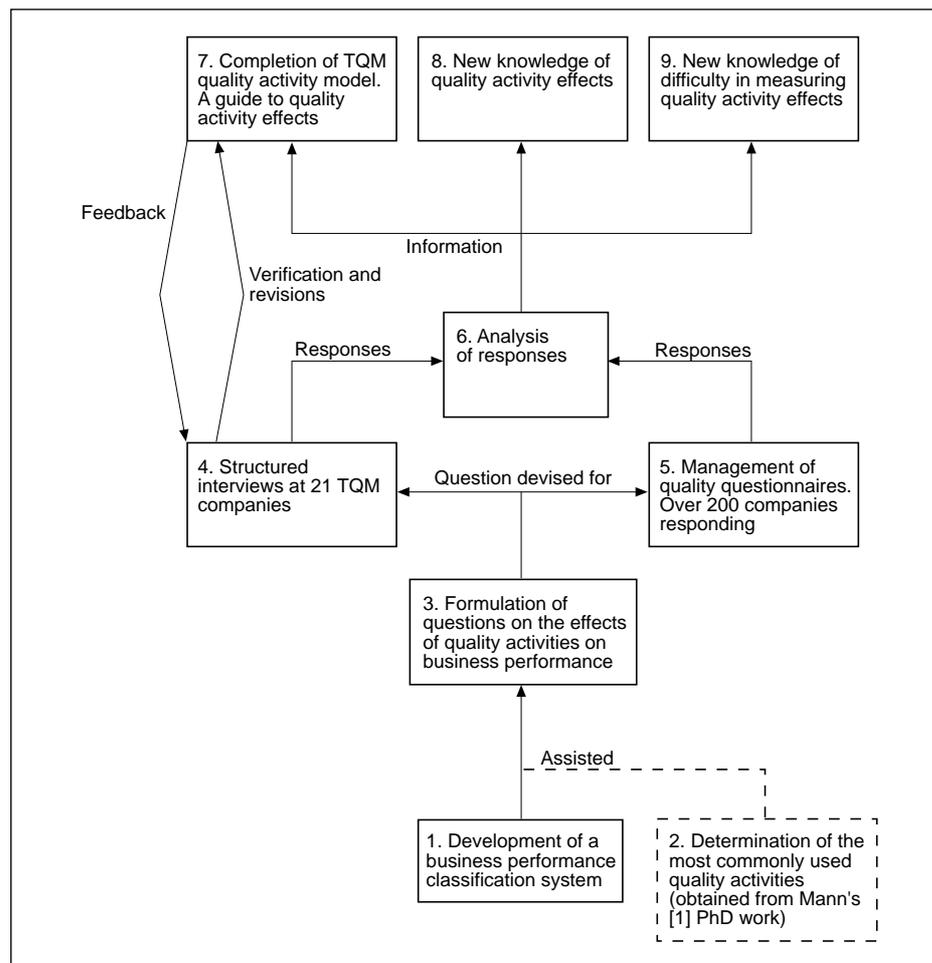


Figure 1.
The Research Method

would assist in the categorization of quality activity effects. Other information, which was important to this stage, was being acquired by Mann's PhD research[1] on the most commonly used quality activities. This research, which identified 65 quality activities[10] helped to determine which quality activities should be targeted for investigation.

Based on this information and other information requirements of the PhD research it was decided that structured interviews and questionnaires were the most appropriate tools to use. Specific questions could obtain detailed information on the most common or important quality activities. General questions could obtain a general picture of the effect of all the 65 quality activities.

An analysis of the questionnaire and structured interview responses (a summary is provided in the Findings Section of the paper) assisted in providing new knowledge of quality activity effects and knowledge of the difficulty in measuring quality activity effects. In addition it assisted in the development of a general guideline (a TQM quality activity model) describing the prime effects of quality activities. The guide, itself, was verified by feedback from the structure interview respondents.

Research Tools

The research tools used were questionnaires and structured interviews. A standard "management of quality" questionnaire was used to address two samples of companies in July/August 1989:

- (1) *The random sample* – A sample of 650 manufacturing companies were randomly selected from the 1988 edition of Kompass[2]. A response rate of 22 per cent (142 responses) was recorded. Nineteen companies had implemented TQM.
- (2) *The TQM sample* – A sample of 120 manufacturing companies likely to be implementing TQM were selected through publications such as *Quality Assurance News*, the *Quality Assurance Journal* and *TQM Magazine*, and through books on TQM. These organizations were either described as TQM oriented or were large multinational organizations likely to be highly quality developed. A response rate of 58 per cent (69 responses) was recorded. Forty-six companies had implemented TQM.

The responses of the companies from both these samples were pooled together for the purpose of the research described in this article.

Structured interviews were undertaken at 21 leading TQM organizations between November 1990 and February 1991. Interviews were with those involved in the steering and planning of TQM (therefore Directors or Managing Directors). Interviews were approximately three hours long.

A Business Performance Classification System

A classification system was developed to assist in the investigation and analysis of quality activity effects of business performance. It was applicable

for both questionnaire and structured interview use and its flexibility enabled the study of a wide variety of quality activities and their effects.

The system was primarily developed through a study of the literature on Performance Measurement Systems. The “new performance measurement systems”, as described by Maskell[3], aim to measure business performance accurately at each organizational level reflecting the breakdown of the organization’s vision, mission, strategies and goals. This concept of measures at different organizational levels was central to the classification system.

The classification system developed, categorizes business performance into strategic business performance (SBP) and operational business performance (OBP). SBP measures refer to those measures typically addressed by the Corporate Management Board. They are concerned with measuring an organization’s performance in terms of its major corporate goals. OBP measures refer to measures which are addressed throughout the organization by both management and employees. OBP measures are concerned with recording on a daily or weekly basis the everyday running of the organization.

Table I shows a list of SBP and OBP measures which were formulated to assess the effects of quality activities. Of the list of measures, those applicable to a question and answer format were included in the questionnaire and are printed in bold type. The other measures simplified the analysis and understanding of the structured interviews.

When formulating the list of OBP measures it was helpful to consider an organization in terms of its inputs, transformations and outputs to ensure all elements of the organization were addressed. This method was also advocated by Crawford *et al.*[4]. These classes were further decomposed into the categories of supplier relationship, processes, people, policy deployment and customer relationship, to aid in the understanding of OBP. Information from the following sources helped in the formulation of a list of measures: Crawford *et al.*[4], Dixon *et al.*[5], Agenti[6], Smith[7] and Cullen and Hollingum[8].

The classification system developed ensured that both higher level and lower level effects were investigated and effects across all functions of the organization were included for analysis. In addition the classification system proved to be an effective communication tool for showing the expected effects of quality activities.

The next two sections on the effects of quality activities on strategic business performance and operational business performance describe the prime findings of the research. Questions investigated the effects of all 65 quality activities either through questionnaires or structured interviews.

Findings: Effects of Quality Activities on Strategic Business Performance (SBP)

Questionnaire Findings

To encourage a high questionnaire response rate the number of questions on the questionnaire was restricted. This reduced the number of quality activities

<i>Strategic business performance measures</i>	
Profitability	Sales revenue
Growth	Exports
Social responsibility	Productivity
Environmental control	Total cost
Market share	Employee welfare
Changes in customer base	Sales turnover
Return on capital employed	Shareholders dividends
<i>Operational business performance measures</i>	
1. Supplier (relationship) measures:	
Vendor performance	Supplier certification
Supplier delivery performance	Material availability
Supplier communication	Supplier price
Supplier product quality	Number of suppliers
Lost production due to supplier material	
2. Process measures:	
Work in progress	Downtime
Lead time	Machine breakdowns
Product quality	Process capability
Preventative maintenance	Setup reduction
First time pass rate	Throughput time
Product standardization	Cycle time
Flexibility to execute changes	Capacity utilization
Number of engineering changes	Scrap
Rework	Number of defects
Internal customer/supplier performance	Downtime
3. Policy deployment measures:	
Business control	Operating expense
Quality costs	Working to schedule
Departmental performance	Departmental spending
Sales forecast accuracy	Team performance
Targets/goals	Quality audit results
Common understanding of strategy	
4. People measures:	
Performance appraisal results	Output per employee
Per cent of employees involved in teams	Absenteeism
Skill level of employees	Employee morale
Department communication	Employee communication
Education and training	
5. Customer relationship measures:	
Customer complaints	Customer service
Customer communication	Deliver as promised
Customer satisfaction survey results	Market research
Product returns	Product replacement
Product liability	Quality reputation
<i>Note:</i> Measures included in the questionnaire are printed in bold type.	

Table I.
Measures to Assess
OBP and SBP

which could be investigated by this method. Those quality activities not investigated by the questionnaires were investigated by structured interviews.

Quality activities to be investigated by questionnaires were selected using the following criteria:

- their expected frequency of use within industry (a sizeable proportion of the sampled organizations needed to be using the quality activity),
- those expected to have the greatest benefits on business performance (this information was acquired from studying the previous research undertaken in this area. It is discussed in detail in Mann's PhD research[1]),
- those described by quality practitioners as important to a TQM strategy (for example Oakland[9] described the prime elements of TQM as Management Commitment, Quality Management System, Tools such as SPC, and Teamwork),
- those selected needed to represent the diversity of roles or functions quality activities can fulfil (this encouraged a broad selection of quality activities to be chosen).

One of the most informative questions asked the respondents to rank the five most beneficial quality activities from the following[11]: quality awareness programme, delegated teams, voluntary teams, internal audits, supplier improvement activities, statistical process control, quality costs, ISO 9000, Taguchi methods and TQM. As the question necessitates a comparison of quality activities with regard to their total effects on the organization, these effects were considered to be their effects on SBP.

To analyse the responses, a point-scoring method was developed. This considered the ranking of each quality activity and the number of quality activities the company used; see Table II. Only those companies who used five or more of the listed quality activities were included in the analysis.

Table II shows the relationship between the points allocated to each rank relative to the number of quality activities used. A higher weighting was given to the views of those companies which used the most quality activities (these

Number of quality activities used	Points scored dependent on rank						Average point score per quality activity
	1st	2nd	3rd	4th	5th	Others	
5	5.0	4.0	3.0	2.0	1.0	n.a.	3.0
6	6.0	4.8	3.6	2.4	1.2	0	3.0
7	7.0	5.6	4.2	2.8	1.4	0	3.0
8	8.0	6.4	4.8	3.2	1.6	0	3.0
9	9.0	7.2	5.4	3.6	1.8	0	3.0
10	10.0	8.0	6.0	4.0	2.0	0	3.0

Table II.
Point Scoring Method
Based on Quality
Activity Ranking

companies could most accurately assess the relative benefits of quality activities). For example, if a company used five quality activities 5, 4, 3, 2 and 1 points were given to 1st, 2nd, 3rd, 4th and 5th ranks as compared to 10, 8, 6, 4 and 2 points if ten quality activities were used. By ensuring the average point score per quality activity was the same (it equals 3) it was believed this system was the most appropriate to use.

The analysis results are shown in Figure 2. This shows the average point score for each quality activity. It shows that the two quality activities (ISO 9000 and TQM), which are implemented across all functions of the organization scored highest. Taguchi, the most specific of the quality activities, scored lowest.

A number of questions investigated specifically the effects of TQM. Table III shows the responses of 65 TQM companies to some of these questions. The responses indicate the favourable effects of TQM, with 52 per cent of companies indicating a general improvement in market share. In addition over 50 per cent of those companies which indicated “stayed the same” and 56 per cent of the companies indicating “don’t knows” had only begun implementing TQM in the previous year. It would be expected that the effects of TQM for these companies would be less.

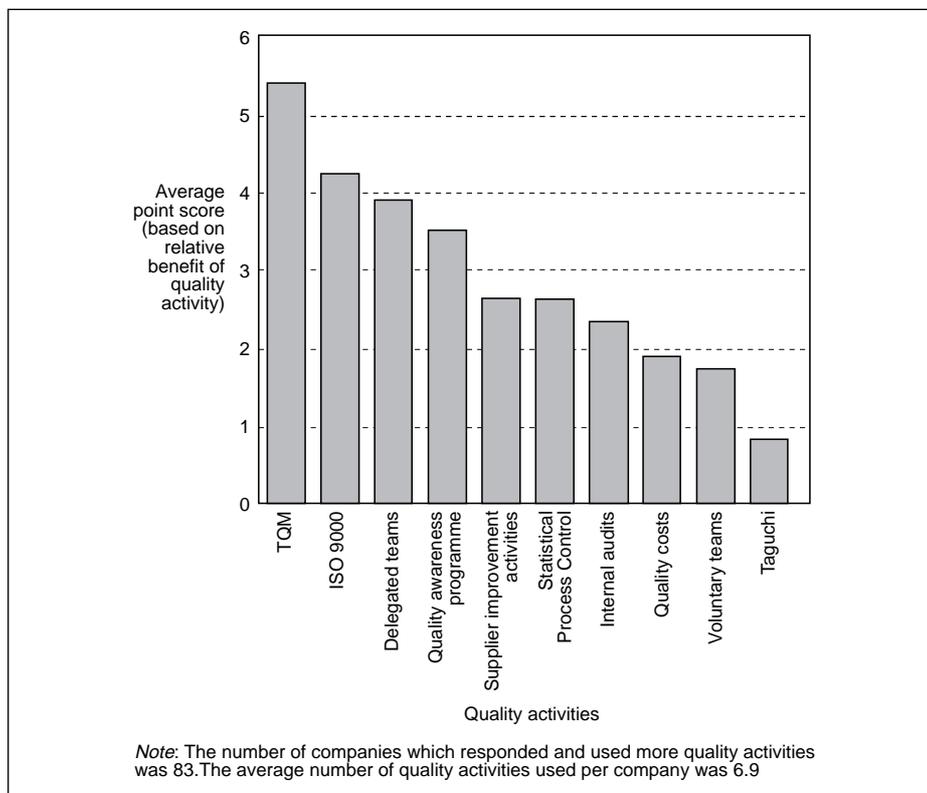


Figure 2.
Relative Benefits of Quality Activities on SBP

Table III.
Effects of TQM on SBP

Question	Responses (%)		
	Yes	No	Don't know
Since the introduction of TQM has the company:			
1. Increased its market share generally?	52	31	17
2. Increased its market share in specific areas?	57	28	15
3. Established a new customer base?	32	53	15
4. Increased its export market?	38	49	13
5. Stayed the same?	17	70	13
Question not answered: 16 companies			
<i>Note.</i> These results are from 65 TQM companies			

Another question investigated how TQM affected sales turnover. This question investigated the extent to which the company's sales turnover had changed since TQM and the proportion they believed was due to TQM. The responses are summarized as follows:

- Number of companies = 31,
- Mean average rate of increase of sales turnover per annum due to TQM = 8.3 per cent,
- Standard deviation = 22.

As the standard deviation was large a median average rate was also calculated:

- List of each company's percentage sales turnover increase per annum due to TQM:
0, 0, 0, 0, 0, 0, 0, 0.1, 0.3, 0.3, 0.3, 0.3, 0.3, 0.4, 0.4, 0.7, 1.0, 1.1, 1.1, 1.8, 2.2, 3.1, 4.2, 6.9, 8.3, 8.3, 10.9, 33.8, 81 and 93.
- Median average rate of increase of sales turnover per annum due to TQM = 0.4 per cent.

It is noticeable that there is a difference between the mean and median average rate of increase of sales turnover. This difference was due to the recording of a few extreme values.

Considering the responses to the TQM/market share question (see Table III) the responses to the sales turnover question indicated smaller than expected effects of TQM. Reasons for this are provided by the structured interview findings.

Structured Interview Findings

Some important but not surprising findings were that:

- (1) Most companies did not measure the effects of quality activities in terms of SBP.

- (2) Few companies have a method of isolating the effects of individual quality activities.
- (3) Companies implement and use quality activities differently.
- (4) Companies use different measurement systems. The results are not comparable.

These findings help to explain the variations in the questionnaire responses with regard to TQM. It indicates that some of the variability may be due to questionnaire respondents wrongly estimating the effects of TQM. Another explanation was arrived at as the result of the following question: "Why did the company initially decide on a TQM policy?". Figure 3 groups together the responses into four categories.

This categorization shows that 30 per cent of companies viewed TQM as a method for "survival". This response may explain why some companies expressed no market share change or sales turnover change; the reason being that many companies had decreasing market share or sales turnover when TQM was implemented. For these companies it may take longer to reverse these trends. One managing director described this point clearly: "With TQM we are becoming more cost-effective and improving but we are still losing market share. It will take time before the effects of TQM reach the marketplace". A contributory factor for the smaller than expected effects of TQM on sales turnover as compared to market share may have been due to the recession. A number of companies reported a decreased sales turnover but increased market share.

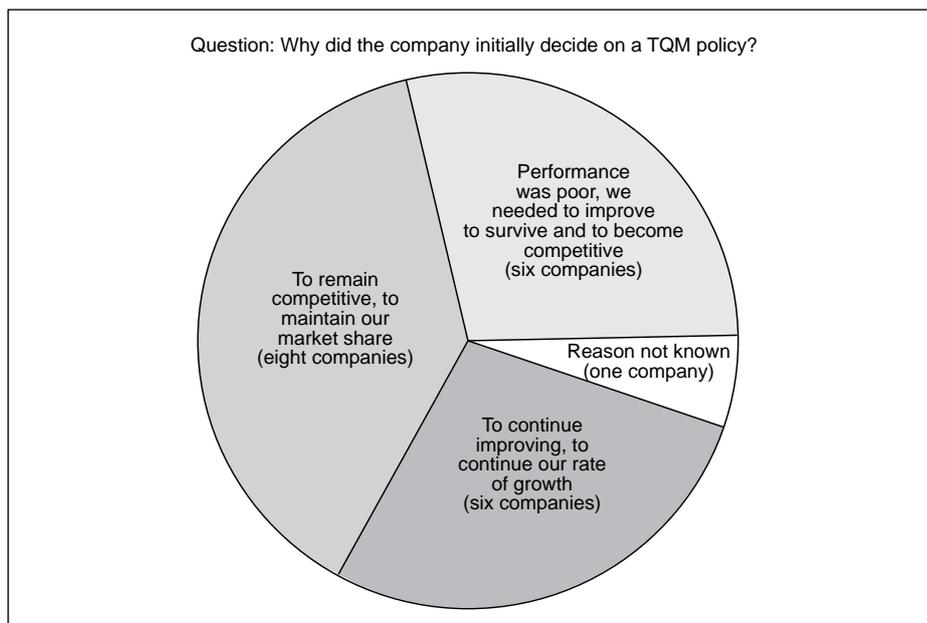


Figure 3.
Initial Reasons for TQM Implementation

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Another important information with regard to TQM was that all 21 TQM companies interviewed believed TQM has had a positive effect on their organization. None of the organizations would like to return to the pre-TQM years.

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Findings: Effects of Quality Activities on Operational Business Performance (OBP)

This section reports the main questionnaire and structured interview findings with regard to the effects of quality activities on OBP.

Questionnaire Findings

Important findings were obtained from the responses to the question shown in Table IV investigating the effects of six quality activities on OBP. For the purposes of summarizing the findings the effects on each of the OBP factors were grouped (according to Table I) into supplier relationship, process, people, policy deployment or customer relationship effects. Figure 4 shows the findings.

The height of each bar represents the average effect each quality activity had on OBP. The actual scores of effectiveness on the y axis reflect whether

If your company uses any of the following quality improvement activities please mark with an "E" those aspects in which they have had an Excellent effect, a "G" for a Good effect, "N" for No effect and an "A" for an Adverse effect:

	Quality improvement activities				Total quality management
	Delegated teams	Voluntary teams	SPC	ISO 9000	
Employee communication					
Departmental communication					
Supplier communication					
Customer communication					
Vendor performance					
Business control					
Quality costs					
Employee morale					
Product quality					

Table IV.
Questionnaire Question

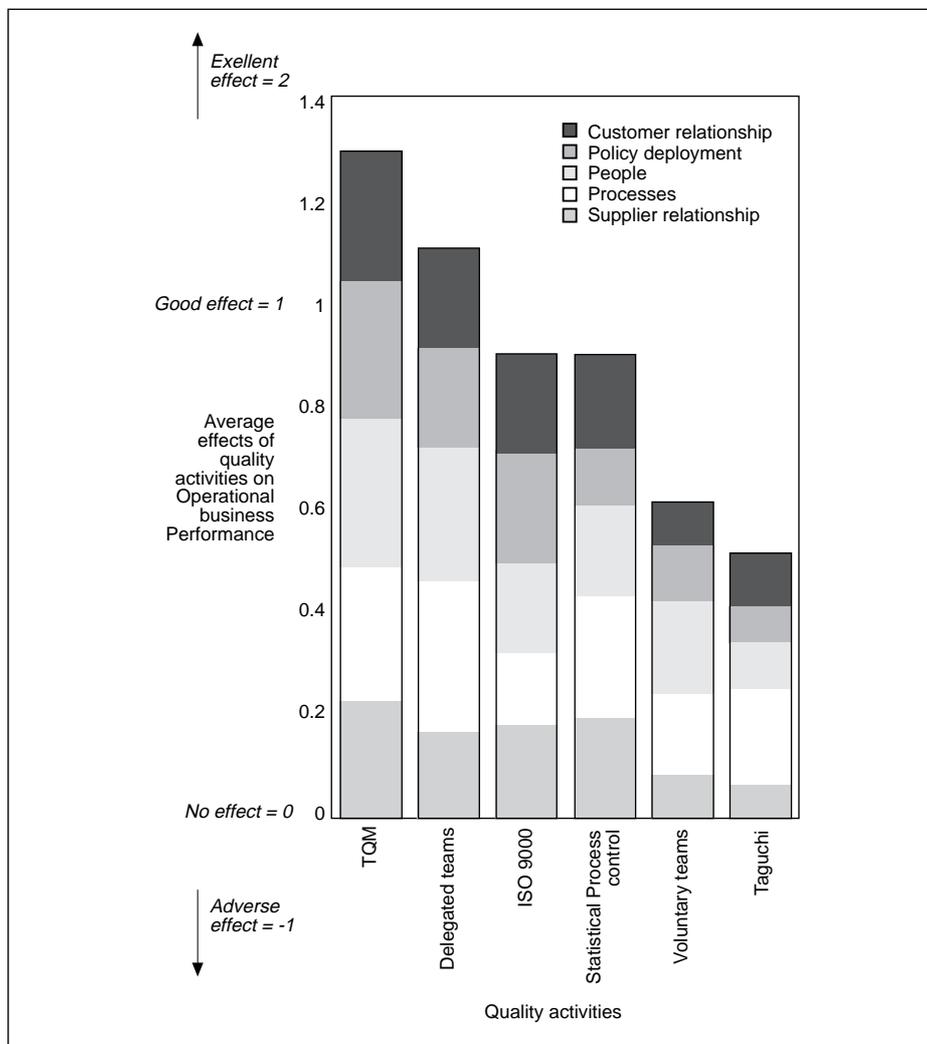


Figure 4.
The Effects of Six Quality Activities on OBP

respondents scored the quality activity, on average, as having an excellent, good, nil or adverse effect. Scores of 2, 1, 0 and -1 were attributed to these categories. For example, TQM and delegated teams were the most effective, averaging just higher than a “good effect”. All the quality activities had, on average, a positive effect on OBP. The proportions within each bar represent how effective each quality activity was at improving each OBP factor. In addition, the relative sizes of these proportions can be compared between the different quality activities. For instance, SPC is less effective at improving policy deployment than ISO 9000 but more effective at improving processes.

In summary, considering these proportions the figure shows:

- Delegated teams were particularly effective at improving processes and people.
- Voluntary teams were most effect at improving people.
- SPC was most effective at improving processes.
- ISO 9000 was least effective at improving processes but equally effective at improving the other four OBP factors.
- TQM's effects were equally shared across the five OBP measures.

One interesting finding from studying the figure in its entirety, and thus the average effects of quality activities on OBP, is the similarity of these results to those recorded for SBP (see Figure 2): the difference being that Figure 4 shows delegated teams ranking higher than ISO 9000. Figure 2 should be considered as the most accurate representation of the total effects a quality activity has on an organization. This is because it allowed the respondent to consider all effects rather than predetermined effects included on a questionnaire.

Structured Interview Findings

The use of structured interviews as a method to investigate the effects of quality activities on OBP experienced similar problems to those discussed when measuring their effects on SBP. In contrast though:

- (1) it was easier to identify the effect of quality activities on OBP as the immediate effects of quality activities are on OBP rather than SBP. These effects may then have "knock on" effects on SBP;
- (2) most companies did measure the effects of at least one quality activity in terms of OBP factors. Although measures were used, their main purpose was to monitor progress at meeting objectives and not the effectiveness of a quality activity. For instance many companies monitored the performance of delegated teams in terms of the teams' objectives. Rarely though were the effects of a quality activity aggregated across the whole organization.

The responses to the following questions provided important findings with regard to the effects of quality activities on OBP:

- (1) "Do you measure quality improvement? How? What are the main indicators?"
- (2) "What are the effects of quality activities on OBP?" This question was repeated for a number of quality activities. OBP was explained to the interviewees.

A summary of the main structured interview findings is provided by Table V. This provides descriptive information of the main OBP effects experienced by the 21 TQM companies for the following quality activities: TQM, delegated teams, voluntary teams, statistical process control, Taguchi, ISO 9000, supplier improvement activities, quality education and training, quality costs and internal audits.

TQM improved the supplier relationship through improved:

- delivery;
- communication;
- product quality (which may lead to no incoming inspection).

TQM improved processes through improved:

- quality costs;
- product quality;
- throughput;
- efficiency;
- energy savings.

TQM improved people through:

- employee involvement and job ownership;
- communication and openness;
- integration of workforce and improved working relationships;
- increased quality awareness and pride;
- removal of fear;
- improved attitudes (people expect change);
- realization of internal customers;
- decreased absenteeism.

TQM improved policy deployment through:

- increased purpose, focus and control over activities;
- move to common language, goals and objectives;
- increasing awareness of roles and responsibilities;
- increased attention to front-end activities;
- encouraging openness in the management team;
- improved departmental co-operation (fewer barriers);
- explaining the need to improve and the importance of meeting the customers' needs;
- the move away from firefighting to prevention activities;
- the realization of employee training needs.

TQM improved the customer relationship through:

- improved service to customers;
- reduced complaints;
- becoming a customer's preferred supplier;
- increased customer loyalty.

Delegated teams primarily improved people and processes through improved employee morale, communication, creating a sense of belonging, improved problem solving and reduced quality costs.

Voluntary teams primarily improved people through improved employee morale, communication and personal development.

SPC primarily improved processes through improved process control, reduced quality costs, increased operator involvement and employee morale.

Taguchi methods primarily improved processes through shortened experimentation time, increased product/process knowledge and improved products/processes.

ISO 9000 primarily improved policy deployment through providing a structure and framework for TQM, encouragement of suppliers to become approved and was favoured by many customers.

Supplier improvement activities primarily improved the supplier relationship through reduced incoming inspection, improved supplier communication and reduced rework due to higher quality incoming products.

Quality education and training primarily improved people through improved communication, commitment, openness and employee morale. These effects included a realization of role importance and an improvement in the work atmosphere reflected in customer service.

Quality costs primarily improved policy deployment through highlighting the areas to be targeted for improvement.

Internal audits primarily improved policy deployment through ensuring activities and functions were being undertaken to the required standard.

Table V.
Quality Activity Effects
on OBP

Discussion

This article has provided an insight into the different effects quality activities can have on business performance. It has also highlighted the difficulty of measuring and assigning specific benefits to particular quality activities.

A method used to provide a summary of the findings is the TQM quality activity model. This model provides a broad guideline to the prime effects of quality activities.

The TQM Quality Activity Model

Through an analysis of the responses and discussions with the 21 companies interviewed a TQM quality activity model was developed (see Figure 5). This model provides a general guideline detailing the effects of 65 quality activities on OBP. An accompanying Glossary of Terms[1] provides definitions of the 65 most common quality activities of TQM. The model shows that the quality activities are classified by the OBP element they *primarily* aim to improve. The vertical order of the quality activities within each of the 10 quality activity categories represents their relative frequency of use within the 21 TQM companies. The divisor lines categorize the quality activities by their frequency of use.

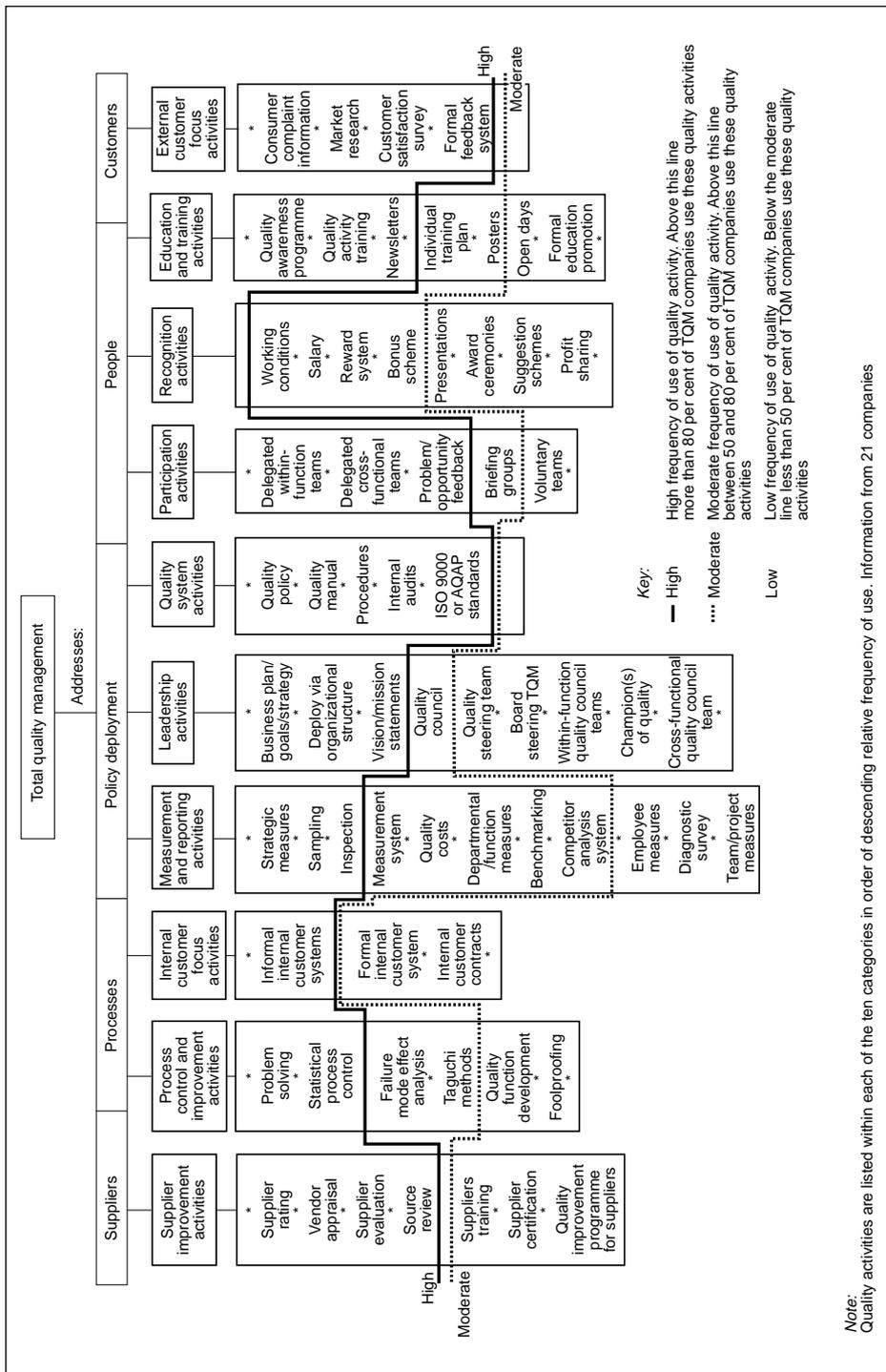
Note that many of the quality activities shown can be used as part of another quality activity. For instance, a formal feedback system may use information from the quality activities: customer complaint information; market research; and a customer satisfaction survey. All the quality activities can be used independently.

The TQM quality activity model provides an important guide to the expected effects of quality activities on business performance. It can be used to assess an organization's present strengths and weaknesses with regard to its targeting of quality activities. This information can assist in deciding which quality activities to implement.

Conclusions

The research has shown that all the quality activities investigated, particularly TQM, has beneficial effects on business performance. The identification of these effects should assist in the planning of TQM strategies and the targeting of quality activities.

In order to obtain a greater understanding of the relationship between quality activities and business performance, researchers need to develop a more sophisticated method of measuring the effects of quality activities. The method should involve consideration of the number of years since quality activity implementation, the method of quality activity implementation, the characteristics of organizations and their level of quality development. It is recommended that the case study approach would be the most effective at obtaining such information.



Note: Quality activities are listed within each of the ten categories in order of descending relative frequency of use. Information from 21 companies

Figure 5.
 TQM Quality Activity Model: Showing the TQM Quality Activities Categorized by their Prime Effects and Including Frequency of Use Divisor Line

Finally, it is hoped, that the work shown within this article will not only assist companies in understanding and implementing TQM but will also provide a solid foundation for future research.

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10. The identification of the 65 most common TQM quality activities and the development of the TQM quality activity model will be discussed in greater detail in a forthcoming article.
11. A Glossary of Terms was given to the questionnaire respondents. This ensured the respondents had a similar understanding of each quality activity. For instance, it was important to explain the difference between delegated teams and voluntary teams:
"Delegated teams – these are formed through delegation. Typically, higher level teams delegate to lower level teams problems/opportunities to be solved and/or investigated. The problems/opportunities may come from a number of sources. The teams usually consist of professional staff and are normally disbanded after their task is complete. The team members are chosen according to their potential contribution to the problems concerned.
"Voluntary teams – teams which are voluntarily formed by the workforce or management. These teams have no management direction. Voluntary teams are trained groups of six to 12 people, usually from the same working area, who meet regularly in company time (typically for one hour a week) under a leader who is often a foreman or first-line supervisor or a manager. Their objective is to discuss and identify problems which they encounter, obtain facts and data regarding these problems and develop feasible solutions to them. Problems may relate to quality, productivity, safety, comfort and so on. A support structure (allocating resources) is required if these teams are to work successfully."