Costs and benefits of ISO 9000 series: a practical study
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This paper presents the result of a study to identify the costs and benefits of obtaining ISO 9000 certification. Toward this goal, a survey of some 500 ISO 9000 certified companies has been carried out. Among them, more than 65 per cent believe that ISO 9001 certification is worthwhile, and more than 76 per cent believe that the cost of certification is inexpensive. The results indicate that companies which seek certification because of their customers’ request seem to gain less benefit from ISO 9000 certification. We also found that concern for high costs is much less after initial certification. In addition, we discovered that contrary to many people’s expectation, some factors do not have any bearing on whether benefits outweigh costs. These factors include time taken to get certified, number of years since certification, and reason for certification. Besides presenting the results of the survey, we also introduce a new classification scheme based on the company’s view on the “expensiveness” of the certification and the received benefits. There are some differences in responses from companies of different classes.

Content Indicators: Readability**, Practice Implications**, Originality**, Research Implications**

Introduction

The adoption of ISO 9000 has been justified in terms of the many benefits it can generate (Rothery, 1993; Street and Fernie, 1993). Starting in 1992, the number of Hong Kong companies certified to ISO 9000 has seen a marked increase (see Table I. Certificates issued by year ). The standards of the ISO 9000 series and other models can help companies enhance quality once they understand the spirit behind these models (Cottman, 1995). Hong Kong companies have taken quality issues seriously, as indicated by the many government programmes on quality (Quality, 1998). Many companies have applied quality standards judicially and creatively according to their own situation. However, there are views that ISO 9000 may not be suitable for small organizations (Bell, 1994; Gome, 1995). Also, there are sectoral differences in the adaptation of ISO 9000 (Taylor, 1995).

This paper presents the results of a survey of ISO 9000 certified companies in Hong Kong. The survey is one of the most comprehensive of its kind done in Hong Kong in recent years. Our aim is to investigate and determine the effect and impact of ISO 9000 certification on the business of certified companies and organizations in Hong Kong, and to examine their reasons for seeking certification and any problems they encountered in implementation. We intend to make recommendations for quality promotional strategies in Hong Kong based on the findings.
In addition to presenting the results of statistical analysis in this paper, we also introduce a new classification based on the perceived costs and benefits. The surveyed companies were divided into six categories and then their characteristics were compared and contrasted.

We contacted the 15 certification bodies that were operating in Hong Kong in 1997. Eight of these bodies, which issued a total of 1,730 certificates as of June 1997, responded. The number of certificates issued each year by these eight bodies is listed in Table I. According to our estimate, the actual number of certified companies in Hong Kong would be under 1,900. The certification bodies provided the names and addresses of the certified companies, to which 1,085 questionnaires were sent to the quality managers. The questionnaire is available in Lee et al. (1997).

A total of 405 completed questionnaires were returned and available for analysis. The responding companies may be classified into three sectors: manufacturing, service, building and construction. The number of companies in each sector is shown in Figure 1. Number of companies surveyed by sector. The total number of staff members covered is 257,749. The number of companies in each size group within each sector is shown in Figure 2. Number of companies in each size group within each sector.

In terms of the numbers of companies certified in ISO 9001, 9002, and 9003 respectively, when all three sectors are considered as a whole, less than half (41 percent) of the companies surveyed obtained ISO 9001, while more than half (59 percent) obtained ISO 9002. None obtained ISO 9003.

Figure 3. Ratio of ISO 9001 to ISO 9002 certified companies by sector shows the distribution of ISO 9000 certifications by sector. Notice the similarity between the manufacturing and the service sectors, and the difference of the building and construction sector from the rest. In the building and construction sector, contrary to the overall trend, ISO 9001 is more popular than ISO 9002. In other words, more than half of the building and construction companies are certified for design and construction, rather than construction alone. Furthermore, the bigger the companies, the more likely they are to be certified for both design and construction. This is likely because larger construction companies are often required to perform design work. Also, knowledge of design is often necessary in large construction projects for the purpose of tender evaluation and for proposing minor design amendments.

Methodology

This paper focuses on the benefits and costs of ISO 9000 certification, as perceived by the surveyed companies. We first introduce a new classification based on the perceived costs and benefits. The 405 companies were divided into six categories:

- Category 1: those that report overall resources for certification low or reasonable, and also agree that overall benefits outweigh cost of certification. In other words, they find ISO certification inexpensive and worthwhile.
- Category 2: those that report overall resources for certification high or too much, but still agree that overall benefits outweigh cost of certification. In other words, they find ISO certification expensive yet worthwhile.
- Category 3: those that report overall resources for certification low or reasonable, but disagree that overall benefits outweigh cost of certification. In other words, they find ISO certification inexpensive yet not worthwhile.
· Category 3a: those that report overall resources for certification low or reasonable, but have no idea whether overall benefits outweigh cost of certification. In other words, they find ISO certification inexpensive but are uncertain of its benefits.

· Category 4: those that report overall resources for certification high or too much, and also disagree that overall benefits outweigh cost of certification. In other words, they find ISO certification expensive and not worthwhile.

· Category 4a: those that report overall resources for certification high or too much, and have no idea whether overall benefits outweigh cost of certification. In other words, they find ISO certification expensive and are uncertain of its benefits.

Next, with all 405 companies as one group, correlation studies between the relevant response were conducted. For most questions in this survey, companies were asked to choose from a five-point score ranging from “strongly agree” to “strongly disagree,” or from “lower than expected” to “too much”. As such, the data that resulted were qualitative rankings. Consequently, statistical techniques such as linear regression were not applicable. To conduct correlation studies of such data, nonparametric techniques such as Spearman Rank Correlation (SRC) and Kendall’s Tau were used. The results were found to approximate each other closely. Henceforth, only SRC values are quoted in the paper.

For each question, the companies were ranked according to their response based on the SRC. (For example, the companies that gave the most positive response were placed at one end, and the most negative response were placed at the other.) The result was that each company had one rank (which was a number between 1 and 405) for each question in the questionnaire. For any two questions, say A and B, SRC is simply the correlation between the corresponding two ranks when all 405 companies were considered as a whole. This ranking and correlation process was performed with the DataDesk statistical analysis software (Velleman, 1997), and only the SRC values were shown as final results.

Theoretically, SRC must range from –1 to +1. When SRC is close to –1, companies that gave positive response to A would most likely give negative response to B, and vice versa. When SRC is close to +1, companies that gave positive response to A would most likely give positive response to B, and vice versa. When SRC is zero, no trend exists, and hence no reliable prediction is possible.

For each aspect of benefit or cost, SRC values were calculated among the related questions. However, only those with strong correlations were quoted for discussion in this paper.

On a question to question basis, we conducted a detailed analysis of the response of the participating companies. For each question, a contingency table was constructed. In the table, data in the same column correspond to companies in the same sector. Data in the same row correspond to the same level of response. Depending on the individual question, possible levels of response range from strongly agree to strongly disagree, or from not required to too much.
Using DataDesk, we determine the degree of freedom of each contingency table by calculating the product of the following: first, the number of columns (which is always three, one for each sector) minus one, and second, the number of non-zero rows (which depends on the number of possible responses and the popularity of each response) minus one. If a possible response is not chosen by even a single company in any sector, the corresponding row will consist of entirely zeros. DataDesk will not include such a row in the contingency table. As a result, the degree of freedom will be reduced by two. Thus, occasional variations in the degree of freedom within questions of identical number of possible responses may occur.

We also compute the Chi square value and hence the level of significance, $\chi^2$, for each contingency table. We adopted the usual practice in which the difference between groups in a contingency table is considered significant if $\chi^2$ is less than or equal to 0.05. Chi square test is useful as a general test to check whether significant differences exist between groups in a contingency table. However, it will not indicate specifically where any discernible pattern can be found, and what kind of pattern it is (e.g. whether the values in some part of the contingency table are increasing or decreasing, or have reached a maximum or minimum, or are simply varying in some chaotic manner). To find any possible pattern, visual inspection of the numbers in the contingency table is necessary. Alternatively, charts can be created to facilitate visualization of the numbers.

**Findings**

We first highlight the results based on the new classification.

**Analysis by category**

*Table II.* Classification of the companies into six companies shows the classification of six categories based on the responses to the benefits and the required resources.

The distribution of companies by category is shown in *Figure 4.* Distribution of companies by category. Note that with the exception of the building and construction sector, the majority (over 50 percent) of companies are happily concentrated in category 1. Overall, of the 405 companies, more than 65 percent believe that the ISO 9001 certification is worthwhile, and more than 76 percent believe that the cost of certification is inexpensive.

We next analyze the major causes of discontent in terms of costs and benefits by category. *Table III.* Major discontents on costs during implementation, *Table IV.* Major discontents on costs during maintenance, and *Table V.* Major discontents on benefits summarize the responses from the three sectors. “B”, “M”, and “S” represent the building and construction, manufacturing, and service sectors respectively. We also highlight those areas of discontent common across the three sectors with a shaded box. Across all three sectors, category 1 companies are the happy group of companies with few complaints.
Cost related discontents during implementation

Note that both categories 1 and 2 find ISO 9000 beneficial. However, category 2 companies regard overall resources for certification excessive, while category 1 companies do not. We first compare and contrast these two categories. We find the greatest increase in the number of detailed complaints when going from category 1 to category 2 within the manufacturing sector in Table III. “Additional time spent by staff” is a common area of discontent across all three sectors of category 2 companies.

Both categories 3 and 4 find ISO 9000 not beneficial. However, category 4 companies also regard overall resources for certification excessive, while category 3 companies do not. We next compare and contrast these two categories. We find the greatest increase in the number of detailed complaints when going from category 3 to 4 are found not within the manufacturing sector, but in the building and construction and the service sectors. Furthermore, most of these complaints found in category 4 are similar for these two sectors. Note that “additional time spent by staff” is also a common area of discontent across all three sectors.

Both categories 3a and 4a are not certain if ISO 9000 is beneficial. However, category 4a companies also regard overall resources for certification excessive, while category 3a companies do not. The uncertainty about benefit should place the relationship between category 3a and 4a somewhere intermediate between the relationships between category 1 and 2 and 3 and 4. Based on the results shown in the table, the above prediction seems justified. In particular, in the manufacturing sector, we find the jump in the number of detailed complaints slightly more severe when going from category 3a to 4a. In the building and construction sector, we find the jump in the number of detailed complaints slightly less severe when going from category 3a to 4a. In the service sector, we find the jump in the number of detailed complaints much less severe when going from category 3a to 4a.

Cost related discontents during maintenance

From the survey, it is rather obvious that the number of complaints is much less after initial certification. As shown in Table IV, we find an increase of only one each in the number of detailed complaints when going from category 1 to category 2 within the building and construction and service sectors, and none in the manufacturing sector. In categories 4 and 4a, all types of complaints were the same as those identified during implementation. In category 4, the building and construction sector has three complaints; the manufacturing sector has two complaints; the service sector has one complaint. In category 4a, only the building and construction sector has two complaints. Note that “additional time spent by staff” is also a common area of discontent across all three sectors in category 4.
Benefit related discontents

Note that all of categories 1, 3 and 3a find the overall resources for certification not excessive. However, category 3 companies perceive no benefit in certification, category 3a companies are unsure of the benefits, while category 1 companies are positive of the benefits. We next compare and contrast these 3 categories. From Table V, we find the greatest increase in the number of detailed complaints when going from category 1 to category 3 within the building and construction sector (11 complaints). We find the next greatest increase in the number of detailed complaints when going from category 1 to category 3 within the manufacturing sector (eight complaints). We find the least increase in the number of complaints when going from category 1 to category 3 within the service sector (five complaints). Many complaints are shared by the three sectors, as indicated by the shaded boxes. We find the greatest increase in the number of doubts when going from category 1 to category 3a within the service sector (eight doubts). We find equal increases in the number of doubts when going from category 1 to category 3a within the manufacturing and building and construction sectors (five doubts each). Building and construction and manufacturing sectors share most doubts. Many doubts in service are not shared by the other two sectors.

Category 3a should be intermediate between category 1 and category 3. This is evident for the manufacturing sector. It is less so for the service and the building and construction sectors. In the service sector, the number of doubts in category 3a exceeds the number of complaints in category 3 (by 3).

All of categories 2, 4 and 4a find overall resources for certification excessive. However, category 4 companies perceive no benefit in certification, category 4a companies are unsure of the benefits, while category 2 companies are positive of the benefits. We next compare and contrast these three categories. We find the greatest increase in the number of detailed complaints when going from category 2 to category 4 within the building and construction sector (ten complaints). We find equal increase in the number of detailed complaints when going from category 2 to category 4 within the manufacturing and service sectors (four complaints each). Most complaints are not shared between manufacturing and service sectors. On the other hand the building and construction sector makes almost all the complaints that the manufacturing and service sectors make, and more.

The transition from category 2 to category 4 should in principle be similar to, and likely worse than, the transition from category 1 to category 3. The above is obvious for the building and construction sector from Table V. However, for the manufacturing and service sectors, category 4 companies have fewer complaints than those in category 3.

We find the greatest increase in the number of detailed complaints/doubts when going from category 2 to category 4a within the building and construction sector (four doubts). We find the next greatest increase in the number of detailed complaints/doubts when going from category 2 to category 4a within the service sector (three doubts). We find the least increase in the number of detailed complaints/doubts when going from category 2 to category 4a within the manufacturing sector (one doubt).
Category 4a should be intermediate between category 2 and category 4. This is evident for the building and construction and manufacturing sectors. It is not so for the service sector, in which doubts/complaints are not shared between category 4 and 4a.

In the following sections, the 405 companies were analyzed as one group.

**Benefits**

The respondents were asked about the benefits to the staff, benefits to the operation of the company, and benefits to the business of the company, respectively (Table VI. Benefits from ISO 9000 system).

We found no correlation for the following:

- Within the five detailed benefits to the staff of the company. This implies those factors, if any, that affect the outcome of one item in benefits to staff is unlikely to affect the outcome of any other item in benefits to staff.
- Between the benefits of ISO 9000 certification outweigh the cost of getting certification and each of the five detailed benefits to the staff of the company. This implies that no single item alone in benefits to staff is a major factor that determines overall benefits of certification.
- Between the benefits of ISO 9000 certification outweigh the cost of getting certification and each of the seven detailed benefits to the operations of the company. This implies that each of benefits to operations alone is not a major factor that determines overall benefits of certification.
- Between the benefits of ISO 9000 certification outweigh the cost of getting certification and each of the six detailed benefits to the business of the company. This implies that each of benefits to company is not a major factor that determines overall benefits of certification.

Correlation of overall benefits to each detailed benefit is low. One possible cause is that overall benefits may be the aggregate result of a large number of detailed benefits, in which no single one predominates.

We found some correlation for the following:

1. (1) Within the seven detailed benefits to the operations of the company, the strongest correlation is between shorter delivery lead time and increased quantity of production (SRC = 0.650), implying that companies that report shorter lead time are also likely to report increased quantity, and vice versa.
   - SRC between increased quantity of production and reduced operational costs is 0.616, implying that companies that report increased quantity are also likely to report reduced cost, and vice versa.
1. (2) Within the six detailed benefits to the business of the company, the strongest correlation is between increased sales with existing customers, and attracted more new local customers (SRC = 0.646).
Resources

The respondents were also asked about the resources required for implementing ISO 9000, and resources required for maintaining the ISO 9000 certification (Table VII. Resources required).

We found no correlation for the following:
- Within the ten detailed resources required for implementing ISO 9000 certification.
- Between the overall perception of the resources required for the whole certification exercise and each of the ten detailed resources required for implementing ISO 9000 certification.
- Within the six detailed resources required for maintaining the ISO 9000 certificate.
- Between the overall perception of the resources required for the whole certification exercise and each of the six detailed resources required for maintaining the ISO 9000 certificate.
- Between the benefits of ISO 9000 certification outweigh the cost of getting certification and the overall perception of the resources required for the whole certification exercise.

We found strong correlation between:
- Equipment calibration fee for certification maintenance and same for certification implementation;
- Cost of additional staff for maintaining certification and same for certification implementation; and
- Certification audit fee and surveillance audit fee.

When overall benefits were correlated with overall resources required, the correlation is weakly positive. This may imply that companies do not necessarily have to commit large amounts of resources in order to benefit from the ISO 9000 system.

Factors determining the cost-benefit

We studied three factors that may impact the observed cost-benefits of the ISO 9000 certification:

1. The time taken to get certified. More time may reflect more effort (and cost) of getting the ISO certification. We postulate that the more time taken to get certification, the less likely that the benefits will be observed. We analyzed the response to time taken to prepare and get certified and the responses as to whether the benefits of ISO 9000 outweigh the cost of getting certification. When all 405 companies were considered, in a contingency table of 12 degrees of freedom, chi-square value was 12. As such, the difference between companies that require various preparation time is not significant ($\alpha = 0.4$). SRC between the two responses is in the –0.01 range. Thus, the overall relationship between responses to the two questions is extremely weak. No significantly higher or lower percentage of companies finds benefits outweigh cost as a result of variations in preparation time.
2. (2) **Number of years since certification.** Based on the results, it seems that it will take several years after the implementation of the quality management system before the benefits can be observed. For companies that have recently obtained the ISO 9000 certificate, they may not see the benefits right away. We postulate that the longer time since certification, the more likely the benefits will be observed. We analyzed the response to the number of years since certification and the response as to whether the benefits of ISO 9000 outweigh the cost of getting certification. When all 405 companies were considered, in a contingency table of 20 degrees of freedom, chi-square value is 32. As such, the difference between companies that was certified in various years is significant at \( a = 0.04 \). SRC between the two responses is in the \(-0.04\) range. Thus, although the differences among the different number of years are statistically significant, no consistently increasing or decreasing overall trend can be identified. Thus, we may conclude that the number of years since certification is not a significant factor in deciding whether a company reports overall benefits outweigh cost or not.

3. (3) **Reason for certification.** The motivation for setting up the quality management system and getting certification may influence the amount of resource and the commitment of the company to the quality system. We postulate that highly motivated organization would report more benefits. We analyzed the response to the main reasons for certification and the response as to whether the benefits of ISO 9000 outweigh the cost of getting certification. We first group the companies according to whether they are customer-driven and non-customer-driven. Customer-driven companies are those companies that seek certification to satisfy their customer’s requirements. These companies may not be fully committed to using the quality management system in their day-to-day operations. The non-customer-driven companies are those companies who adopted ISO 9000 with a view to develop business and improve management systems. The 114 customer-driven companies consist mainly of building and construction companies, followed by manufacturing companies. Only ten companies are customer-driven in the service sector.

The main differences between the customer-driven and the non-customer-driven groups are as follows:
- in the customer-driven group, only 58 percent strongly agree that benefits of ISO 9000 outweigh cost, while 68 percent of the non-customer-driven group do so;
- in the customer-driven group, up to 18 percent disagree or strongly disagree that benefits of ISO 9000 outweigh cost, while only 9 percent of the non-customer-driven group do so. Thus, significantly less customer-driven companies report benefits outweigh cost compared to the other group.

When all 405 companies were considered, in a contingency table of four degrees of freedom, chi-square value is 16. As such, the difference in perceived benefits between companies that were customer-driven and non-customer-driven is significant at \( a = 0.003 \). But the SRC is in the 0.1 range. Thus, although the differences between the groups are statistically significant, no consistently increasing or decreasing overall trend in levels of agreement can be found. Thus, we may conclude that the reason for certification is not a significant factor in deciding whether a company reports overall benefits outweigh cost or not.
Comparing to other studies

The paper presents a major study of cost and benefits of ISO 9000 in the Asia context. We strongly believe that the results can be generalized to other Asian countries, and China in particular. As our classification of companies is unique, there are no data for comparison. However, other researchers have previously studied the two factors that may affect the cost-benefit, namely, number of years since certification and reason for certification.

A study commissioned by Lloyd’s Register Quality Assurance indicated that companies that had been certified for more than five years reported greater benefits than companies that had recently obtained certification (Osman, 1994; Brecka, 1994). However, a recent study by Jones and Arnot (1997) found no evidence that longer-established certified companies reported greater benefits from ISO 9000 than more recently-certified companies. Our study finds no support for the findings of Lloyd’s Register Quality Assurance, and matches the findings of Jones.

Jones and Arnot (1997) have also studied the impact of the reason for certification. It was reported that customer-driven companies perceived fewer beneficial outcomes than companies which seek certification for the primary purpose of developing the internal performance of their organization. Although we find that fewer customer-driven companies agreed that benefits of ISO 9000 outweigh cost than non customer-driven companies, the reason for certification is not a significant factor in deciding whether a company reports overall benefits outweigh cost or not.

Conclusion

The study has introduced a new classification of companies and some preliminary analysis has been done. It was originally hoped that the causes of discontent in categories 2, 3, 3a, 4 and 4a could be easily identified. Chi square tests confirm that for almost every question concerning detailed benefits or costs, the six categories are distinct and different from one another. We are looking for a nonparametric statistical method that can interpret the data and come to any coherent and meaningful conclusions.

In summary, the major findings from the study are:

1. (1) The majority of companies report that overall benefits of certification outweigh the cost, and that the resources required for the certification exercise low or reasonable. In other words most companies report ISO 9000 certification worthwhile to acquire. From our introduced classification of the company, very few companies belong to the group that believe ISO certification is expensive and not worthwhile.

2. (2) Regarding benefits, we found strong correlation between:
   · shorter delivery lead time and increased quantity;
   · increased quantity and reduced cost;
   · increased sales with existing customers and more new local customers; and
   · enhanced communication with customers and enhanced communication with subcontractors.

3. (3) Regarding resources, we found strong correlation between:
   · equipment calibration fee for certification maintenance and same for certification implementation;
- cost of additional staff for maintaining certification and same for certification implementation; and
- certification audit fee and surveillance audit fee.

1. (4) The following factors do not seem to affect the cost-benefit:
- time taken to get certified;
- number of years since certification; and
- reason for certification.

1. (5) The customer-driven companies benefit less from new quality systems.

The study also points out several areas that need further investigation:
- The responses from the different categories indicate that they may be dependent on the industry sector. Further study is needed to understand the extent that the responses are due to sectoral difference.
- Find out whether a significant number of companies choose to have ISO 9002 first, and then upgrade to ISO 9001 later.
- Look for a set of factors that determine whether the benefits outweigh the cost.
- Further analysis based on the variation of size of companies may provide additional insights.

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References