

QUALITY MANAGEMENT SYSTEMS IN CONSTRUCTION ORGANISATIONS - THEIR INTRODUCTION AND IMPLEMENTATION

by

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Abstract

Developing construction industries as in Sri Lanka, have yet to respond to increasing international pressures for the incorporation of comprehensive quality systems. Valuable lessons may therefore be derived from both the successes and failures in developing and using such quality systems in other countries. Past developments, the present status and international trends in the international quality scenario are summarised herein. An interim evaluation of quality systems implementation in the Hong Kong construction industry is also presented herein, based on a series of recent surveys. Since no single universal solution is possible, a structured approach is recommended in choosing an appropriate system, say for a Sri Lankan construction organisation. Decision-aid formats are suggested, based on estimated costs, durations and effectiveness of alternative systems, in turn based on similar experiences. Existing evidence does however favour longer term and more comprehensive 'Total' Quality Management Systems, as against market-(or client)-driven Quality Assurance or ISO 9000 certification, by itself, for example. The latter is now often recognised as one stage of a more comprehensive organisation-oriented Quality Management System.

1.0 Quality Management Systems in general

1.1 Past Developments

Concerns for quality can be traced back through human history, despite their apparent recent resurgence with increasing development. The Pyramids of Egypt, the Great Wall of China and the Dagobas of Sri Lanka all exemplify their 'fitness for the purposes' for which they were designed and destined, including durability. Furthermore, product quality has been deftly designed as being 'fit for purpose' or even expanded to 'fit for purpose and safe to use' (McGoldrick, 1994). ISO 8402 defines Quality more completely as the 'totality of features and

characteristics of a product or service that bear on its ability to satisfy stated or implied needs'. Further definitions of Quality Management and associated terminology such as Quality Assurance, Quality Plan, Quality Audit and Quality Control are given in ISO 9000.

While more recent developments in Quality Management have originated largely from the manufacturing industry, ancient codes-such as that of Hammurabi (McKaig, 1963) in Babylonia around 1950 BC and even the 1804 Civil Code of Napoleon in France - imposed liabilities on designers and builders related to the quality of their construction including materials, workmanship and their management.

The formation of artisans' guilds in medieval Europe led to craftsmen inspecting and testing their own work as well as that of others, with 'guild elders' acting like 'quality auditors'. The industrial revolution led to mass production, prompting a shift from this 'pride in Workmanship' driven 'self-policing' mode of Quality Management to the 'Supervision' phase involving hired managers, at the turn of this century. This led on to the 'Inspection' and 'Testing' phase; and next into the 'Statistical Process Quality Control' stage developed by Walter Shewhart in the Bell Laboratories in the 1920's. Edwards Deming and Joseph Juran who also began their careers at the Bell Laboratories popularised broader concepts of Quality and Quality Control in U.S.A. and Japan (Lee, 1995). Taichi Ohno and Kaoum Ishikawa promoted related concepts including statistical approaches, flexible manufacturing, defects elimination and Quality Circles in Japan (Belagamage, 1995); Crosby popularised the 'do it right the first time' and 'zero defects' approaches after the 1970's. The emphasis on Quality Assurance, BS 5750 and ISO 9000 emerged in the late 1970's and 1980's respectively.

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1.2 Present Status

Quality Assurance, ISO 9000 and equivalent national standards became increasingly popular in manufacturing and other industries including construction. Manufacturing, contracting, consultancy and other service organisations developed 'self-policing systems based on general guidelines contained in such standards, obtained third party certification of such systems and professed to clients and prospective clients that their services were 'quality assured'. Clients themselves began seeking and/ or giving preference to organisations that had ISO 9000 or equivalent certification.

Over 70 countries have officially adopted the ISO 9000 series of standards as their national quality system standards, apart from those like the U.K. and Australia that have their own standards, which are very similar to ISO 9000. The 1994 edition recently up-dated ISO 9000 by incorporating a few minor modifications (Kam and Tang, 1995).

An international survey (ISO 9000 Forum, 1995) indicated that 70,517 ISO 9000 certificates had been issued in 76 countries up to end June 1994, including 23,971 after September 1993, signifying their importance and acceptability.

Nevertheless, third party certification of systems is now also being perceived as merely one useful aspect of organisational Quality Management Systems, both in general, as well as in capital projects (Anderson, 1995). The importance for Total Quality management (TQM) in construction organisations in particular, was described by Hellard (1993).

1.3 International Trends

The European Construction Institute (1993) formulated a system for 'Total Quality in Construction', whilst clearly distinguishing TQM from Quality Assurance. In U.K., the Latham report (1994) highlighted the debate within the construction industry as to (a) the cost effectiveness of quality assurance to BS5750 (the U.K. equivalent of ISO 9000); (b) the effectiveness of BS 5750 in assuring 'quality', given that it is designed to ensure that self-specified standards of quality are achieved, but does not ensure that good standards are set at the outset.

Meanwhile the Associated General Contractors of U.S.A. (1992) has recommended "TQM in construction" to its members as the only way to remain competitive in national and international construction and engineering markets. However, different stages of development in other countries and differentials in client demand

(pull-factors) and industry push-factors lead to a range of Quality Management Systems. For example, the initial emphasis on ISO 9000 certification is still evident in countries like India (Taneja, 1994), Singapore (Construction Industry Development Board, 1995) and in Hong Kong (Industry Department, 1994). Such certification apparently induces some 'comfort' in both the organisation and its clients of meeting some uniform and universally acceptable though generalised standards. However, the third party audits often only check that self-determined targets are being achieved and rarely whether such targets are within acceptable industry norms. Furthermore an over-emphasis on ISO 9000 certification for example, may even distort the healthy development of a comprehensive company-specific Quality Management System.

Such an awareness perhaps prompted a large Egyptian contractor, the 'Arab Contractors' Company' to consciously divert efforts initially aimed at ISO 9000 certification, to re-focus on TQM. Similarly in Singapore, the need has been noted to integrate ISO 9000 with TQM (Liao et al., 1995).

Considering another dimension, an ongoing investigation into quality problems in Botswana public building construction is based on a hypothesis relating these shortfalls to inappropriate project organisational structures in the traditional building procurement system. Examples of such problems arising from adversary relationships and conflicting interests for example have been described previously by that investigator (Rwelamila, 1992).

Developing construction industries and organisations, such as in Sri Lanka, can learn much from such recent experiences of other countries and organisations in the development of Quality Management Systems, in order to optimise their applications and also to avoid common pitfalls.

2.0 The Hong Kong Experience

2.1 Initial Initiatives

Hong Kong has witnessed the progressive development of extensive and intensive Quality Management Systems in general, as well as in construction. The close links with the U.K. and the international industry, the high standard of living and advanced stage of development have provided a greater impetus in the quest for Quality.

Initial pressures for quality assurance led to the establishment of the Hong Kong Quality Assurance Agency (HKQAA) by the Hong Kong

Government in 1989, to lead such developments: in training and information dissemination as well as in providing services for independent third party audits and certification. The Quality Services Division of the Hong Kong Industry Department supplements such services and provides updates, such as through the 'Quality Quest' newsletter (Industry Department, 1994). Other bodies such as the Institute of Quality Assurance, other independent certification bodies, and a growing body of consultants, participate in the development of Quality Management Systems in Hong Kong.

Particular initiatives in the construction sector itself were evident from the late 1980's. The Hong Kong Housing Authority placed itself at the 'cutting edge' of this movement with the slogan 'Quality starts with Housing' (Chan, 1993). It announced in 1989 that both the Construction branch of the Housing Department and its contractors and suppliers would soon be certified to ISO 9000. Deadlines were set by the Housing Authority for ISO 9000 certification: in 1992 for its ready mix concrete suppliers, on 31st March 1993 for its building contractors; and in 1994 for certain categories of nominated sub-contractors (Byrne, 1995).

Following this initiative, on a broader front, the Hong Kong Government itself launched a three year Quality Awareness campaign in March 1990 (Byrne, 1995), after which (in March 1994) the Secretary for Works announced a time table for Quality Assurance in all public works construction that required: (a) concrete suppliers to be registered, under the 'Quality Scheme for the Production and Supply of Concrete' by July 1994; (b) engineering and associated consultants for agreements over HK \$ 10 million (about UK £ 0.81 million) and all architectural consultants to be certified to ISO 9001 by April 1996; and (c) all contractors in the highest grade and certain categories of specialist contractors to be certified to ISO 9002 by October 1996.

In comparison, in Singapore, ISO 9000 certification will be required from certain grades (G6, G7, and G8) only after July 1999. Meanwhile, those contractors who have adopted the officially recommended ISO 9000 oriented scheme, will be rewarded with a 0.5% tendering price advantage when bidding for public projects after July 1995 (Construction Industry Development Board, 1995).

This is now superposed on the existing Construction Quality Assessment System (CONQUAS) in Singapore which confers a price advantage of up to a maximum of 5% on contractors with higher 'CONQUAS scores' in their recent projects (Construction Industry

Development Board, 1995).

In comparison in this context, the Hong Kong Housing Authority has also designed a comprehensive Performance Assessment Scoring System (PASS) which enables them to evaluate the performance of their contractors regularly on ongoing jobs; and to provide more tendering opportunities to those contractors who achieve higher 'PASS scores' (Hong Kong Housing Authority, 1994).

The foregoing developments indicate the importance of the Quality Management Systems that extend beyond ISO 9000 requirements alone. In fact: (a) PASS scores are based on an assessment of the contractor's outputs, as well as their inputs in the construction process, combined in a 3:1 ratio; and (b) the majority of respondents to a particular question in a recent survey (Wong, 1995), considered PASS inspections to be more 'difficult' than ISO 9000 audits.

2.2 Current Status

The following indicate the numbers of companies in some of the different categories in the Hong Kong construction industry, that are certified to ISO 9000 as of 5 December 1994, as obtained from the HKQAA: Building New Works = 50; Concrete products = 45; Building Maintenance = 42; Piling = 8; Civil Engineering New Works = 6; Civil & Structural Engineering Consultancy = 2; Quantity Surveying Consultancy = 2; Construction Material Supplier = 2; Architectural Consultancy = 1.

With particular reference to consultants and contractors registered with the Works Branch of the Hong Kong Government (which oversees most of the public engineering work), the status as of July 1995 was that: (a) 171 out of a total of 348 (33.6%) in all categories were certified to ISO 9000 and another 64 (18.4%) had applied for certification. Within specific categories: (a) 90 out of 195 (46.2%) of construction contractors had been certified, while another 18 (9.2%) had applied for certification; whereas (b) 15 out of 29 (51.7%) Electrical and Mechanical (E & M) contractors had been certified, while another 10 (34.5%) had applied for ISO 9000 certification. The other categories comprised different types of consultants - Architectural, Building Services, Engineering, Quantity Surveying, Structural and Landscape. These figures indicated that the contractors (and specially E & M contractors) were more motivated in general, to seek ISO 9000 certification, than the consultants. Of course, particular requirements by clients would have contributed to such motivation as well.

However, (a) some categories such as 'lift installation contractors' are not included in the foregoing summary; (b) it is possible that the same company may be certified in more than one category; and (c) certification efforts have apparently been greater in categories where clients such as the Hong Kong Housing Authority had set strict deadlines by which time their contractors had to be certified. Chan and Lee (1995) quoted HKQAA statistics that indicated the growth from 28 ISO 9000 certified contractors in 1992, through 63 in 1993 to 118 in 1994.

As of January 1995, 205 of the 319 companies (64%) certified by HKQAA were construction related (Byrne, 1995). Large public sector clients, such as the Hong Kong Housing Authority and the Architectural Services Department have now themselves developed systems that earned them ISO 9000 certification. Another large client, the Mass Transit Railway Corporation has developed a Quality Management System in line with ISO 9001 and also obtained ISO 9001 certification for its system for the Project Management of the New Railways. In recognition of the uncertainties facing many contractors, the Hong Kong Construction Association (1992) has developed a booklet 'as useful guidance for contractors implementing a Quality Assurance System for Certification to ISO 9000'. More such construction - specific guidelines would be valuable to companies, in that they could incorporate for example, the 'lowest common denominator' of requirements for contractors/ consultants/ clients; as well as provide useful pointers to potentially critical parts within their operational areas.

Contractors and certifiers have faced dilemmas in devising suitable methods of incorporating the sub-contractors work for Quality certification, more so in view of the high level of multi-layered sub-contracting in Hong Kong and given that sub-contractors vary widely from project to project anyway. One extreme suggestion is for contractors to deploy only ISO 9000 certified sub-contractors, but it is more usual and presently practicable for the former to develop strict sub-contractor control procedures. (Industry Department, 1994).

The last three years experiences of ISO 9000 certification in the Hong Kong construction industry and the development of organisational Quality Management Systems, has perhaps led to a suitable stage to take stock of both successful and less successful efforts. In learning lessons from these experiences, it is noted that many questions arise during this quest for quality, for example as to: the allegations about excessive paperwork that detract from the 'real' work; and

the assessment of 'real' net benefits as available from different systems, based on both tangible and intangible costs and benefits.

3.0 Perceptions of Benefits and Costs of ISO 9000 certification in the Hong Kong Construction Industry

Insights into experiences in obtaining and maintaining ISO 9000 certification in Hong Kong are available through the results of the following surveys. Each survey was carried out independently, hence the apparent differences between the questions asked of the respondents. Nevertheless the main conclusions are found to be consistent.

The first three surveys, described in the following sub-sections are of construction contractors, the fourth and fifth are of clients and the sixth of consultants; all of whom, have obtained ISO 9000 certification.

3.1 Survey A - of Contractors - in the 1994/95 University of Hong Kong Student Project

This survey was an important part of a Final Year undergraduate research project of the Department of Civil and Structural Engineering in 1994/95 (Yiu, 1995) which was supervised by this author. The full project included surveys of contractors, consultants and clients who had achieved ISO 9000 certification; and Quality Assurance consultants who had assisted contractors. The surveys of consultants and clients are summarised in subsequent sub-sections.

The research project objectives were: (a) to investigate the extent and benefits of the implementation of ISO 9000 standards in the Hong Kong construction industry; (b) to investigate whether the benefits of ISO 9000 certification exceeded the costs; and (c) to recommend improvements in the implementation of ISO 9000 standards in the Hong Kong construction industry.

16 responses were received to specially designed questionnaires sent to 60 building and civil engineering contractors certified to ISO 9002. The main responses can be summarised as follows:

(a) In stating the aims of seeking ISO 9000 certification, only 6 (38%) included the aim of 'increasing effectiveness/ efficiency' while 14 (88%) included that of fulfilling clients' needs.

The following summarises the responses to this particular question.

- 14 - fulfill customers' requirements
- 9 - increase reputation
- 8 - improve internal process
- 7 - provide third party certification
- 6 - follow competitors' action
- 6 - increase effectiveness/ efficiency
- 4 - improve profitability
- 1 - open new markets.

(b) 13 respondents (81%) had set up Quality Assurance divisions, usually with 1 to 3 full time staff.

(c) Only 7 respondents (44%) considered it necessary to employ a Quality Assurance consultant to assist them towards certification. However, 10 of them (63%) actually did so with a view to an accelerated process.

(d) The average time to obtain certification was 3 years from the initial decision.

(e) After obtaining certification only 7 respondents (44%) noted an increase in clients' satisfaction; while 13 (81%) experienced an increase in management control of their companies. The following summarises the responses to this particular question:

- 13 - increase in management control
- 9 - increase in construction cost
- 9 - increase in reputation
- 7 - increase in clients' satisfaction
- 7 - increase in quality
- 7 - increase in employees' morale/ discipline
- 2 - decrease in defective work
- 1 - increase in profitability.

(f) 6 (38%) of respondents conceded that they did not 'address' all clauses (aspects) of ISO 9002 during their day-to day operations; while 2 (12.5%) admitted a 'lot of' inconvenience and another 2 (12.5%) encountered a 'little' inconvenience in addressing all the clauses. Most of the inconvenience was attributed to excessive documentation and increased overheads.

Specific clauses identified as being difficult to address in the context of current resources of the local construction industry were: 4.4

(document control); 4.5 (purchasing); 4.7 (product identification and traceability); 4.8 (process control); 4.13 (corrective and preventive action); and 4.18 (statistical techniques).

(g) However 8 respondents (50%) felt that the costs exceeded the benefits of certification, while another 8 (50%) thought that the benefits exceeded the costs. Of these 16 respondents however, 14 respondents (88%) in general welcomed the introduction of ISO 9000 standards in Hong Kong.

(h) Some of the specific comments received: (i) requested more construction - industry specific standards; (ii) suggested reduced documentation, for example by grouping some specified items; and (iii) welcomed clarification of grey areas in the 1994 revision of ISO 9000.

The foregoing findings from the questionnaire survey were confirmed and further clarified by follow-up interviews with three medium/ large contractors and two Quality Assurance consultants. For example, the Quality Assurance consultants concurred with most of the difficulties experienced and the consequential recommendations of the sample of contractors. Those included concerns as to sub-contractors, safety and cost-related issues. However, they also noted: that: (a) the general criticisms of ISO 9000 had reduced after some of the benefits began to be appreciated; and (b) contractors should realise that many benefits would be long term rather than short term.

3.2 Survey B - of Contractors - by the University of Hong Kong Industrial Centre

(Lee, 1994) conducted a survey in 1994 to: '(1) reflect the experience of implementing the ISO 9000 standards in Hong Kong; and (2) to identify the strengths and weaknesses of the quality assurance systems in Hong Kong as a guide for continuous improvement'.

61 completed questionnaires were received from 137 sent to all those companies certified by the HKQAA at the time. The main findings that are relevant to this paper are as follows:

(a) 73% of the building and construction respondents indicated that they adopted ISO 9000 because of their clients' requests; whereas only 1 of the 19 service industry companies responded similarly.

(b) The smallest certified company in the building and construction sector had 7 staff members, while the biggest had 1200.

- (c) Apart from 27% of the building and construction respondents, who did not increase their manpower for purposes of implementation; most hired one or two additional people, while some claimed that they expanded their workforce up to 5% for this purpose.
- (d) Only 15% of building and construction companies demanded ISO 9000 certification from their sub-contractors, compared to 37% and 41% from 'service' and 'manufacturing' companies respectively.
- (e) In general it was evident that dramatic short-term net benefits would not be directly derived from the certification itself.
- (f) Table 1 was used by Chan and Lee (1995) to summarise the immediate benefits as perceived in different industries, as well as in overview. The markedly lower perceptions of 'immediate benefits' in the building industry in comparison to other industries, are worth noting.

different Industry Perceptions of Immediate Benefits from ISO 9000

3.3 Survey C - of Contractors - by the Technical Audit Unit of the Works Branch

The Quality Policy of the Works Branch issued in May 1991, committed it to achieving international quality standards in public works construction. In keeping with this goal, it was decided in February 1993 that all contractors in List I Group C (local contractors for projects over HK \$ 30 million/ about UK L 2.4 million) or List II (overseas contractors) should be certified to ISO 9000 after October 1996.

A survey by the Technical Audit Unit of the Works Branch was carried out between November 1993 and January 1994, in order to study the consequences of certification to international Quality Assurance standards. Questions were answered by 20 major contractors in the aforementioned target categories (List I Group C and List II). Meetings and a site visit strengthened the findings.

The main findings that are relevant to this paper are summarised as follows:

- (a) 18 of the 20 companies stated that they initiated a quality system because of the certification requirements of the Hong Kong Housing Authority.

Table 1 Different Industry Perceptions of Immediate Benefits from ISO 9000

Immediate Benefits	Building (%)	Service (%)	Manufacturing (%)	All Industries (%)
Reduce Wastage	27	53	63	44
Better Team Spirit	58	84	81	72
Less Staff Conflict	27	63	69	49
Increase Efficiency	50	74	69	62
Less Customer Complaints	19	79	50	46
Improve Sales	31	21	38	30
Shorter Lead Time	15	37	38	28
Better Relations with Subcontractors	27	37	50	36

Source: Chan, J.K.W. and Lee, T.Y. (1995).

- (b) Advantages noted after implementation included: improved work quality; reduced rework; better administration, document control and information retention; better material control/ reduced wastage and improved site safety.
 - (c) Disadvantages noted included: additional costs (both in setting up and running) deemed irrecoverable under the current tender climate; and excessive documentation for example in 'double - handling' of paperwork.
 - (d) 15 companies (of the 18 who replied) consented to estimate their additional costs for their quality system, as a percentage of annual running costs. Discarding two special cases, these ranged from the highest estimate of 15%, to the lowest of 0.5%; with an average (arithmetic mean) of 2.9%.
 - (e) 12 of the 20 companies agreed that ISO 9000 'could' be applied in the Hong Kong construction industry. Advantages were specially noted in contract reviews, document control, material control and work inspection. But 4 of these 12 companies suggested relaxations in items such as the traceability of sundry materials and the calibration of minor tools, highlighting differences between the construction and manufacturing industries. One respondent noted that 'ISO 9000 is just a starting point' and one component of TQM that enables self-improvement.
- 4 respondents considered ISO 9000 as unsuitable for the construction industry.

Another suggested that a provisional sum be incorporated to cover a Quality Assurance system. Almost all the respondents recommended the incorporation of Quality Assurance systems in the syllabi of academic institutes so as to reduce the 'learning curves' on construction projects.

- (f) 17 of the 20 companies employed 'Quality consultants' to assist them in obtaining their certification. 12 of these 17 companies said that those consultants were useful at the initial stage in 'understanding' ISO, but Quality Manuals prepared by Consultants were usually found to be lengthy and complicated to implement. However, 4 other respondents were satisfied because their consultants were familiar with the construction industry.

3.4 Survey I - of Clients - in the 1994 /95 University of Hong Kong Student Project

The Mass Transit Railway Corporation (MTRC) had established an internal Quality Management System based on ISO 9000 with a two-tier documentation structure comprising a Project Quality Manual and a Department Procedures Manual. The interview of relevant MTRC officers confirmed that while it did not insist that its contractors be ISO 9000 certified, it still required them to work according to the standards, for example to submit quality plans and to submit to audits.

The Hong Kong Housing Authority, had on the other hand used ISO 9000 as a benchmark both for itself and its suppliers and contractors; setting deadlines for its achievements. However, even this client expects and obtains more than mere ISO 9000 certification from its contractors. This is demonstrated in their PASS - Performance Assessment Scoring System (Hong Kong Housing Authority, 1994), which confers more tendering opportunities on contractors achieving higher PASS scores.

At the interviews, both clients confirmed the long term goals of their Quality Management Systems, expressed general satisfaction with interim results and indicated the areas of current review (Yiu, 1995). For example, the Housing Authority is developing their 'Input Assessment' component of PASS that evaluates construction resource inputs; and the relatively new Maintenance Assessment Scoring System (MASS). Another final year project investigation under this author's supervision in 1994/95, resulted in recommendations on such PASS developments (Wong, 1995); one of which was to minimise the duplication of documentation and other efforts required from contractors: (a) in obtaining ISO 9000 certification and (b) in their PASS Input Assessment.

3.5 Survey II- of Clients - by this Author

The author issued questionnaires in April 1995, to groups of middle/ senior level professionals (architects, engineers and quantity surveyors) from two large public sector (building) construction clients identified here as A and B. A had itself obtained ISO 9000 certification a couple of months before the survey, while B had obtained it about two years previously. However a relatively larger sample (13) was obtained from A than B (6).

The respondents had to answer questions on a scale from 1 (not at all) to 5 (very much). Table 2

indicates the average responses to each question of each of the target groups ie from each of the organisations A and B.

Table 2 Clients' attitudes to ISO 9000

Notes:

- (a) Sample size: 13 from A; 6 from B. The following is the average (arithmetic mean) of the responses from each sample, to each question.
- (b) Scale : 1 = not at all; 2 = a little; 3 = reasonably; 4 = a lot; 5 = very much
- (c) 'ISO' refers to ISO 9000 systems.

	<u>A</u>	<u>B</u>
1. Have you participated in		
(a) developing ISO? (in your organisation)	2.0	2.3
(b) Using ISO	3.6	4.2
(c) evaluating ISO?	1.8	1.8
2. How familiar are you with ISO?	3.1	3.3
3. Has ISO brought significant net benefits to your organisation?	2.4	3.2
4. Has ISO brought significant net benefits to end-users?	2.2	2.8
5. Have the overall benefits exceeded the costs?	2.2	2.5
6. Is ISO appropriate for your organisation?	2.3	2.7
7. Is it easy to install?	2.2	2.2
8. Is it easy to operate?	2.6	2.8
9. Should the frequency of audits be reduced?	3.6	3.0

It appears that while both sets of respondents have more than a reasonable familiarity with ISO 9000 systems, they are in general not so satisfied with its installation, operation and benefits; except that those from organisation B are reasonably satisfied with the overall benefits to their organisation. Furthermore, it should be noted that the ISO 9000 certified systems have been in place longer in organisation B, thereby allowing more time for the manifestation of longer term benefits.

A tenth item in the questionnaire solicited recommendations for improving ISO 9000 systems. Responses included suggestions for simplification, reduced paperwork more attention to the 'principles' rather than 'word by word' interpretations when auditing, and in the extreme, even that it should not be applied to design type process (2 responses, from a total of 19). Follow-up group discussions with the same target groups, led to recommendations for improved approaches, if developing a Quality

System in a similar organisation in the future. For example, a goal of TQM was recommended, while ISO 9000 certification was considered useful in the short term for third party audits in respect of the organisation, its consultants and its contractors.

The author's interviews of senior officials of a large public sector client co-ordinating body, have discerned a growing awareness of the increasing need for, integrating other crucial areas of current concern in construction, into broader Quality Management Systems. Specifically, 'construction safety' and 'dispute avoidance and resolution' systems which are themselves being developed could be incorporated in this overall system.

If not so incorporated, each of these areas would generate its own sub-systems, including organisational and documentation demands that may duplicate or conflict with one another. If integrated as proposed here, the overall system

could still be considered a Quality System rather than a general management system, since concepts of doing things 'right the first time' or 'better each time' and 'fitness for purpose' or 'satisfying needs', necessarily signify doing things 'safely' and also implies an avoidance of disputes.

3.6 Survey of Engineering Consultants - in the 1994/95 University of Hong Kong Student Project

By mid July 1995, only 1 Architectural and 3 Engineering Consultants had obtained ISO 9000 certification in Hong Kong, while many others were awaiting audits or had applied for certification. Questionnaires sent to the three ISO certified engineering consultants were all completed in early 1995 (100% response rate). Two are internationally reputed private sector consultants, while the third is the management division of a large public sector client in Hong Kong, which recently received certification of its Project Management system for an on-going mega project.

In Summary:

- (a) The respondents stated that they were more concerned with improving their internal processes and their effectiveness and efficiency; rather than in fulfilling clients' needs.
- (b) None of them used 'Quality consultants' to assist them in obtaining the certificates.
- (c) One respondent admitted to not addressing all clauses of ISO 9001 in practice, while even the others concurred on the inconvenience of addressing all the clauses, such as that incurred through increased documentation and overheads.
- (d) Two of the respondents believed that the benefits exceeded the costs incurred in obtaining their ISO 9000 certification; while all three welcomed its introduction.

3.7 Conclusions from the Hong Kong Surveys

Complete integration of the survey observations is difficult because of the differentials within: (1) the target groups, (2) the questions asked and (3) the post - certification periods of different respondents. However, the general conclusions from recent experiences, as discerned from the majority views of those in construction organisations in Hong Kong, clearly demonstrate that:

- (a) Quality Assurance and ISO 9000 certification is only an useful step along the 'Quality

Management' path and enables reasonably standardised Quality Systems training, while facilitating fairly uniform systems of checks and recording, as well as a 'Quality discipline'.

- (b) However, Quality Management Systems should extend beyond ISO 9000 in order to optimise the benefits/ costs trade-off for Quality systems and to achieve overall goals of enhanced effectiveness and efficiency; and to help inculcate a 'Quality culture'.
- (c) A long-term strategy is needed for each organisation, in order to incorporate and balance the foregoing needs, instead of the present ad-hoc responses to clients' requests and narrow short-term tactics that may hinder the optimal development of a sustainable effective and efficient Quality Management System.
- (d) A Quality Culture that permeates from top to bottom of all construction organisations is needed, as would accompany an awareness of the longer term benefits that should counter criticism of any lack of short-term gains and any high initial costs.
- (e) Quality can not be 'bolted on' as an afterthought into a management system, but must be 'designed into the system' at the outset.
- (f) Other special sub-systems, such as 'Safety Management' and 'Dispute avoidance/ rapid resolution' principles and procedures should be integrated with the Quality Systems themselves.
- (g) A specific set of guidelines is required for the construction industry; for example: rationalising and reducing paperwork, perhaps by integrating with other cost, progress and materials control systems; as well as with the afore-mentioned 'Safety Management' and 'Dispute avoidance/ rapid resolution' systems recognising different tolerance levels and traceability needs of sundry/ less significant materials and eliminating such less significant paperwork; catering to the special effects of sub-contractors; and recognising the short-term nature of projects and the specific vagaries and variables in construction projects.
- (h) General Quality Management consultants can not by themselves develop useful Quality Systems for construction organisations, unless they have specific construction industry experience.

- (i) Quality Management principles and special aspects such as the Quality Assurance/ ISO 9000 requirements should be integrated into all engineering, design and construction oriented academic and training courses.
- (j) Lessons learned from such recent experiences must be consolidated, distilled and applied, both in Hong Kong and internationally, before formulating strategies for the future, and even more so, given that we appear to be at the cross-roads of a quality revolution with many options and opportunities ahead.

4.0 A Sri Lankan Perspective

4.1 Background

Concepts and some practices of Quality Management have been introduced to different degrees in different industries. For example:

- (a) Quality Control Circles have proved successful in organisations and on the Employees' Trust Fund Bond and Dankotuwa Porcelain (Pvt.) Ltd., as reported in Case Studies at a recent international convention (Hong Kong Productivity Council, 1994).
- (b) The Sri Lanka Standards Institution promotes and assists in developing Quality Assurance systems in general industry, while some large organisations such as Unilevers are developing such systems and pursuing ISO 9000 certification. The Sri Lanka Association for Quality (SLAQ) formed on June 30, 1994 brings together 'top and senior managers, quality professionals, engineers and others interested in initiating a vigorous quality movement; and has launched a biannual journal named 'Quality Today'.
- (c) Quality Assurance has been publicised or discussed in the Construction industry itself, for example in general by Samaranayake (1993); and recently in programme initiatives (for contractors) being formulated by the Development Division of the Institute for Construction Training and Development.

However, there do not appear to be (to this author's knowledge or on record) any construction organisation in Sri Lanka, that has actively introduced specific Quality Management or Quality Assurance programmes of the types discussed in the foregoing sections; although some organisations are reportedly considering same.

4.2 Lessons for Sri Lanka

Like most principles and practices, direct transplantation of successful systems from other countries will rarely be appropriate. For example: (a) Belagamage (1995) explained why Quality Circles by themselves failed in U.S.A.; (b) Keiningham et al (1995) reported how the costs of elaborate quality systems led to the bankruptcy of the Wallace Co., which won the 1990 Malcolm Baldrige National Quality Award in U.S.A. and also how IBM suffered massive losses and laid off tens of thousands of workers (including the Chairman who began the quality programme) after implementing its 'market-driven quality' programme in 1990; and (c) the Latham Report in the U.K. (Latham, 1994) cited a 1993 survey into 'Quality Management in Construction' in the U.K. which found mixed results and responses from the firms surveyed.

Industry specific lessons may of course be assimilated from internationally documented experiences as in this paper before formulating appropriate strategies that take local conditions, objectives and constraints into consideration.

Westbrook and Utley (1995) listed six attributes of Total Quality Management (TQM) as: organisation culture; customer focus; team orientation; problem-solving emphasis; continuous improvement and measurement. They also hypothesised that 'if a culture supports employee efforts and customer needs, then TQM implementation is more successful' and *vice versa*. The results of their reported study supported that hypothesis. This underscores the need for a conducive organisational culture in order to successfully implement a TQM system.

4.3 Identifying Options and Formulating Strategies

Conventional decision making strategies may be used, for example in brainstorming to identify objectives, constraints and available options; and to evaluate their effectiveness, efficiency and possible repercussions. Previous international, local industry-specific and company-specific experiences would assist in such evaluations. The following is proposed as an example of such a strategy:

- (a) Three alternative Quality 'routes' are suggested as examples of options for this illustration, but there could well be more. Here 'ISO 9000' could signify a market driven or client-driven request, whereas TQM could indicate a more comprehensive longer-term objective.

Table 4 Cost/ Time Estimates for Alternative Quality Systems and Different Approaches

APPROACH:	Full-Time In-house	Part-Time In-house	External Consultants	Other (eg: mix)
<u>ROUTE</u>				
ISO 900	\$ / months	\$ / months	\$ / months	\$ / months
TQM	\$ / months	\$ / months	\$ / months	\$ / months
Other (eg: combined)	\$ / months	\$ / months	\$ / months	\$ / months

Figure 1 gives an example of a flowchart that summarises the sequence of steps to be taken in developing the foregoing Tables 3 and 4; and in formulating an appropriate strategy.

The generalised nature of this model enables its application by construction organisations in most scenarios whether in developed or developing countries. However, modifications may be made to the list of goals in Table 3, the range of routes in Tables 3 and 4 and the accompanying schedules of Target Outputs and Inputs. Thus appropriate Quality Management system strategies may be rapidly developed to suit specific scenarios based on the proposed model.

Construction organisations in Sri Lanka can now benefit from a more informed approach to the choice of an appropriate Quality Management System since the basic question is not whether a system is needed, but as to which type of system

is best suited to the present operations and future aspirations of the organisation.

5.0 Acknowledgments

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6.0 Abbreviations

HKQAA	-	Hong Kong Quality Assurance Agency
ISO	-	International Standards Organisation
PASS	-	Performance Assessment Scoring System
TQM	-	Total Quality Management

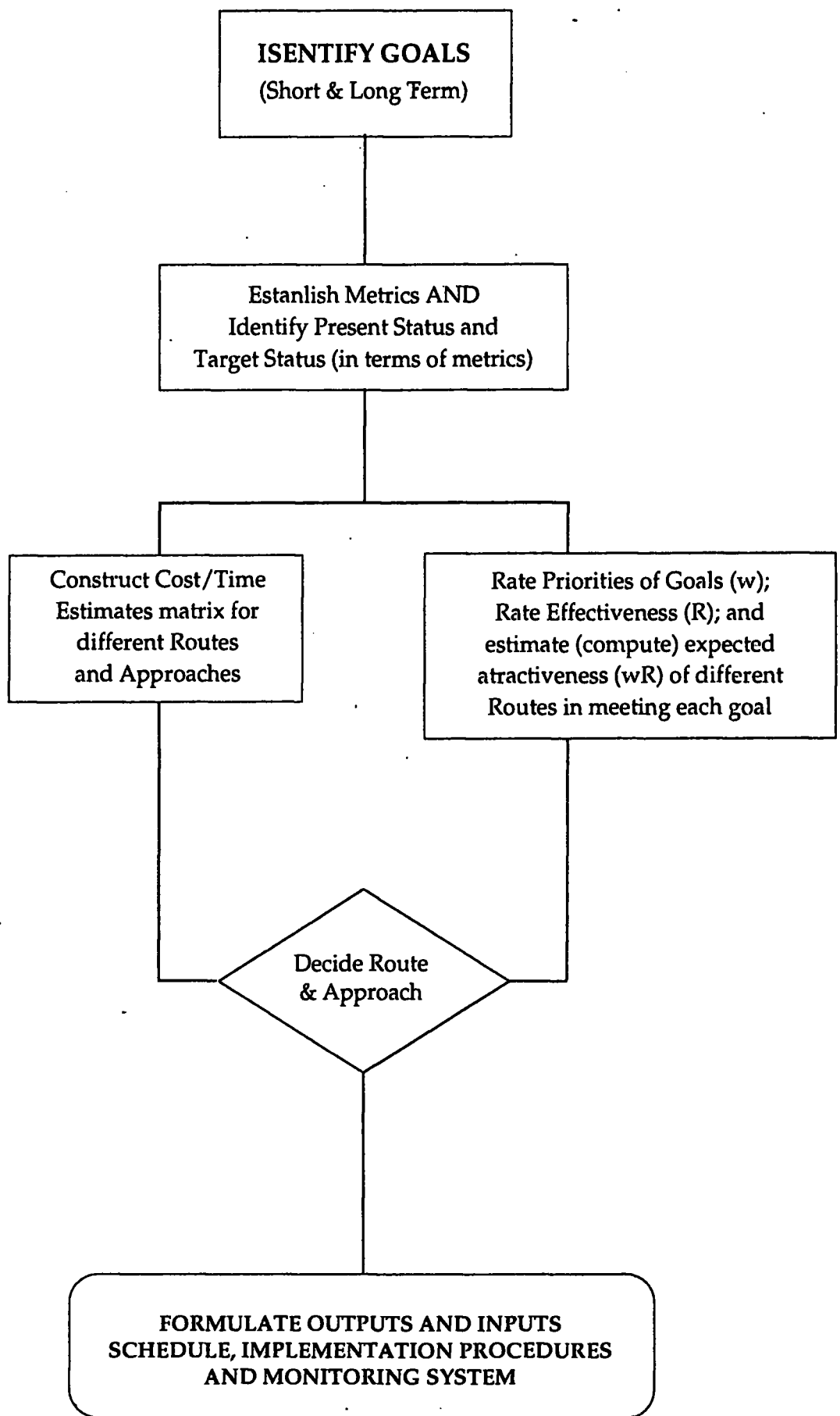


FIGURE 1. A Strategy for Formulating the Optimal Quality System for an Organisation

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