QUALITY AND CONSTRUCTION MANAGEMENT

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ABSTRACT

The construction industry has long tended to equate 'quality' with 'excellence at any price'. This is at last changing, and like most other industries, construction has started to accept that quality should be seen more in terms of 'fitness for purpose'. At the same time that the concept is changing, an attempt is also being made to change the way that quality is achieved. As in many other industries, construction is attempting to manage quality into its projects without compromising their cost or time parameters. This effort has been handicapped by a misunderstanding over the difference between Total Quality Management (TQM) and Quality Assurance (QA). This misunderstanding has created confusion for two reasons; one is simply related to the meaning of the terms and the other is due to a mistaken belief that the industry is one homogeneous unit. The difference in the meanings of the terms is explained and a brief examination of the characteristics of the different sectors of the industry suggests that the appropriate way of managing quality into the products of construction is by using QA in design-oriented organisations and TQM in contracting organisations.

1.0 INTRODUCTION

The construction industry is sometimes referred to as the oldest profession. Its long tradition has meant that many of its habits and customs have been ingrained by its historical development. One such habit is the belief that the concept of quality is linked with that of the masterwork or masterpiece that craftsmen used to produce in order to end their apprenticeships. In this habit of thought, quality is associated with the idea of the best - the most excellent piece of work. The concepts of the cost and time involved in its production are not really relevant.

This traditional concept is no longer viable in the modern world, in which time and money are such valued resources, and so the concept behind 'quality' has changed to one more in keeping with the times. It retains the element of excellence in its meaning, but this is moderated by the practicalities of time, cost, functionality and usefulness (1).

2.0 THE QUALITY CRUSADE

One of the prime movers in the redefinition of quality was W. Edwards Deming. He has written extensively on his 'quality crusade' in many different contexts and his ideas have helped stimulate a worldwide response in terms of a new focus on quality in its wider context (2).

In the early 1950's and 1960's, Japanese goods were generally considered to be cheap but of relatively poor quality. Since that time, they have managed not only to maintain low prices but also to achieve the highest quality in the goods they produce. One factor which apparently (3) assisted this improvement was their recognition of the benefits to be gained from what Deming, amongst others, was 'preaching'. Japanese experts like Taguchi (himself four times recipient of the Deming Award) and Ishikawa (4)(5) developed the quality philosophy and Japanese firms embraced a 'culture' of quality by building quality into both their products and their production systems. Although Japanese companies have been very successful at it, this process of adopting a new corporate culture is not as simple as it may appear and this will be returned to later.

Japanese companies were quick to accept that one of the key aspects in trying to improve quality would be a rejection of the idea of trying to inspect quality into their products. Instead, they directed attention towards introducing systems that would 'engineer'

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quality into their products. In other words, instead of checking for and rejecting defective goods, they aimed to get it *right first time*. This meant that they had to introduce systems that enabled them to design, construct and manage the production process so as to ensure that quality was achieved at each stage, and thereby, was built into their products. In other words, in order to emphasise providing the customer with a quality product every time, both the management system and the production system must be designed for quality (6).

In its simplest form, the structure of a quality system is encapsulated in what is now known as the Shewhart-Deming Cycle (7), which is essentially a graphical representation of a cyclical process aimed at achieving continuous quality improvement. It is supposed to lead an organisation into a spiral of development and is characterised by the acronym PDSA, which stands for Plan-Do-Study-Act. The cycle constantly feeds back information so as to enable the system to be improved. This is shown in **Figure 1** below:

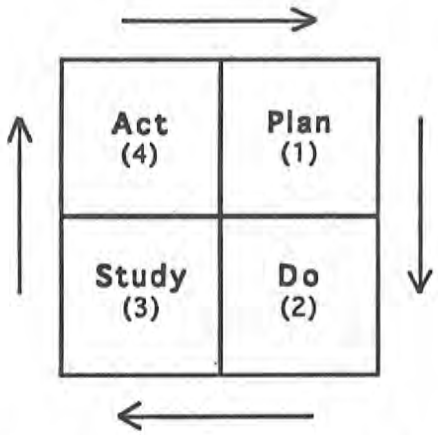

Figure 1: The Shewhart-Deming Cycle

It would be foolish to suggest that quality was not an issue before the 1960's when Deming launched his 'quality crusade', because there were obviously many engineers, managers and indeed, companies that were very concerned with the practicalities of achieving quality output. Products were produced which were of the highest quality and many production systems were extremely efficient and effective at producing quality output. Quality tended to result either from small-batch production of customised units or from careful inspection of mass-produced items designed to reject faulty goods before they reached the customer. On the rare occasions when firms achieved high-quality, low-reject mass production, the structure of the production systems (the knowledge of what these firms did and how they did it) tended not to be formalised into written procedures, and partly for this reason, tended to remain within the companies and sometimes the individuals concerned. During the 1960's, a start was made on the process of rationalising the procedures involved in such systems so that they could be properly defined and recorded, and hopefully used elsewhere.

It is no coincidence that this occurred during a period when there was widespread interest in understanding the processes involved in 'technology transfer' and the problems associated with defining appropriate technology. International funding agencies were experiencing difficulties, often finding that the technologies imported into developing countries were incapable of fitting-in or being used effectively in their new settings. (8)

At least part of the problem arose from the lack of an appreciation of the detail of the procedures involved in making a specific 'technology' work efficiently. To be transferred effectively, a technology really needs to be 'de-engineered', so that its elements are defined and their interrelationships understood, and then 're-engineered' for its new environment. This process allows the development of a configuration that is appropriate to the needs of the transferee.

This procedure of 'de-engineering' and 're-engineering' is similar to that involved examining a product closely in order to establish how it was made, so that the resulting structure of activities can be assembled into a production technology that will enable a similar product to be made. Astute engineering in this assembly stage can allow the process to be oriented towards achieving quality first time, every time. It is widely felt that the Japanese used this procedure to good effect in moving from their state of relatively poor industrial performance in the early 1960's to their leading status currently (9).

3.0 QUALITY STANDARDS

Efforts at designing systems that help ensure quality have become accepted to the extent that authorities are trying to formalise the process. Quality has, for

example, become enshrined in the national and international standards with which industries have to work. For example, *BS5750: Part 0: Section 0.1:1987* in the UK, *EN 29000-1987* in Europe, *TTS 1 65400: 1988* in Trinidad and Tobago and *ISO 9000 - 1987* world-wide, all represent standards on "Quality Systems" (10).

The definition of 'quality' underlying these standards is usually stated as being, "The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs". (11) Given this focus, the purpose of a *quality system* is to establish procedures which will achieve this end.

4.0 QA AND TQM

The overall approach to implementing 'quality system' standards is one in which the organisation tries to establish a behaviour pattern which will lead inevitably to a quality product. Ideally then, this behaviour is institutionalised in such a way that it can easily be followed and readily be monitored (12). This process is fundamental to Quality Assurance (QA), under which, in addition, a certifying agency normally examines the procedures identified by the firm, confirms that they comply with the requirements of the standards and then conducts assessments and audits to ensure that the firm is doing what it says it should do. QA is supposed to provide the customer with an objective, external assurance that the firm operates a system that should produce a quality product. (The audits can be conducted internally by the firm itself but this system is less common (13) (14).

Total Quality Management (TQM) is somewhat different in structure, in that it is normally an internally driven initiative. Again, the focus is on trying to ensure that the customer gets a quality product, and again, this is achieved by trying to ensure that the system is oriented towards quality and that performance is continuously monitored and improved. However with TQM, no external standards or certification are involved.

There is no dispute that the fundamental purpose of TQM and QA is the same, but there is debate as to whether the internal approach, typical of TQM, or the external orientation of the approach characterised as QA is better (15)(16)(17). There is also dispute over whether QA should or should not be a part of TQM. These are rather sterile arguments. Far more important and problematic is the fact that many firms and individuals feel that both TQM and QA are a waste of time.

There are two main reasons for this attitude. One is the belief that firms use TQM or QA simply as their latest management gimmick. It will be replaced when the next fad comes around, so why pay much attention to it? It is clearly not enough for firms simply to pay lip service to quality. Far too often, organisations write 'quality' as one of their corporate objectives and that is as far as they go. If there is no follow through, then they are simply indulging in propaganda. QA largely overcomes this reservation because certification will not be achieved without effort.

The second reason is that often firms approach QA by assuming that what they do now is good and that if they define their current procedures and follow them in future, then everything will be fine. While the starting point for writing down the procedures that will be defined in the Quality Manual must be what the firm does currently, this should always be examined to see if a better quality output could be achieved by changing the procedure. Simply writing what you do now, and then doing it, is not enough. Staff will not be motivated by that. The procedures in Quality Manuals must be valid, must be seen to be valid and must not be allowed to ossify, i.e., they should constantly be under review.

5.0 THE CONSTRUCTION SECTOR

Firms in the construction industry suffer from both of these problems. In addition, there is a problem that is specific to the construction industry in developing countries and it is that international clients and lending agencies are increasingly demanding some form of quality assurance, often in the form of certification to ISO9000. What this effectively means is that firms wishing to be considered for work on major international construction projects need to get QA certification.

It should be noted that having a commitment to TQM in such a situation, is not sufficient. If the clients want certification to ISO9000 because they feel that the objectivity of the external monitoring and auditing involved are necessary, then certification will have to be obtained. TQM does not involve external certification.

This need for external certification (18) does create

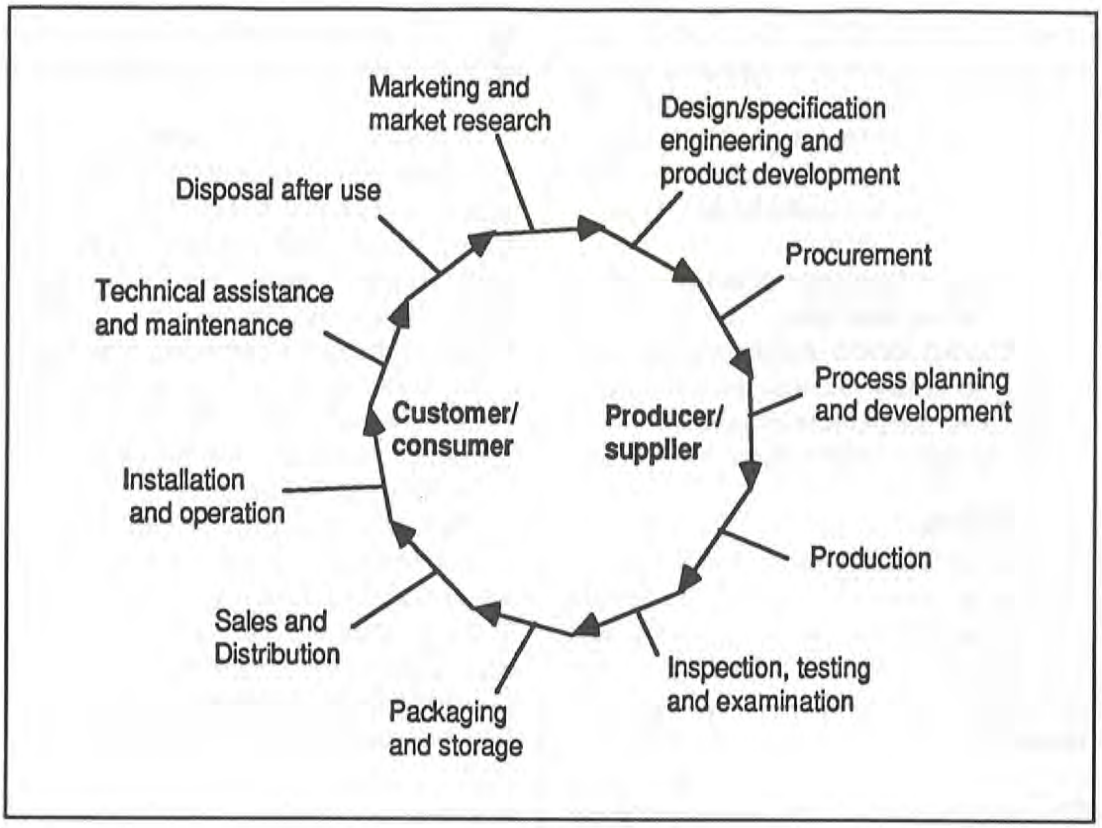

Figure 2: Quality Loop

an immediate problem, in that certifying agencies do not yet exist in many parts of the world, such as the Caribbean for example. As a result, if local consultants or contractors want to acquire QA certification to ISO 9000, they would have to go to agencies in the UK or elsewhere. This would be both considerably more expensive and time-consuming than for firms in those countries. Quite apart from anything else, this would immediately put the local Caribbean firms at a competitive disadvantage, even on jobs in their own area.

In addition, it is not yet clear that ISO 9000 certification is appropriate for contracting firms because it is difficult to specify procedures that are both specific enough for a Manual and flexible enough for the eventualities that will be met on site. While the basic methodology used in most construction operations is very well established (steel-fixing, concrete work, masonry, carpentry, plumbing and the other trades, all involve standard procedures), differing circumstances can change the appropriate approach (19). Thus, the correct procedure for placing concrete may vary depending on the temperature, weather and quantity that is to be placed and even the shape of the finished object. QA certification is currently far from widespread in the industry and this may be part of the reason. The important issue of course, is not that a firm is certified but that it emphasises quality (20).

6.0 MANUFACTURING OR SERVICE INDUSTRY

There are a number of other implications for firms which decide to seek certification. The local national standard TTS 1 65 404:1988 (which is identical with BS 5750: Part 0: Section 0.2: 1987 and ISO9004-1987), is subtitled ***"Guide to Quality Management and Quality System Elements"*** (21). It presents a Quality Loop as shown in **Figure 2** above.

Although it does not state it explicitly, it is apparent that this figure relates to manufacturing operations (e.g., the element relating to "Packaging and storage"), and is not immediately relevant to the construction industry, at least not without a little massaging of the terminology, and recognition that much of the work of

the industry is wrapped up in one single 'activity' in this loop, i.e., "Design/ specification, engineering and product development". Clearly, this 'loop' is not very relevant to the construction industry.

It is rather more helpful to examine the industry in the terms set out in the standards for a service industry. The service industries were only really acknowledged in the quality standards as being different from those involved in manufacturing in BS 5750: Part 8: 1991 (identical with ISO 9004-2: 1991)(22), in which the **Service Quality Loop** was introduced. (See Figure 3.)

As can be seen, there are a number of significant differences between this and the previous (manufacturing) quality loop. Perhaps the key difference is the active interface between the supplier and the customer which allows and encourages feedback on performance quality. Because the products of the construction industry tend to be 'customised', this strong link with the client/customer is naturally established. Thus, the characteristics of this service loop seem better suited to construction than those of the manufacturing loop. This goes against the current tendency to try to deal with construction as if it is a manufacturing process.

The fact that construction products tend to be customised in itself poses a problem in that their unique design, site, timing and even the team of personnel involved, mean that there is limited scope for feedback that can easily be related to future projects. This makes it difficult for firms to modify their procedures in order to improve the quality of the subsequent projects. This does of course beg the question of how to generalise specific feedback so that procedures can be modified to improve quality.

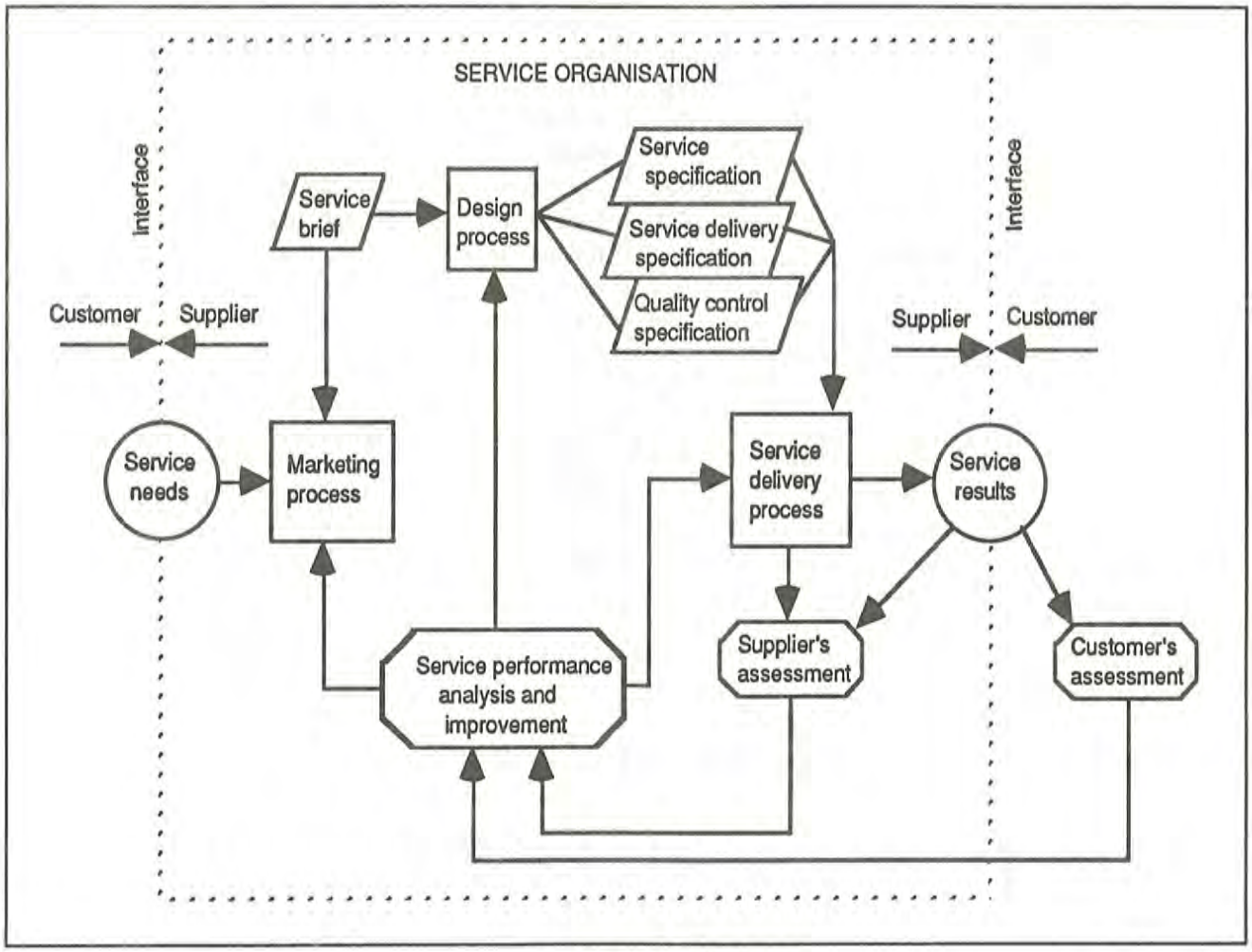

Figure 3: Service Quality Loop

7.0 MEANS OR ENDS?

As has been mentioned, the essence of a quality management system is the identification of how each task should to be performed if a quality product is to be obtained. In a Quality Assurance scheme, having identified the 'correct' procedure for every such task, this should be written down and the procedure followed on future occasions. For firms involved in design and consulting, this is not a problem. Indeed, it may be seen as an advantage for them, particularly if a failure occurs. Because such firms are legally required to follow conventional methodology (i.e., their peers would have done the same) when undertaking designs etc., when failures occur, they are assessed according to their compliance with accepted standards, codes of practice, and current knowledge in the industry. They are judged according to their means rather than their ends. If they did things according to 'good practice' and trouble occurred, then it was not their fault. It was the 'good practice' that was to blame.

In effect, QA certification can help a design-oriented organisation to set up a management structure that will assure both themselves and their clients that the system will produce a quality product.

By contrast, firms involved in the contracting side of the industry will find great difficulty in gaining QA certification. The reasons for this owe much to the fact that contractors tend to be judged more by what they produce (their results) than how they do it (their procedures). This is especially the case where performance specifications are used. As long as the end result provides the services required by the client, the approach used to get there is not really of concern to the client.

The competitive edge that is so important to a successful contractor often lies in his ability to adopt a somewhat unconventional approach to the construction process. Successful contractors find ways of doing things that achieve the desired results, while reducing the cost involved and writing down this information would be anathema to them. At one level, they would be concerned that this information may be 'leaked' to their competitors. At a more fundamental level however, they would find difficulty in putting the process on paper because it is more of an art than a science.

Although the contract documents do not seem to allow much flexibility, the importance of the contractor's knowledge of construction technology and his ability to effectively 'build the project in his head' should not be underestimated. Given that material specifications are usually tight, if there was no art involved in establishing the work breakdown structures for a project and in scheduling the tasks involved, then all bids should come in more or less the same. Experience shows that this is not the case.

Thus, it is hardly surprising that contracting firms have shown little enthusiasm for QA certification and this seems unlikely to change unless they are forced to by the clients. It is much more likely that they would prefer to adopt a TQM approach to ensuring quality in their product.

8.0 CONCLUSION

The result of this review is that it would appear that the construction industry will once again be split along its traditional lines. In other words, the design organisations will go one way towards quality assurance and external standards and audits and the contracting organisations will go the other, towards internally motivated and monitored total quality management systems.

There is no reason why this should be a bad thing. Indeed, the attempts that are made to classify the industry as a homogeneous whole are probably both futile and foolish. The 'industry' may be entirely directed towards trying to produce a quality product, but the different 'players' involved in the industry have very different roles, very different specific objectives and are judged according to very different criteria, so it should hardly be surprising that they adopt different approaches to quality in construction management.

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