Conceptual linkages between benchmarking, total quality management and construction productivity

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CONCEPTUAL LINKAGES BETWEEN BENCHMARKING, TOTAL QUALITY MANAGEMENT AND CONSTRUCTION PRODUCTIVITY

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Abstract

The decline in construction productivity over the last two decades is an issue of wide concern when compared to manufacturing industry. There have been several calls for major reforms in the way that the construction industry operates if its performance is to be improved. There is, however, a general lack of credible suggestions for implementing these reforms. This paper examines benchmarking (a continuous and systematic process of comparing an organisation's efficiency in terms of productivity, quality and practices with those companies and organisations that represent excellence) as one such reform tool. Conceptual linkages between benchmarking, Total Quality Management (TQM), and construction productivity are also explored.

TQM is suggested as a general framework for reform implementation with benchmarking as a tool for kick-starting managerial or organisational change processes. Benchmarking is presented as a viable tool for performance gap identification and quantification. The performance gap is seen as an important motivator for a company wishing to: take the initial step into TQM; and utilise benchmarking as a sustenance and acceleration tool through continuous comparison and improvement in the TQM implementation process.

Keywords: Benchmarking, Change Management, Construction Productivity, Total Quality Management.

Introduction

The construction industry is still characterised by low productivity, fragmentation, divided responsibility, and conflicting objectives. The decline in construction productivity growth has been an issue of wide concern for some time. There have been no major breakthroughs leading to substantial productivity improvements despite considerable research and numerous reports on the subject. Pioneering work in construction productivity by Frank Gilbreth (1868-1924), who performed extensive labour productivity studies in bricklaying, found ready application in the manufacturing industry whose productivity growth rate has continued to outperform that of the construction industry. In the period 1909-1952, manufacturing productivity per manhour increased 2.6 times faster than that of construction productivity. This trend has not significantly changed during the second half of the twentieth century. Kellog et al. (1975) noted that construction productivity had grown at a minuscule rate of less than one tenth of one per cent per annum. Briscoe (1988) illustrated a stagnation of labour productivity between 1977 and 1986. This trend has also been established in the United States (Sidwell et al. 1988).

A recent report to the European Commission on 'Strategies for the Construction Sector' recognised the need to focus on the following issues in addressing long-term strategies (Commission of the European Community 1993):

- changing the way in which industry operates;
- raising the level of output;
- improving quality and competitiveness; and
- improving productivity through training and innovation.
The paper aims to assist the construction sector develop a strategic response to the major issues which are creating change. The initial challenge for industry is to identify the tools and mechanisms that could bring about changes required for world class competitive performance, central to which is productivity. The understanding and implementation of changes in management culture is fundamental for success in the industry. This paper explores these trends and relates them to Total Quality Management, benchmarking and productivity.

Objective

Organisations, for many years, have often pursued quality and productivity as two independent issues. The quality revolution, brought about by the Japanese management philosophy in 1970's and 1980's, has led to the integration of quality and productivity through the Total Quality Management concept. Effective research into productivity cannot therefore ignore the quality aspect and hence the interlinkages. In the authors' research into labour productivity, they have also found it necessary to explore current management trends in performance improvement. Benchmarking is a useful tool that enables organisations to enhance their performance by learning from industry leaders. This paper, therefore, also sets out linkages between Total Quality Management, benchmarking and productivity.

The Challenges and Prospects for Change.

Increasing numbers of professionals, researchers, professional societies, and publications associated with the construction industry have, in recent years, expressed growing concern over the problems facing the construction industry, most of which relate to the low levels of productivity. There have been several calls for reforms in an industry that is known for its unwillingness, or perhaps its inability, to change (Burati et al. 1992; Commission for the European Community 1993). Some studies have suggested that construction companies must adopt Total Quality Management as a management philosophy within the next five to ten years or become non-competitive in the national and international construction and engineering markets (Burati et al. 1991).

The TQM concept offers a promising future for the construction industry. The initiation of a TQM programme within an organisation is best achieved by the identification of a performance gap with its competitors. Benchmarking is a powerful tool for performance improvement through comparisons with competitors both at the initial stages of a TQM programme and for its sustenance through continuous comparison and improvement. This paper attempts to establish conceptual linkages of TQM, benchmarking and productivity as they apply to the construction industry during the change process.

Linkages between Productivity and Quality

Traditional definitions of productivity and quality do not betray any linkages between the two concepts. Quality has been defined as the totality of features and characteristics of a product or service that bear on its ability to satisfy the stated or implied needs (Hellard 1993). On the other hand, productivity has been defined, at a very fundamental level, as a ratio of output to input in a production process. Until very recently, the two have been pursued separately, as observed later in this paper. The traditional organisation of the construction industry places higher responsibility for productivity on the contractors, while the consultant has to ensure that contractor's work is of the required quality. The contractor is often viewed as the party who is
inclined to provide poor quality, if it is possible to get away with it. The general view is that in order to achieve high quality, productivity has to be sacrificed and vice versa. Mefford (1991) argued against the traditional view that there is a trade-off between quality and productivity, and that efforts to achieve ever higher quality levels of both are likely to be uneconomic. He offers the following three reasons for a positive correlation between productivity and quality:

**Direct linkage:** This is a direct result of how productivity is defined and measured. Productivity is measured by dividing output by input; it therefore follows that the numerator should not include defective output, thereby reducing productivity.

**Indirect linkage:** Quality improvement programmes are likely to result in better and smoother production processes that are likely to have fewer breakdowns and lesser defects.

**Motivation:** There is increasing evidence that improvements in quality and productivity have a salutary effect on employee motivation; through empowerment, implementation of performance related bonuses, and the pride or security of working for a growing organisation.

Karof and Ostblom (1993) offer a viable model relating productivity and quality through the concept of efficiency, which they propose is made up of four basic components:

- quality;
- price;
- production volume; and
- cost.

Value is the quotient of quality and price, and determines the number of units sold in a free market economy. The quotient of production volume and cost is productivity, and the motive force for efficiency in a market economy is that the value which is delivered, must be higher than the cost of producing a unit of product or service. Thus, efficiency is a function of value and productivity as shown in Figure 1. The figure represents quality and productivity as determinants of efficiency.
This concept agrees well with Deming's claims that quality benefits both the worker and the organisation, as illustrated below in the Deming chain reaction, see Figure 2 (Hellard, 1993).

**Figure 1: Efficiency matrix (Karolof & Ostblom, 1993)**

**Figure 2: Deming quality: productivity chain reaction (Hellard, 1993)**

**Total Quality Management and Productivity**

The recently issued BS7850 Total Quality Management (1992) defines TQM as: a technique that assures maximum effectiveness and efficiency within an organisation by putting into place processes and systems which ensure that every aspect of its activities are aligned to satisfy customer needs and all other objectives without waste of effort and using the full potential of every person in the organisation. The philosophy recognises that customer satisfaction, health, safety, environmental considerations, and business objectives are mutually dependent.
Total Quality Management has been described as the third industrial revolution, which has emerged from a rapid development in the third quarter of the twentieth century (Hellard, 1993). It has two main streams contributing to its development: that of scientific development and that of quality. The progression of the two streams over the last 100 years has been well summarised by Hellard (1993), as shown in Figure 3. The merging of the two streams in the 1980's, and the emergence of TQM in the 1990's, has created a whole new philosophy and has brought back the quality concept from the product into the process. The European Quality Award (EQA) self evaluation model represents the current management thinking brought about by the merger (Davies, 1993). The model illustrates: a shift away from the traditional performance indicators such as business results to a more integrated approach with priority on customer satisfaction; a shift in management style from control to leadership; increased employee empowerment through teamwork and decision making; and an emphasis on process and statistical process control.

The quality being subjected to these techniques defies concise definition. Oswald and Burati (1992) argued that it includes:

- satisfied customers;
- reduction of variation and re-work in the work process;
- reduction of production-service cycle times;
- the absence of disputes;
- greater alignment of individuals and corporate objectives; and
- repeat business, including long-term business relationships.

Approaches such as Quality Function Deployment (QFD) are now being used to initiate a quality product development from the customers' point of view, and tailor the design and manufacturing process towards addressing the customers' needs (Karlof and Ostblom, 1993).

The adopted concept of the customer in the TQM context is wider than the end user of the product. There are internal customers who receive, process and supply semi-finished products in the process chain; and there are the external customers who receive the final products. Indeed, each party in a process chain has three roles: supplier, processor and customer, whether they be internal or external. Burati et al. (1992) refers to this as the triple role concept (after Juran, 1988). Each party plays a role of receiving products processes these products, and supplies products of higher value to the next customer in the chain, whether it be physical products or information. The triple role concept is illustrated in Figure 4.
Figure 3: The evolution of technique, practice and philosophy leading to total quality management in construction in the 1990's (Hellard, 1993)
Figure 4: Juran's triple role concept applied to construction (Burati et al, 1992)

This view has now led to productivity being considered as an aspect of process quality. BS7850 recognises this view by offering the following definitions for process, quality improvement and quality losses (BS7850: Part 2, 1992: pp. 3).

Process: Any activity that accepts inputs, and adds value to these inputs for customers. The customers may be internal or external to the organisation.

Quality improvement: Action taken throughout the organisation to increase the effectiveness and efficiency of activities and processes to provide added benefits to both the organisation and its customers.

Quality losses: Losses caused by failure to utilise most effectively and efficiently the potential of human, financial and material resources in a process.

The last definition issue leaves no doubt that BS7850 views productivity as part of the quality loss. While accepting these views, an understanding of the interaction between product and process quality, and productivity (as a ratio of output to input) still remains to be established.

**Benchmarking as Tool for TQM Implementation**

TQM concepts are now accepted for performance improvement efforts in the construction industry after successful applications in the service and manufacturing industries (Burati et al. 1991). Several models for TQM implementation have been proposed. What is lacking in these models is a guide to the initial step required to launch a TQM programme for an organisation.
The Construction Industry Institute's model (1992) mentions the "perceived need for change" as a starting point. However, a tool for quantification of the "need for change" is missing in this model. Both the Malcolm Baldrige Award (Research Technology Management 1990) and the European Quality Award (Davies, 1993) models serve as tools for progress evaluation in the TQM implementation. They offer little in terms of kick-starting the programme. The same can be said of "Total Quality in Construction" published by the European Construction Institute (1992).

Davies (1993) proposed a progress evaluation criteria based on the EQA model from which he extracted a progress checklist. His progress mapping proposal is based on the norm that the quality evolution of an organisation goes through several stages of development: survival, prevention, and continuous improvement, each of which has its sub-stages, as presented in Table 1. The progress evaluation mapping can then be made against criteria extracted from the EQA model, see Figure 5. The model offers an acceptable framework for progress evaluation, but lacks practical tangible measures.

Table 1: The quality evolution - stages of development for the world class company (Davies, 1993)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Recognising competitive threat and the need for improvement</td>
<td>• Bringing the business under control</td>
<td>• Business as an integrated process</td>
</tr>
<tr>
<td>• Isolating key problems</td>
<td>• Management ownership</td>
<td>• Total customer orientation</td>
</tr>
<tr>
<td>• Organising to solve them</td>
<td>• Challenging existing roles and methods</td>
<td>• Empowering management style</td>
</tr>
<tr>
<td>• Solving them</td>
<td>• Building quality into the business</td>
<td>• Controlled improvements and change is the norm</td>
</tr>
<tr>
<td>• Developing capable and motivated people</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Survival</th>
<th>Prevention</th>
<th>Continuous improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>People management</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Policy/strategy</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Resources</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Processes</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>People satisfaction</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Impact on society</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Business results</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Figure 5: Mapping progress against the survival, prevention and continuous improvement assessment criteria (Davies, 1993)
There is still the lack of a motivational tool that could be used to encourage an organisation to embark on a TQM programme. Benchmarking, a performance comparison tool, could be used to quantify the performance gap which would give the management the motivation to embark on a performance improvement programme. Figure 6 represents a proposed conceptual model for TQM implementation.

Figure 6: Benchmarking as a tool for Total Quality Management implementation

Model Implementation and the Scope for Performance Improvement

Benchmarking is the search for industry best practices that leads to superior performance (Camp, 1989). Benchmarking is also widely accepted as a tool for quality and productivity improvement opportunity identification through comparison with recognised leaders. The search for best practices is initiated through performance comparisons with leaders on the basis of performance indicators or metrics. These indicators can be business results such as profitability, turn-over, market share, share prices etc. The identified performance gap provides the motivation for embarking on performance improvement programme. TQM is one such viable programme. Once the programme has been initiated, the initial quality and productivity improvement steps are achieved through the incorporation of best practices throughout the organisation.

As the practice of TQM becomes part of the organisation's management philosophy, benchmarking, both internally and externally, becomes part of the process as a means of setting targets, identifying best practices and incorporating them into in the organisation's processes.
There is extensive scope for benchmarking applications in performance improvement throughout the construction industry. Figure 7 illustrates a conceptual framework which spans from corporate to crew level. Performance indicators can be identified at different levels, and associated with various practices. The framework can be used as basis for identification of the main or critical indicators, which in turn highlight the improvement potential. Focusing on productivity as a central performance issue, specific indicators of productivity at various levels can be isolated and prioritised. Further work is expected to utilise the conceptual framework to develop specific performance indicators and associated best practices as a major step towards developing a practical benchmarking model for the construction industry.

![Diagram of Benchmarking and Productivity](image)

*Figure 7: Benchmarking performance indicators and construction productivity relationships*

**Conclusions**

This paper has developed a set of conceptual models that link TQM, productivity and benchmarking, in order to integrate concepts and recent developments in management philosophy with regards to construction quality and productivity. The prospects for productivity improvements are a major challenge currently facing the construction industry. The TQM concept, a management philosophy widely applied in the manufacturing sector, offers a promising future. The implementation of the concept into construction management philosophy would, however, necessitate major changes in the way the industry currently operates. Alignment of objectives for all parties involved in the industry is one such major change. Benchmarking is not only a viable tool for kick-starting the TQM process, but it is essential for both orienting the change process and sustaining the TQM philosophy. These models are still conceptual, and their practical viability is still an issue for further debate.
References

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FIG. 8: Change in Labour Output in United Kingdom - 1971-1992

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Table 1: Comparison of Benchmarking Definition by Different Authors
<table>
<thead>
<tr>
<th>Author</th>
<th>Definitions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Benchmarking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camp (1989)</td>
<td>Performance comparison of units or departments within one organisation</td>
<td>There are no conflicting definitions of internal benchmarking among authors</td>
</tr>
<tr>
<td>Zairi (1992)</td>
<td>Same as above</td>
<td></td>
</tr>
<tr>
<td>Watson (1993)</td>
<td>Same as above</td>
<td></td>
</tr>
<tr>
<td><strong>Competitive benchmarking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camp</td>
<td>Direct product competitor benchmarking looking at processes and products</td>
<td>Zairi’s definition seems to deviate from the other two definitions.</td>
</tr>
<tr>
<td>Zairi</td>
<td>Comparing specific models or functions with competitors</td>
<td></td>
</tr>
<tr>
<td>Watson</td>
<td>Product oriented comparisons with processes involved</td>
<td></td>
</tr>
<tr>
<td><strong>Functional benchmarking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camp</td>
<td>Specific function comparison with best practice</td>
<td>Zairi’s definition limits comparison to best in class, a view not shared by both Camp and Watson</td>
</tr>
<tr>
<td>Zairi</td>
<td>Comparison of specific function with best in industry and best in class</td>
<td></td>
</tr>
<tr>
<td>Watson</td>
<td>Comparison of particular business functions at two or more organisations</td>
<td></td>
</tr>
<tr>
<td><strong>Generic benchmarking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camp</td>
<td>Search for best practice irrespective of industry</td>
<td>Camp’s definition is best here because the search should not be limited to industry and the aim should be to identify the best of the best.</td>
</tr>
<tr>
<td>Zairi</td>
<td>Comparison of all functions of business operations with those of best in class</td>
<td></td>
</tr>
<tr>
<td>Watson</td>
<td>Comparison of particular business functions at two or more organisations without regard to industry.</td>
<td></td>
</tr>
</tbody>
</table>
FIG. 1: Benchmarking Objectives
FIG. 2: Total Quality Management Model (Chandra, 1993, pp. 20)
FIG. 3: Benchmarking Types
FIG. 4: The Benchmarking Process Compared to Deming Cycle (Watson, 1993, pp. 4)
Identify the function to be benchmarked

Select the superior performers
(Competitive or non-competitive)

Collect data and analyse for pinpointing
gaps in performance, processes and practices

Set performance goals for improving and
surpassing the best in class

Implementing plans to bridge the gap
and monitor results

FIG. 5: Process of Benchmarking (Shetty, 1993)
FIG. 6: Xerox Benchmarking Model (Karsnia, 1991)
FIG. 7: European Quality Award Model (Davies, 1993)
FIG. 8: Change in Labour Output in United Kingdom - 1971 - 1992
Sources: DE Gazette; DoE Housing and Construction Statistics