LESSONS LEARNED IN CONSTRUCTION PROCESS IMPROVEMENT

Sarshar[1], M., Haigh[2], R.

ABSTRACT

Process improvement is recognised as a main driver in achieving productivity improvements in the construction sector. Organisations often adopt top-down or bottom-up methodologies for improvement, such as EFQM, lean construction and Business Process Re-engineering(BPR).

Implementation of all these approaches has proved challenging and many organisations reach initiative overload and fatigue, with little evidence of improvement.

The authors have conducted process improvement case studies in real life settings for over five years. The paper reviews the assessment approach and reveals four key lessons, which have emerged as a result of these case studies.

A key message is that process improvement initiatives should shift focus from methodologies to the creation of organisational learning infrastructures. These infrastructures allow linking organisational strategy to operational capability, through the creation of a dialogue among all the levels of the organisation hierarchy. The emphasis shifts from the implementation of an improvement methodology to the formation of appropriate organisational learning processes and cycles.

INTRODUCTION

Traditionally the construction industry approaches its work from a functional point of view and functional project structures. In this type of structure, each discipline involved in a project carries out its own activities without much thought for how it fits into the activities of other disciplines. There can be a communication wall between the various professions and organisations on the project, and an adversarial culture predominates. In this type of structure, the focus on the customer becomes clouded, and many issues related to the life cycle of the building are undermined.

In order to improve productivity, the construction industry has set itself the target of moving away from functional thinking and towards the production-based philosophy found in manufacturing industry. Most people agree that improvements in construction processes are a means to achieving this goal. This is emphasised by the Egan (1998, 2002), George (1996), and Latham (1994) reports.

In response to this need organisations have started implementing various process improvement initiatives, some which are top down influencing the whole organisation, and some which are bottom up, responding to local and more detailed process needs. Some of the most more prominent approaches in current use include EFQM (European Foundation for Quality Management), lean construction approaches and Business Process Re-engineering (BPR).

---

[1] Marjan Sarshar is an Associate Dean at the Faculty of Built Environment, Univ of West of England, Frenchay Campus, Coldharbour Lane, Bristol, BS16 1QY, UK Tel- (00) 44 (0) 117 344 3093, Email- Marjan.Sarshar@uwe.ac.uk

[2] Richard Haigh is a Research Fellow at the School of Construction & Property Management, University of Salford, The Crescent, Salford, M5 4WT, UK. Tel- (00) 44 (0) 161 295 4600, Email- R.Haigh@pgr.Salford.ac.uk

The author also proposed an alternative framework for process improvement, which is titled SPICE (Sarshar 2000). SPICE is based on five levels of sequential improvement, focusing on a small number of key processes at each level.

Despite major emphasis on development and implementation of these methodologies in construction organisations, real life evidence of significant results and improvements remains scarce.

This paper reviews the results of the process improvement case studies during the SPICE research. Through these studies it became increasingly evident that improvements in organisational infrastructures takes precedence over the shape and form of the process improvement methodology. Improvement processes, which are solely driven by the views of senior managers have limited impact on an organisation. The paper emphasises the need for the creation of organisational learning infrastructures, which provide continuous feedback loops between staff and management.

PROCESS IMPROVEMENT METHODOLOGIES

In the past two decades many process improvement methodologies have been proposed and adopted by the construction industry. This paper briefly reviews three key approaches, which have had following both among the industrial and academic communities. These include EFQM, lean construction approaches and BPR.

EFQM

The EFQM model is a non-prescriptive framework that recognises there are many approaches to achieving sustainable excellence. The model is based on the premise that customer satisfaction, people (employee) satisfaction and impact on society are achieved through leadership driving policy and strategy, people management, resources and processes, leading ultimately to excellence in business results (Shergold and Reed, 1996). In essence, the EFQM model subscribes to Deming's continuous improvement philosophy of "plan-do-check-act". Moreover, the process is driven by self-assessment, which Porter and Tanner (1996) maintain is not only a means for measuring continuous improvement, but also an excellent opportunity to integrate total quality management into normal organisational operations.

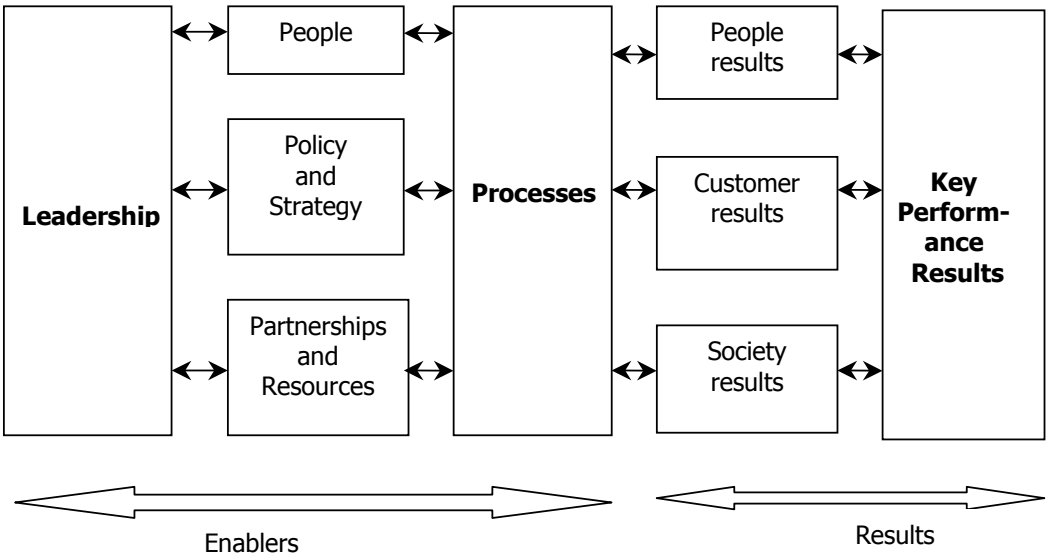


Figure 1: The EFQM model for business excellence (EFQM,1999)

The EFQM model is based on the nine criteria, of which five are enablers (how things are done in the organisation) and four are results (what is achieved by the enablers). The belief is that "excellent results with respect to performance, customers, people and society are achieved through leadership driving policy and strategy, people, partnerships and resources, and processes" (EFQM, 1999). A diagrammatic presentation of the model is shown in Figure 1.

EFQM Implementation -EFQM is often implemented through a *self-appraisal* process. It requires an organisation to consider and assess each of the nine elements of the model, as shown in figure 1. Within the enabler criteria, assessment addresses the excellence of the approaches used and the extent of the deployment of these approaches, both vertically throughout all levels of the organisation and horizontally to all areas and activities within the organisation (Shergold and Reed, 1996). The output of this process identifies strengths and areas for improvement (together with a score). The organisation then chooses improvement actions to exploit its strengths and overcome its weaknesses.

Due to time and resource restrictions, the *self-appraisal* is often conducted via questionnaires to *management* alone. The results provide the basis for identifying gaps and prioritising solutions.

Lean Construction Approaches

Lean construction approaches in construction are influenced by successful production management principles in the manufacturing sector (Koskela, 2000; Santos, 1999). From this operations management perspective, processes are analysed through a more detailed approach, considering what happens throughout the development of work. Processes are mapped and analysed in detail and redesigned in order to reduce: (i) the process cycle time; (ii) variability and value loss; or (iii) increase transparency.

Koskela (2000) suggests that processes are composed of transformations, flows and value generation. Process issues can be understood, analysed and therefore improved in a manner more familiar to production management. Within a conversion or transformation concept of production, the process receives inputs and transforms them into exports to the environment or to the next process. The output value can then be compared to the input value. In contrast, according to the flow model, production is a flow constituted of processing, waiting, inspecting and transporting activities. Within this model, processing activities are the only ones that actually add value to the customer, and therefore, waiting, inspecting and transporting are considered non-value-adding activities.Finally, by looking at process as a value generating concept, the emphasis is on systematic analysis of customer wishes and transformation into product or service specifications.

Hence, the definition of value is critical, and should affect all aspects of the production system. Customers' perception of value should be one of the main inputs to define production management strategies. Although these are three distinct concepts, it is not necessary to look at them in isolation. Santos (1999) emphasises that these are complementary parts of a coherent whole.

Lean Construction Implementation -The issues being addressed in production management tend to be specific and detailed, and are consequently unsuitable for addressing directly through high-level processes maps. Santos (1999) highlights the need for stability to allow for accurate analysis. Furthermore, processes need to be analysed while the process develops. This means that projects should be developed through similar processes, thus permitting the type of detailed analysis and continuous improvement proposed within the production management research to occur.

Lean construction approaches are often implemented by middle management, with input from staff. Successful results can demonstrate productivity improvements, in the local areas under analysis.

BPR
The literature on process improvement in construction is heavily influenced by the concept of business process re-engineering (Green, 1998). BPR is aimed at the fundamental rethink and radical redesign of business processes to realise dramatic improvements in performance. The word fundamental is significant; it implies that there are no assumptions, so the organisation must return to basic questions about the processes that add value to the product or service. This is based on the assertion that continuous improvement will not convey the major breakthrough that companies need to remain competitive in a global marketplace (Hammer, 1990).

Indeed, incremental change processes with the aim of gradual improvement are explicitly rejected because they are inadequate for achieving the aims of BPR, in that BPR's focus is radical change. Consequently, organisations are encouraged to completely restructure their operations to meet current requirements.

Hammer and Champy (Hammer and Champy, 1993) in the original *'Reengineering the Corporation'* presented a business system diamond model, which indicates the changes that occur when a company re-engineers their business processes. There are four points of interaction. The first is related to business processes, and the second is concerned with the structure of the jobs and the people needed to fill them. The third refers to the role of managers, the working relationships and the measurements systems; the fourth point is related with employees' values and beliefs. Consequently, re-engineering affects all aspects of the company. The literature describes dramatic success stories, such as IBM Credit reducing the time to give a quote for leasing equipment from seven days to one (Hammer and Champy, 2001).

BPR Implementation – While business process reengineering has become an often-suggested solution for achieving sustainable business competitiveness, many attempts have proven unsuccessful. Some empirical studies indicate that although BPR has led to dramatic improvements in time, cost and quality, the results for an entire business unit or company are often disappointing. Failure rates in excess of 70% are widely reported (Doherty and Mistry, 1996; Hall et al., 1993; Hammer and Champy, 2001).

BPR is a major strategic initiative. Hammer and Champy (1993) offer some implementation guidelines. Similar to most strategic initiatives, BPR is driven from the very top of an organisation. Lower levels of management become increasingly involved in detailed mapping the redesigned processes. They normally plan the operational aspects of change. Staff are expected to put the changes into practice.

CASE STUDIES IN CONSTRUCTION PROCESS IMPROVEMENT

The authors have researched construction process improvement for over five years, during the SPICE project. A number of case studies have been performed. This paper aims to summarise some key findings.

The case studies were performed using the SPICE process improvement framework (Sarshar 2000 (a)(b)). The paper briefly explains the model though this is not the focus of this paper. Rather the focus is on implementation issues of process improvement. Therefore the SPICE assessment process is explored in more detail, as it provides the basis for much of the findings.

The SPICE Framework

SPICE was a research project looking to developing a evolutionary step-wise process improvement framework for the construction industry (Sarshar 2000, Finnemore 200). The framework was developed utilising experience from the IT sector, which has adopted a similar approach. Successful implementers had reported productivity gains, improvements in quality, reduced defects and a significant return on investment. The research specifically drew on the use of the Capability Maturity Model (CMM) (Paulk 95).

The SPICE framework is based on five levels of organisational process maturity. Each level comprises a set of key processes that, when satisfied, stabilise an important part of the construction process. Each level lays successive foundations for the next. The model states that little value is added to the organisation by addressing issues at a higher level if all the key processes at the current level have not be satisfied. With the model, effective and continuous improvement can be achieved based on evolutionary steps.

Level 1 of SPICE characterises organisations, which do not have a process focus. Level 1 organisations focus on achieving Level 2 key processes. These ensure the establishment of good project management practices. The key processes at Level 2 include: Brief and Scope of Work Management; Project Planning; Project Tracking and Monitoring; Subcontract Management; Project Change Management; Health and Safety Management; Risk Management; Project Team Co-ordination.

Each key process is characterised by five generic process enablers, namely: commitment, ability, verification, evaluation and activities. The definition of these is explained in Sarshar (2000(a)(b)). The process enablers ensure that each process is implemented effectively and is stabilised in an organisation.

The SPICE Assessment Process

The SPICE assessment reviews the performance of each key process against the process enablers. A key aspect of the SPICE assessment is that it engages the vertical organisation, including the senior managers, middle managers and staff, as shown in figure 2.

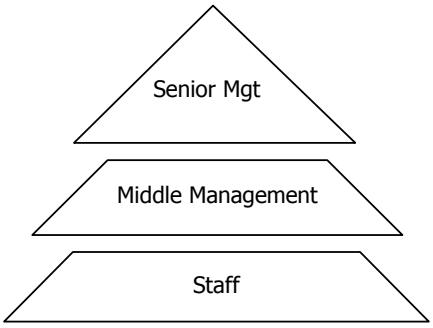


Fig 2- Levels of organisational management

A full assessment follows four-stages, as shown in figure 3. These include preparation, assessment, findings, and improvement planning.

- Preparation – During this stage the necessary support is obtained from senior management for the assessment to proceed.

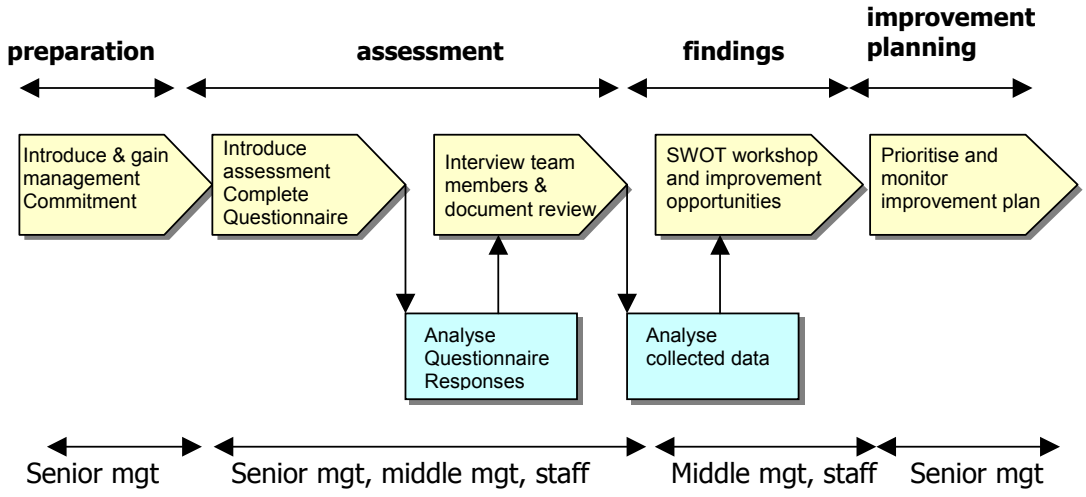


Fig 3- The assessment process, and the level of organisational management involvement.

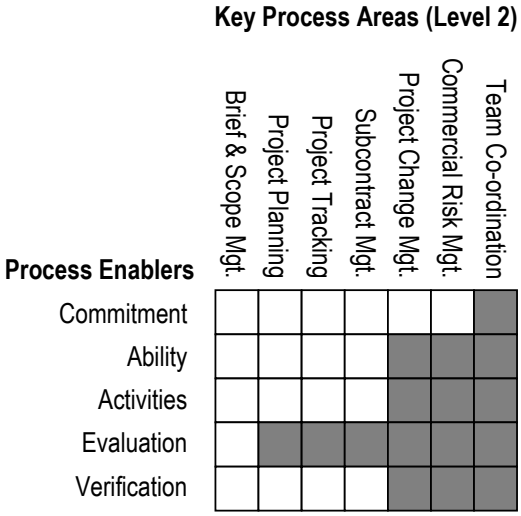
The objectives and plans for the assessment are developed with the senior management.
Once the commitment to the assessment has been gained, the organisational scope of the assessment is decided. An appraised entity may be any portion of an organisation, for example: An entire company, a selected business unit, a specific project etc.

- Assessment – information about the project and organisation are collected via questionnaires, interviews, workshops, document reviews, and any other means necessary.

The assessment engages all the levels of the organisational hierarchy. It begins with senior management interviews, and continues with interviews and questionnaires directed at middle management and staff.

- Findings – data is collated from the assessment phase and findings determined. The findings are presented in the form of a SWOT report and are summarised in a matrix, as shown in figure 4, which highlights strengths and weaknesses.

Fig 4- Example of an assessment matrix.



The SWOT analysis is presented in a workshop to the staff in order to reach a consensus on the results. During the workshop staff suggest necessary improvements. These improvement opportunities are recorded.

- Improvement planning – The SWOT analysis and improvements opportunities are presented to senior management. They prioritise the improvements and provide a support infrastructure to initiate the improvement efforts.

To ensure continuity and confirm that the improvement initiatives have been successful, this process can be repeated in a periodic fashion. The follow up assessments are normally a shorter process. Fact-finding (the "assessment" stage) is frequently via workshops, rather than lengthy interviews and questionnaires.

The Case Studies

During a five-year period the SPICE assessment was repeated in a number of organisations. In particular the case studies included the following:

- A large firm of contractors offered two studies. One was a large PFI hospital, the second a medium sized refurbishment project.
- A large client organisation offered two case studies, on different sites. These were both long-term partnering arrangements on civil projects.
- Another large contractor offered three case studies, on a civil engineering contract for a county. The first study was a full assessment, followed by two follow up assessments for the same organisation unit, on annual basis.
- Estates Divisions of two different hospitals offered two case studies.

LESSONS LEARNED

Despite the varying natures of the case studies, and different organisational contexts, four lessons have emerged:

Lesson 1- Senior mgt frequently have a visibility gap- The assessment process has allowed the researchers to compare the views of different levels of the management hierarchy. In his thesis, Haigh (2003) undertook statistical analysis of the views of senior

management in three major case studies. In all studies the senior management had a skewed view of the organisation. They consistently had a more positive perception of the processes, than the reality.

Senior management are often not aware of the difficulties in operational processes. Sarshar (2001) reports the view of one senior manager in a hospital: “The size of our operations at the Trust (hospital) makes it difficult for our senior management team to understand the problems faced by our operational staff”.

This is an important finding, as it implies that improvement initiatives, which are primarily based on views of senior managers fail to address many operational process issues.

Lesson 2- Good organisations have a shared view of the organisation- There were two organisations, which particularly scored high on the SPICE assessments. The cells in the summary results matrix (figure 4) of these organisations were almost totally white, thereby achieving all the process capabilities required by SPICE.

A common factor in both these organisations, was that the views of the senior management and staff on their process capabilities were strongly aligned.

The implication of these first two lessons leads us to our third lesson.

Lesson 3- Improvement initiatives should focus on creating a dialogue between the levels of the organisational hierarchy- Many organisations focus on selecting the “right” improvement methodology. They then focus on selecting a low cost implementation mechanism. In this process the views of the staff are often neglected. This shadows the success of the improvement initiative.

BPR is a strategic initiative, which by nature is senior management driven. It is increasingly becoming evident that such strategic approaches have major implementation challenges. A study of 275 portfolio managers reported that the ability to execute strategy was more important than the quality of the strategy itself (Ernest & Young 98). These managers cited strategy implementation as the most important factor shaping management and corporate valuation. More evidently, a survey of prominent CEO failures concluded that the initially the CEOs believed that the emphasis placed on strategy was all that was needed to succeed. However, “In majority of cases- we believe 70%- the real problem isn’t [bad strategy but] …bad execution” (Charan 99).

During EFQM implementation, organisations often focus on the model. To cut costs during implementation, the implementation often consists of managers self-assessing their own operations, via a questionnaire. Needless to say many organisations achieve high scores in this self-assessment. Nevertheless, the industry wide process challenges are still to be resolved.

Lean construction approaches normally include views from middle management and staff. They re-design local processes based on discussions between staff and middle managers. However, because the strategic view of senior management is often absent the improvement results remain local.

The focus of improvement initiatives should shift to creating organisational infrastructures, which allow continuous two-way communication and learning between senior management, middle management and staff. A key question is then “how can an organisation create such learning infrastructures”?

Though the authors do not have the whole answer, lesson four includes a recommendation for one way forward.

Lesson 4- Organisational assessments can provide an organisation learning infrastructure, for continuous process improvement- Initially the purpose of the SPICE assessment process was fact finding. The process was conducted to accurately evaluate the

process capability of an organisation unit. However, during the case studies it became increasingly apparent that the main value of this assessment was the creation of a strong communication infrastructure between senior management, middle management and staff.

The process allowed senior management to:
- Prioritise improvements based on strategy;
- Reduce their visibility gap into the organisational performance; and
- Check how well the organisational strategy has been communicated to staff.

The benefits for staff were that:
- They had a channel to voice their concerns about operational practices.
- Improvement priorities were selected based on these concerns.
- Periodic re-assessments could confirm if the improvements had occurred.

The assessment process created a shared consensus on process challenges and priorities throughout the organisation.

The final lesson is therefore that organisations can use an assessment process, which creates a dialogue among all the levels of organisational hierarchy as an infrastructure to encourage organisational learning.

SUMMARY AND CONCLUSION

This paper emphasised the need for construction process improvement. Three mainstream improvement methodologies were examined, namely EFQM, lean construction and BPR. A further framework, which was developed during the SPICE research project, was also briefly introduced.

During the SPICE project many case studies on real construction organisations were conducted. The paper focuses on four lessons learnt during these case studies, i.e.:
1- Senior management frequently have a visibility gap into operational practices and challenges.
2- Good organisations have a shared view of the organisational challenges and strategies, among the levels of organisational hierarchy.
3- Improvement initiatives should focus on creating a dialogue between the levels of the organisational hierarchy.
4- An organisational assessment, which includes dialogue between senior management, middle management and staff, can provide an organisation learning infrastructure for continuous process improvement.

A key message is that process improvement initiatives should shift focus from methodology selection to the implementation process of a methodology. Often the organisational assessment process is viewed as a mere fact finding process. Many organisations aim to cut costs in this fact-finding activity. The assessment process should be viewed as a learning infrastructure continuously increasing the understanding between the levels of the organisational hierarchy.

REFERENCES

Charan, R. and Colvin, G. (1999), Why CEO's Fail, Fortune, 21 June 1999.

Doherty, N. and Mistry, A. (1996) The application of business process re-engineering in the United Kingdom: an empirical analysis. European Academic Conference on Business Process Re-engineering, Cranfield

EFQM (1999), [on-line serial], Web: http://www.efqm.org/imodel/modelintro.htm

Egan, J. (1998) Rethinking Construction. London, H.M.S.O.

Egan, J. (2002) Accelerating Change. London, Strategic Forum for Construction

Ernst & Young (1998), Measures That Matter, Boston 1998, 9.

Finnemore, M., Sarshar, M., Haigh, R., Goulding, J., Barrett, P., Aouad, G., Can Process Capability Be Used to Manage the Construction Supply Chain?, International Journal of Construction Procurement, Vol 6, No 2, November 2000.

George, B. (1996) A Statement on the Construction Industry. Royal Academy of Engineering.

Green, S. (1998) The technocratic totalitarianism of construction process improvement: a critical perspective. Engineering, Construction and Architectural Management, vol. 5, no. 4, pp. 376-386

Haigh, R., (2003) Using Process Capability Assessments within Construction Project Teams to Facilitate Continuous Process Improvement, PhD Thesis, Univ of Salford, UK.

Hall, G., Rosenthal, J. and Wade, J. (1993) How to make re-engineering really work. Harvard Business Review, vol. Nov-Dec, pp. 119-131.

Hammer, M. and Champy, J. (1993) Reengineering the Corporation: A Manifesto for Business Revolution. HarperBusiness.

Hammer, M. and Champy, J. (2001) Reengineering the Corporation: A Manifesto for Business Revolution. 2nd ed, London, Nicholas Brealey Publishing.

Hammer, M. (1990) Re-engineering work; don't automate, obliterate. Harvard Business Review, vol. Jul-Aug, pp. 104-110.

Hammer, M. (2001) The Agenda. London, Random House Business Books.

Koskela, L. (2000) An exploration towards a production theory and its application in the construction sector. Ph.D. thesis, VTT, Finland.

Latham, M. (1994) Constructing the team : joint review of procurement and contractual arrangements in the United Kingdom construction industry : final report. London, HMSO.

Paulk, M., Weber, C., Curtis, B. and Chrissis, M. (1995) The capability maturity model: guidelines for improving the software process. Reading, MA, Addison-Wesley.

Porter, L. and Tanner, S.J. (1996), Assessing Business Excellence: A guide to self assessment, Butterworth-Heineman

Santos, A. (1999) Application of flow principles in the production management of construction sites. Ph.D. thesis, University of Salford.

Sarshar, M., Haigh, R., Finnemore, M., Aouad, G., Barrett,P., Baldry,P., Sexton, M., SPICE: A Business Process Diagnostics Tool for Construction Projects, Engineering, Construction & Architectural Management, Issue 3, September 2000.

Sarshar, M., Haigh, R. and Finnemore, M. (2000) Construct IT: Introduction to SPICE. Salford, University of Salford.

Sarshar, M., Haigh, R. and Amaratunga, M. (2001) Construct IT: SPICE FM: A Step by Step Organisational Development Framework for FM Organisations. Salford, University of Salford.

Shergold, K. & Reed, D.M. (1996), Striving for excellence: how self-assessment using the business excellence model can result in step improvements in all areas of business activities, The TQM Magazine, Vol. 8, No.6, pp. 48-52.