A FRAMEWORK FOR MEASURING CONSTRUCTION PROJECT PERFORMANCE: OVERCOMING KEY CHALLENGES OF PERFORMANCE MEASUREMENT

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Performance in the construction project context, and the need for its measurement are examined in this review of literature. It is shown that despite the inherent benefits of performance measurement in helping identify unnecessary causes of waste so that remedial actions can be taken, performance measurement is not extensively implemented because of the inadequacy of measures, complexity of measurement, time consuming and costly nature of performance measurement, and project-oriented nature of the industry. Where performance measurement is implemented, various frameworks are available, some targeting project performance whilst others focus on overall business performance. The criteria for these various frameworks are contrasted and assessed in terms of their suitability for on-going research into the impact of organisational culture on construction project performance. Following this assessment, the key requirements of suitable performance measures and measurement frameworks are identified as including, having a few but relevant measures, being linked with critical project objectives, providing accurate information, and comprising financial and non-financial measures. It is argued that a 'one-fits-all' approach in performance measurement is non-existent, and that measures chosen must align with the purpose of the measurement – in this case, the need to investigate the impact of organisational culture. On the basis of these arguments, an approach for identifying performance measures in this research is proposed.

Keywords: construction project performance, organisational culture, performance measurement, performance measures, performance measurement frameworks.

INTRODUCTION

In the UK, construction project performance is generally perceived as being poor (Egan, 1998), although to a certain extent, this perception is based on anecdotal evidence. This situation necessitates performance measurement, which is supposed to help organisations assess not just how well they have done retrospectively, but more importantly how well they are currently doing (and will be doing prospectively) so that through benchmarking, they can identify areas in which they are under-performing and take remedial action. Unfortunately, beyond academic and industry-sponsored research, performance measurement has not taken root at the organisational level in the construction industry (Cain, 2004). In this examination of performance measurement, factors hampering and accounting for the lack of performance measurement are explored. The key requirements of an effective performance measurement framework are also examined with particular emphasis on construction projects, and various performance measurement frameworks are assessed. This

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assessment focuses particularly on the lessons that can be applied to the measurement of performance in an on-going research into the impact of organisational culture on construction project performance. Based on the findings of this review, a proposal is put forward for the development of a framework that will be employed in the on-going research.

PERFORMANCE

Performance can be considered as an evaluation of how well individuals, group of individuals, organisations or systems have done in pursuit of a specific objective. These objectives vary significantly, but from an organisational perspective, they generally revolve around satisfying the key stakeholders, notably customers, employees, shareholders, the various suppliers, government and society as a whole. Mullins (2005) described performance as relating to such factors as increasing profitability, improved service delivery or obtaining the best results in important areas of organisational activities.

Performance in the construction context may be approached from two perspectives; the first relating to the business performance of organisations and the second relating to project performance. The former is normally assessed using financial results and ratios, and productivity figures (Mbugua, 2000). Other more comprehensive self-assessment tools such as the balanced scorecard (Kaplan and Norton, 1992), pyramid of measures (Lynch and Cross, 1995) and the business performance measurement framework (Mbugua, 2000) are also available for use in assessing the business performance of construction organisations. In many cases, references to performance and research in this genre have been focused on project performance (e.g. Soetanto *et al.*, 2001; Xiao and Proverbs, 2003). Primarily, this can be linked to the characteristics of the industry whereby each project can represents a major part of a contractor's annual turnover, and can be the ultimate determinant of a construction organisation's business performance. References to performance in this review therefore generally relate to project performance, and to the extent to which performance measures are met.

Measuring Performance

Amaratunga and Baldry (2002), in a review of the subject of performance measurement, suggested that it was a topic which was often discussed but rarely defined. In that review, performance measurement was projected as the process of ensuring that an organisation pursued strategies that led to the achievement of overall goals and objectives. More appropriately it has been defined as the process of quantifying the efficiency and effectiveness of an action taken (Neely *et al*., 1997), for instance by an organisation.

It has also been defined simply as the systematic assignment of numbers to entities or activities and the recording of business activity to provide a stimulus for action that would facilitate continuous improvement (Zairi, 1992). In a construction project context, it is regarded as a systematic way of judging project performance by evaluating the inputs, outputs and final project outcomes (Takim *et al*., 2003).

Measurement is important because it is a means of generating data that could find useful application in a wide variety of problems and situations. Its purpose is to provide timely and accurate feedback on the efficiency and effectiveness of operations and to focus attention on continuous improvement (Amaratunga and Baldry, 2002). Through this function, it acts as a key factor in supporting and ensuring the successful

implementation of an organisation's strategy (Fiztgerald *et al*., 1991 in Amaratunga and Baldry, 2002; Costa and Formoso, 2004). According to Zairi (1992) and Kaplan and Norton (1996) "if you can't measure it, you can't manage it." It provides necessary information for process control, and also enables an organisation to establish challenging but feasible goals (Costa and Formoso, 2004).

With regards to the business of construction, Cain (2004) argued that the only way that prices could be seriously reduced, profit margins seriously raised and the out-turn costs kept within budget, is by the elimination of unnecessary costs caused by the ineffective and inefficient utilisation of labour and materials. These unnecessary costs can however only be eliminated if their causes can be located, and performance measurement provides the means by which these unnecessary causes of waste can be identified so that the organisation knows where to focus its efforts (Cain, 2004).

Quite clearly, it is a critical means to the end of achieving continuous performance improvement in construction project delivery. It may be a "complex, frustrating, difficult, challenging,…abused and misused" process (Sink, 1991 in Zairi, 1992), but as appropriately pointed out by Cain (2004), "if you don't know how well you are doing, how do you know you are doing well?"

Performance measurement in construction

According to Costa and Formoso (2004), managers in Brazilian construction firms still make decisions mostly based on intuition, common sense, experience, and a few broad financial measures that are inadequate in today's competitive environment. Although Brazil may not be representative of the general situation, anecdotal evidence suggests that to some extent, strategy is formulated in a similar fashion even in countries such as the UK where there has been strong advocacy for performance measurement (Egan, 1998; Cain, 2004).

Costa and Formoso (2004) reported a growing awareness among construction firms of the importance of measurement systems for monitoring and controlling their performance. Unfortunately, this realisation has not been well established and as a result, performance measurement is still not widely implemented in the construction industry (Takim *et al*., 2003; Costa and Formoso, 2004).

This situation has been attributed to the inadequacy of measures with construction companies claiming to have difficulties in identifying and selecting adequate performance measures related to their strategies and critical processes (Costa and Formoso, 2004). It has also been due to the fact that industry practitioners consider comprehensive measurement too complex and time consuming, and that the benefits accruing from these measurements would not necessarily offset the cost of undertaking them (Cain, 2004).

To some extent, another drawback to effective performance measurement has been the project-oriented nature of the industry (Costa and Formoso, 2004). It is argued that the generally utilised approaches based on the business performance and measures of profitability do not meet the specific needs and strategies of a project-based industry like construction. Other views expressed in industry have been to the effect that "efficiency levels were universally high across the industry," (Cain, 2004) implying that measurement is unnecessary. This perspective is paradoxical, considering the myriad of government and industry sponsored reports published on the construction industry since Simon (1944), all bemoaning the under-achievement of an industry, which is believed could be world-beating at its best (Egan, 1998). A further reason put

forward by Cain (2004) for the lack of implementation of performance measurement was to the effect that the construction industry was unwilling to reveal the truth to itself by measuring its performance, finding it more convenient to bury its head in the sand like an ostrich.

Despite this situation, it should be said that some amount of performance measurement is undertaken, and traditionally within the construction industry, performance has been measured in terms of cost, time and quality (Xiao and Proverbs, 2003) as shown in figure 1. This has mainly been due to the fact that these indicators of performance provide 'hard' and relatively easy-to-collect data. Another important reason is that construction products tend to be investment goods with great potential to appreciate in value (Harvey and Ashworth, 1997), hence the strong emphasis by construction clients on cost, time and quality.

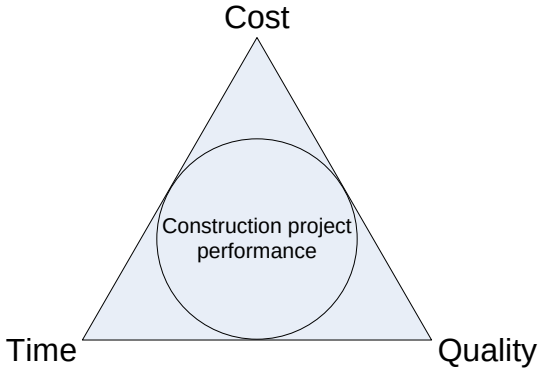

Figure 1 The 'iron triangle' of construction project performance measurement

Other 'hard' indicators that are also employed in measuring performance include labour turnover, accident rates, and productivity (Costa and Formoso, 2004). In the construction industry, labour productivity dominates such measures of productivity (Olomolaiye *et al*., 1998).

More recently, the inception of such initiatives as the Construction Best Practice Programme (CBPP), the need to comply with Quality Management Systems (QMS) based for instance on ISO 9001, the inadequate support for decision-making using such measures as productivity rates, and the need for benchmarking (Costa and Formoso, 2004) have led to the development of improved frameworks for performance measurement.

Besides the traditional reliance on the measures of cost, time and quality, these other frameworks have extended measures to include client satisfaction measures encompassing 'softer' aspects of satisfaction, which have increasingly been found to be rather significant. An examination of some client satisfaction literature provides evidence of this shifting paradigm (see Table 1). Some measurement frameworks have even synthesised some of these 'softer' indicators into measures such as "trust/confidence in contractors' ability" and a "willingness to use the same contractors again" (CCF/CBPP, 1998/99; CIB, 1999).

Apart from the client satisfaction criteria, greater attention is also being paid to such issues as environmental impacts, health and safety, investment in research and development and personnel training (commitment to continuous improvement), as well as the sustained profitability of the organisations in the supply chain and the nature of relationships with the other members of the supply chain (Xiao, 2002; Xiao and Proverbs, 2003). This reflects the changing objectives and philosophy of the

construction industry at large and shows the growing awareness of the importance of the other stakeholders to the value chain.

Table 1 Evolution of client satisfaction/project performance criteria

Harvey and Ashworth (1997)	**Hatush and Skitmore (1997)**	**Chinyio *et al.* (1998)**	**Soetanto *et al.* (2002)**	**Maloney (2002)**
Client requirements: Quality Costs Time	Predominant project success factors: Time Cost Quality	Performance criteria: Economy Function Safety Quality Time Cost-in-use Flexibility	"Hard" measures: Cost Time Quality "Soft" measures: Honesty Spirit of cooperation Contractor attitude Site management Resource management Quality of service	The physical product: Cost Time Quality Quality of service: Access Communication Competence Courtesy Credibility Reliability Responsiveness Security Understanding customer

An examination of some of the current performance measurement frameworks used in the industry provides evidence of the application of this complex mix of criteria. Table 2 summarizes the key features and characteristics of some of the performance measurement frameworks developed for the construction industry, and contrasts the various criteria used in these frameworks. The frameworks include both those currently employed in industry and those developed and employed in academia for research purposes. The latter are also relevant because they provide useful insights which inform the development of the more practical industry-oriented frameworks. In either case, the end objective is the same – the assessment of performance.

Besides those shown in table 2, there are other frameworks in use in various other parts of the world including the AHP (Saudi Arabia), CDT (Chile), Blueprint (USA), CV (Hong Kong) and IPI (India). These are reviewed in greater detail in Takim *et al*. (2003) and Ahadzie *et al*. (2005).

APPLICABILITY OF THE VARIOUS FRAMEWORKS IN CONSTRUTION MANAGEMENT RESEARCH

Researchers seeking to measure performance may choose to adopt any of these frameworks. However, it is important to realise that as shown in table 2, each particular framework has its limitations and has been developed within specific contexts and targeted towards a specific audience with the intention of achieving specific end results such as benchmarking (CIIBM, 2004; Xiao 2002; Costa *et al.*, 2004) and charting industry performance from a client perspective (CCF/CBPP, 1998/99; CIB, 1999). The multiplicity of these performance measurement frameworks and measures implies that a 'one-fits-all' approach to the measurement of performance is unlikely to be appropriate or even exist. It may therefore be necessary to develop a measurement framework that aligns measures with the purpose of the research being undertaken, and is appropriate for the context. As indicated by Mbugua (2000), "measures are nothing; but measurement is everything." This implies that measures used in particular frameworks are dynamic and it is up to the researcher or industry practitioner seeking to measure performance to refine the criteria appropriately. What matters, is the measurement itself, and the methodology that is applied.

Table 2 A comparison of the various frameworks for measuring construction industry performance

	KPIs [DTI, 2004][2]	CCF/CBPP 1998/99	CIB (1999)	Mbugua (2000)	Soetanto *et al.* (2002)	Xiao (2002)	QLASSIC CIBD, 2001	CALIBRE (2000)	SISIND (Costa *et al.*, 2004)	CIIBM (2004)
Criteria	Construction cost Construction time Predictability – cost – time Client satisfaction – product – service Defects Profitability Productivity Safety	Ability to keep to price quoted Ability to keep to time Build/quality of end results Resolution of any defects Trust/overall confidence in ability of contractor Overall performance	Ability to keep to price quoted Ability to keep to time Build/quality of end results Resolution of any defects Trust/overall confidence in ability of contractor	Cost control Timeliness Quality Customer satisfaction Employee satisfaction Business partner performance Project manager Soft/intangible assets Hard/tangible assets Leadership Growth Cash Profit Safety and the environment Innovation	Time Cost Quality Attitude of contractor /client/ architect etc. Quality of service Site and resource management Criteria at pre-construction stage Criteria at completion stage	Construction cost Cost certainty Construction time Time certainty Functional quality Quality of service post-completion Harmonious relationship Profitability R & D investment and training Environment friendliness Safety record	Structural works – quality of workmanship – quality of materials Architectural works – finishes and fittings External works	Productivity Time wastage Environmental impacts Energy consumption CO_2 emissions Material wastage Programme predictability Work methods Health & safety	Cost Time Plan Client satisfaction & product quality Sales Supply Safety Health & environment Quality management systems People	Cost Schedule Project changes Work hours & accident data Project environment impacts Front end planning Design Procurement Construction Start-up & commissioning Organisation Processes Controls AI technology
Target	All participants Project & Business performance	Client Project performance	Client Project performance	Contractor Business performance	All participant Project performance	Contractor Project & Business performance	Contractor Project performance	Contractor Project performance	Contractor Project & Business performance	Contractor & client Project performance
Where used	Industry (UK)	Industry (UK)	Industry (UK)	Research (UK)	Research (UK)	Research (UK)	Industry (Malaysia)	Industry (UK)	Industry (Brazil)	Industry (USA)
Strengths	Reasonable number of measures	Few measures	Few measures	Synthesises several existing BPM[3] frameworks	Considers participant perspective	Few measures	Easy to implement	Real-time and objective	Some leading measures	Some leading measures
Weaknesses	Mainly retrospective measures	Retrospective	Retrospective	Retrospective Several measures Cannot be applied in a project context	Retrospective	Retrospective	Retrospective Measures only structural, architectural and external works	Provides information only on specific site activities	Several measures	Several measures
Other features	The 10 criteria identified above represent headline project KPIs. The CBPP has also developed specific KPIs for people, the environment, housing, as well as the various sectors.	Developed from a client perspective as part of an annual assessment framework to chart performance improvements being made by the industry	Same as the CCF/CBPP (1998/99) framework.	Construction-specific framework for measuring business performance of construction firms. Proposed as an alternative to existing generic frameworks like Balanced Scorecard, MBNQA, ISO9000, etc.	A framework developed for assessing the performance of a member of the project organisation e.g. contractor from the perspective of other members e.g. client & architect.	Provides the basis for comparison of the prospective performance of contractors from different countries.	5 objectives are to evaluate the quality of workmanship, to comply with approved standards and specifications, to compare quality between projects, and to estimate the productivity level of the project.	Based on activity sampling. Software tool that provides a complete digital record of project and as-built plans.	Benchmarking initiative. Still under development.	Benchmarks performance Project phases considered in this framework.

[2] Key Performance Indicators proposed by the Construction Best Practice Programme (CBPP) following Egan (1998)
[3] Business Performance Measurement (BPM) frameworks such as the balanced scorecard (Kaplan and Norton, 1992)

Other key requirements for performance measurement

Besides the need to align measures with the purpose of the measurement, performance measurement undertaken must meet four basic criteria in terms of what it enables the assessor to achieve. Essentially, performance measurement must enable the assessor to check the position of an organisation, communicate this position, confirm priorities and compel progress (Neely, 1998 in Amaratunga and Baldry, 2002).

To fulfil these functions, performance measurement frameworks and their associated measures must have certain characteristics, some of which are pointed out by sources such as Amaratunga and Baldry (2002) and Neely *et al*. (1997). However in the context of this research, the relevant characteristics of performance measurement as noted from the various sources are that they must:

- be composed of both financial and non-financial performance measures (Amaratunga and Baldry, 2002);
- be intelligible to a majority of stakeholders (Amaratunga and Baldry, 2002);
- provide timely and accurate feedback (Neely, 1997; Neely *et al*., 1997);
- be based on a few but essential indicators (Ritter, 2003);
- provide visibility e.g. a 'score-board' (Zairi, 1992; Neely *et al*., 1997; Amaratunga and Baldry, 2002);
- concentrate on the core of activities/processes critical to the firm's strategy (Medori and Steeple, 2000);
- facilitate understanding of cause and effect relationships regarding performance (Amaratunga and Baldry, 2002);
- be founded on easy to collect data (Amaratunga and Baldry, 2002);
- be dynamic (Bititci and Turner, 2000); and
- allow performance to be compared against competitive benchmarks (Zairi, 1992; Amaratunga and Baldry, 2002).

The questions that then arise from these discussions are that; what is the purpose of the measurement in this research? and what few, easy-to-collect but essential indicators covering the activities that are core to both the organisation's strategy and this research, and composed of both financial and non-financial measures can be constituted into a framework that provides accurate information, is intelligible to a majority of stakeholders and allows for comparison with other benchmarks?

Answers to these questions hold the key to the development of an appropriate framework for assessing project performance in this research.

The on-going research

The purpose of this on-going research, which seeks to measure project performance, is to examine the organisational culture of construction project organisations (CPOs) by measuring their orientation along specific dimensions of organisational culture and to correlate these measures of culture with measures of project performance. Ultimately, the aim is to establish the extent to which organisational culture can be considered an important determinant of project performance, and which cultural orientations are amenable to good performance.

Some measures of performance may be more responsive to such cultural impacts than others. It can be argued here therefore that for this study, the existing frameworks may not be wholly appropriate. The approach for measuring performance of construction projects must be bespoke and must recognise that the focus is on the impact of organisational culture. However, there are useful measures and lessons to be drawn from these existing frameworks.

A proposed approach

In identifying the appropriate measures to be adopted in this research, the existing frameworks provide useful insights. Quite clearly, the corner stone of performance measurement are the 'iron triangle' measures of cost, time and quality (fig. 1). These criteria are a common feature of virtually all frameworks as seen in tables 1 and 2. Despite the inclusion of various other measures, and despite the fact that cost, time and quality may not always be an accurate reflection of performance since some projects may be justifiably over-budget or delayed (Tam and Harris, 1996), these three measures still represent the ultimate and most important measures of project performance (Chua *et al*., 1999; Xiao and Proverbs, 2003). It can thus be argued that these measures must be the bedrock of performance measurement in this research as well.

Going by Takim *et al*.'s (2003) proposition of assessing performance by evaluating the inputs, outputs and final project outcomes, and taking organisational culture as an input, it can be argued that the other measures of project performance to be applied in this research must be based on the outcomes which are the direct and indirect results of an input of organisational culture. An appropriate analogy is the evaluation of the 'performance' of food on the basis of taste when the interest is in an input such as salt. An outcome such as appearance or aroma will be most inappropriate in this case. Figure 2 summarises the approach that will be employed in choosing the other appropriate measures of performance in this research.

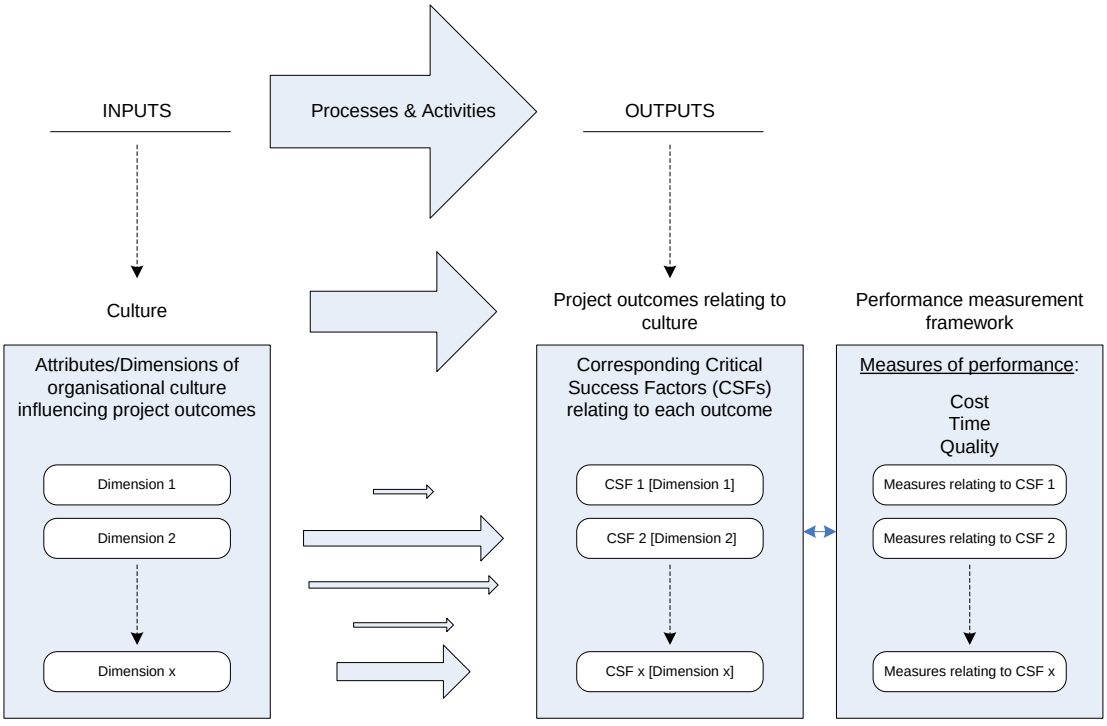

Figure 2 A proposed approach for choosing performance measures

This approach will also take account of the source of the measurement data (contractor/client/consultant/project manager), and the status of the project (on-going/completed). As seen in table 2, these factors also influence the measures chosen and the methodology applied. Measures identified this way will be constituted into a questionnaire instrument. This is consistent with the frameworks examined in table 2, all of which, with the possible exception of the CALIBRE instrument, utilise questionnaire survey instruments for measuring performance.

CONCLUSION

Performance within a construction project context may be regarded as how well the CPO has done in pursuit of project objectives, and performance measurement as the evaluation of the output and final project outcomes based on the inputs employed in the construction process. Quite clearly, it provides the means to identifying areas of unnecessary costs and inefficiency in the construction process so that through benchmarking and the implementation of change, improvements in processes, activities and final project outcomes can be achieved.

Various performance measures and measurement frameworks exist for this purpose, showing that a 'one-fits-all' approach to performance measurement is non-existent. It is therefore argued in this paper that the choice of measures and frameworks must be based on the motivation or purpose of the measurement. In this research which seeks to examine the extent to which the organisational culture of CPOs influences project performance, it is proposed that an appropriate approach will be to focus on those measures of performance which evaluate project outcomes associated with the dimensions of the CPO's culture. Other lessons drawn from the examination of the existing frameworks are that the 'iron triangle' measures of cost, time and quality are an essential part of any performance measuring framework, and questionnaire instruments provide reliable measures of performance. Furthermore, account must also be taken of the sources of data and status of projects to be assessed.

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