A CRITICAL REVIEW OF PMS IN CONSTRUCTION: TOWARDS A RESEARCH AGENDA

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Performance measurement system (PMS) is a fast evolving and diverse research field attracting many researchers and practitioners from the fields of strategy, accounting, operations, human resource, and marketing. The characteristics of the construction industry that influence the research and directions adopted in practice significantly contribute to certain weaknesses in application, such as limited focus on business performance measurement, insufficient organisational learning, and difficulty in linking the project PMS with the firm. The *aim* of this paper is to briefly review the literature of PMS (specifically at the corporate level) for addressing the knowledge gap and presenting a research agenda in the context of construction. The main findings from this review are: (1) the evolution of PMS in construction management literature is much slow; (2) further research should focus on the design and implementation related issues of PMS in construction; and (3) benchmarking is an integral part of PMS but it is insufficient for 'continuous improvement'. Finally, a research agenda is presented.

Keywords: performance measurement system, PMS, benchmarking, strategy, firm performance

INTRODUCTION

Performance measurement (PM) has gained significant interest among researchers and practitioners (Neely and Bourne 2000). Traditional financial measures have not met the multiple requirements of an increasingly competitive and turbulent marketplace (Kaplan and Norton 1992). Researchers express a general dissatisfaction with traditional backward looking PMSs (Bourne *et al.* 2000). The main weakness of traditional PM is the absence of non-financial measures, e.g., productivity, quality, and leadership (Neely 2005). This causes other problems, including failure to link PM and strategic initiatives of organisations, focusing on external reporting rather than internal decision making, and anticipating future performance. Therefore, traditional PMSs are insufficient and inappropriate (Neely *et al.* 1995). PM has given considerable attention to the introduction of the Balanced Scorecard (BSC) approach (Kaplan and Norton 1992), although other frameworks were designed earlier to decrease the gap between financial and nonfinancial measures, for example, the

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Performance Pyramid (Cross and Lynch 1988/89). Furthermore, researchers focused upon how PMS is successfully designed to satisfy specific requirements, implement firm strategy, and then gain competitive advantage through such a process (Bourne *et al.* 2000; Neely and Bourne 2000; Neely *et al.* 1995).

The PM revolution has spread to the construction industry (Bassioni *et al.* 2004), where most large construction engineering organisations have adopted PMS, and a growing number of organisations are adopting BSC and excellence models (Robinson *et al.* 2005a). Some industry reports have identified many areas for performance improvement and highlighted the role of PM in improving the current situation of the industry (Egan 1998; Latham 1994) –a critical reason for that PM having increasing popularity in construction . However, PM in construction is mainly project-focused, whilst the PM of construction organisations has received small interests (Love and Holt 2000). The *aim* of this paper is to review the literature of PMS (specifically at the company level) for addressing the knowledge gap and subsequently presenting the research agenda in the context of construction.

AN OVERVIEW OF PM IN CONSTRUCTION

PM in construction is mostly project-based, specifically the productivity issue in project management (c.f. Bassioni *et al.* 2004) and project success criteria and factors (e.g., Chan *et al.* 2004; Chua *et al.* 1999). Many developed countries have launched their own project-based PM programmes, such as the US (Lee *et al.* 2005), the UK (CBPP-KPIs, 2002), and Canada (Rankin *et al.* 2008) [an excellent review of national PM programmes can be found in Costa *et al.* (2006)]. As a project-based industry, radical changes to the way of delivering projects will contribute to the performance improvement of the industry (Egan 1998), while the project focus dislocates PM from the corporate centre (especially management support and budgets), from programme management and hence hampers the feedback loop from being effective. However, PM is a diverse research field in construction, and the literature can be generalized into three main purposes:

1. Industry purpose: assess the performance of the industry, both nationally and internationally (e.g., Costa *et al.* 2006; Fisher *et al.* 1995; Lee *et al.* 2005; Rankin *et al.* 2008).
2. Business purpose: measure the performance of the construction organisation, including both one-time evaluation and continuous measurement (e.g., Bassioni *et al.* 2005; Beatham *et al.* 2005; El-Mashaleh *et al.* 2007; Horta *et al.* 2010; Kagioglou *et al.* 2001; Love and Holt 2000; Luu *et al.* 2008; Rankin *et al.* 2008; Yu *et al.* 2007). As noted, this purpose has been weak due to the lack of non-project budgets to facilitate, adequate feedback loops and the spreading and embedding of lessons learnt to generate improvement in project businesses and construction.
3. Project purpose: evaluate the performance (and success) of construction projects (e.g., Chan *et al.* 2004; Liu and Walker 1998). This may work over the project lifecycle, but most project organisations measure insufficiently to induce improvement opportunities within a project hence potential benefit is to tease out generic lesson for spreading and embedding of lessons on other projects.

Given many existing research approaches, following sections mainly focus on the review of PMS at the company level, including defining PMS, applying conceptual frameworks, and benchmarking.

DEFINING PMS

PMSs provide information that helps a firm to align its management processes, such as target setting, decision-making and performance evaluation, with the achievement of chosen strategic objectives (Ittner *et al.* 2003). PMS is a widely used but rarely defined term (Franco-Santos *et al.* 2007; Neely 2005; Neely *et al.* 1995). For example, Franco-Santos *et al.* (2007) found that PMS was explicitly defined in only 17 out of the almost 300 articles they reviewed. The fact that the lines of literature on PMS span many management disciplines, such as strategy, operations, accounting, human resources, and information systems contributes to the lack of a cohesive body of knowledge. According to Franco-Santos *et al.* (2007), the three defining aspects of a PMS are its features, roles, and supporting processes. Firm level definitions of PMS in construction management research are extremely limited However, some general definitions can be found in the literature (see Table 1). For example, Bassioni *et al.* (2005) define PMS as the measurement system implemented by construction organisations for the purpose of internal management of the firm, not the evaluation by clients and stakeholders, while Love and Holt (2000) highlight that an effective business PMS should enable a construction company to evaluate and establish its position with respect to the business environment, indicating the principal role of PMS within a construction organisation. According to Table 1, most of the characteristics of PMS are highlighted fully or partially by construction management research, but some important and implicit characteristics of PMS are largely overlooked, such as communication, influencing behaviour, and system review.

As reviewed above, no research in construction makes explicit the definition of PMS at corporate level, while most of them present a vague definition or refer to those definitions in management literature, which coincidently keeps pace with Fanco-Santos *et al.*'s (2007) finding that most researchers did not define PMS when they used it. This prevents or severs the link between corporate strategy and measured performance which the review stated was important earlier (e.g. Banker *et al.* 2004).Vague definitions of PMS in construction also show an incomplete realization of PMSs' features, roles, and processes, but those aspects of PMS definition have induced lots of fruitful researches in management literature, for example, empirical investigations of the role of PMS in building organisational capabilities and facilitating decision-making. Additionally, despite an incomplete exploration of PMS in construction, the literature shows a common concern on the strategic alignment, and this consistent concern may be influenced by the application of BSC, as those who do not adopt a BSC approach tend to overlook the importance of strategic alignment. Strategic alignment is a fundamental aspect of PM frameworks and PMS design, but it is difficult to transfer strategies from the corporate centre to projects in construction context, and more difficult to gain feedback from the construction projects whether organisational strategies have been implemented effectively. Obviously, this discrepancy hampers the application of PM frameworks in terms of "translating strategy into action".

Table 1: Mentioned characteristics of the definition of firm-level PMS in the construction management research (●: Fully Mentioned; ○: Partially Mentioned)

Aspects	(Kagiogl ou *et al.* 2001)	(Beatha m *et al.* 2005)	(Bassion i *et al.* 2005)	(Yu *et al.* 2007)	(El-Mashaleh *et al.* 2007)	(Luu *et al.* 2008)	(Horta *et al.* 2010)
Features of PMS							
Performance Measures	●	●	●	●	●	●	●
Supporting infrastructure		○	○				●
Roles of PMS							
Measure performance	●	●	●	●	●	●	●
Strategy management	○	○	○	○		●	
Communication		●					
Influence behaviour							
Learning&improvement	○	●	●	○	○	○	○
Processes of PMS							
Design of measures	●	●	●	●	●	●	●
Collection of data	●	●	●	●	●	●	●
Inform. management	○	○	●	●			○
Evaluation and reward	○	○	○	○	○	○	
System review		○		○			
Defined Explicitly?	No	No	No	No	No	No	No

APPLICATIONS OF CONCEPTUAL FRAMEWORKS

The application of conceptual frameworks in construction is limited to BSC, European Foundation for Quality Management (EFQM), and Malcolm Baldrige National Quality Award (MBNQA) (see Table 2). A previous survey shows that the application of PM frameworks is even more narrow in practice, indicating that KPIs approach, BSC, and EFQM are dominating the business PM in the UK construction industry (Robinson *et al.* 2005a). It is clear that the degree of popularity of those frameworks in general largely affects their applications in construction, but it does not mean that these frameworks are more appropriate for construction context than those that are not applied in practice and/or adopted in research, for example, a recent framework – Performance Prism (Neely *et al.* 2002), which has not been applied in construction industry but does have great potentials.

Some researchers in construction tried to understand the performance of construction firms by designing conceptual frameworks, such as Kagioulou *et al.* (2001), Love and Holt (2000), and Bassioni *et al.* (2005). Kaigioulou *et al.* (2001) design a conceptual framework by adding two dimensions—project and supplier perspective—into the BSC to make it more appropriate for the situation of construction industry, where project performance and suppliers performance are crucial to the overall performance of construction firms. As the project management team is usually temporary, the perspective of innovation and learning is problematic in construction industry. The conceptual framework concentrates on practical application in practice (e.g. the PM

matrix, and the alignment among strategies, goals and measures), and case studies also show some usefulness and validity, whilst no evidence shows causal links among performance dimensions and empirical validation is needed as stated by the authors. A more complex and comprehensive framework is designed by Bassioni *et al.* (2005), who build it upon the principles of BSC and EFQM, and empirical weights of these dimensions are presented (Bassioni *et al.* 2008). Although interviews show that the framework is practical to some extent, successful application is doubted because of its complexity.

Some other researchers assume that these frameworks can be applied directly in construction industry and used as a management technique both in research and in practice, such as Yu *et al.* (2007), Luu *et al.* (2008), Arditi and Lee (2003), and Beatham *et al.* (2005). Yu *et al.* (2007) designed 12 benchmarking measures under four perspectives of the BSC, indirectly showing that strategy alignment is not the predominant issue for the application of the BSC. This contradicts with the premise of the BSC. A more specific approach is adopted by Luu *et al.* (2008), who apply the BSC to design PMs within a case study construction firm, and firm strategies are deployed to design PMs. Besides the application of those popular frameworks, some operation models are adopted to benchmark the overall performance of construction firms, e.g. DEA (El-Mashaleh *et al.* 2007; Horta *et al.* 2010). Simple measures are adopted to make the benchmarking process more applicable. Although progress has been made in the application of PM frameworks, there are significant challenges at the planning, deployment and assessment and review stages (Robinson *et al.* 2005b). As applications of KPIs, BSC, and EFQM have been adopted in the industry for a long period, barriers and problems during the application process should be further researched (Bassioni *et al.* 2004).

PMS design issues are concerning the design of an appropriate system within a construction firm and successful implementation of the system. Given that the KPIs programme in the UK provides little chance for construction firms to change, Beatham *et al.* (2005) present an integrated business improvement system, containing four stages—understanding, performance measures system design, implementation of PMs, and use of PMs. Robinson *et al.* (2005b) discuss three main issues of PMS in construction: planning, operationalisation, and assessment and review. In their other research, six key considerations have been highlighted in implementing PMS: leadership and commitment, choosing appropriate PM models, choosing right measures, understanding the purpose of PM, knowledge management, and managing the change (Robinson *et al.* 2005a). Their findings show that most of case study organisations are at infancy stages in implementing PMS (Robinson *et al.* 2005b).

Table 2: Applications of conceptual frameworks in construction

Authors	Dimensions	Objective	Method	Sample	Source
Kagioulou *et al.* (2001)	BSC; project management; suppliers	Design a conceptual framework for construction firms	Case studies	2 cases	BSC
Bassioni *et al.* (2005)	13 dimensions combining both BSC and EFQM	Design a holistic and conceptual framework for construction firms	Interviews, case studies	11 interviews, 5 cases	BSC, EFQM
Yu *et al.* (2007)	4 BSC dimensions	Develop an implementation model for construction firms	Interviews, questionnaire survey	12 experts 34 firms	BSC
El-Mashaleh *et al.* (2007)	Schedule; cost; safety; customer; profit	Propose a benchmarking model	DEA	74 firms	None
Luu *et al.* (2008)	4 BSC dimensions	Identify and validate KPIs to measure strategic performance	Interviews and case study	1 case	BSC
Horta *et al.* (2010)	Organisational and operation	Develop a methodology for assessing company overall performance	Questionnaire survey, DEA	22 firms	None
Arditi and Lee (2003)	MBNQA	Develop a tool to measure the firm service quality	Questionnaire survey	19 owners, 21 contr.	MBNQA
Beatham *et al.* (2005)	EFQM and KPIs	Review key facets of PMS to design a new one	Case study	N/A	EFQM

BENCHMARKING PRACTICES

The development of competitive benchmarking makes PM revolution more real (Eccles, 1991). Many benchmarking systems exist in the construction industry, such as Fisher *et al.* (1995), CII-BM&M in the US, CBPP-KPIs in the UK, and Canada-Benchmarking Programme (Rankin *et al.* 2008). Given no available benchmarked standards for the construction industry, Fisher *et al.* (1995) designed ten measures to collect benchmarked data in the US, which is the first benchmarking system (model) in the construction industry (El-Mashaleh *et al.* 2007). This research aims to be the third-party benchmarking system for providing objective and industry-cross standards. Other well-known benchmarking systems include Construction Industry Institute Benchmarking and Metrics (CII-BM&M) and UK construction best practice program (CBPP-KPIs). All these benchmarking programmes are initiated to become a third-party facilitator. Clearly, there are some benefits, such as marketing advantages, improved performance opportunities, agreement on common definitions for metrics, and setting an industry-cross standard (Costa *et al.* 2006). However, some problems are also significant: *i)* Project specific benchmarking initiatives provide little indication of the overall performance of organisations from business perspective (Beatham *et al.* 2004; El-Mashaleh *et al.* 2007; Kagioglou *et al.* 2001); *ii)* Availability and validity of data (Beatham *et al.* 2005; Costa *et al.* 2006; Kagioglou *et al.* 2001); *iii)* Failure of demonstrating the relationship between measures from a holistic view (El-Mashaleh *et al.* 2007; Kagioglou *et al.* 2001); *iv)* Little measures related to suppliers' performance, employee satisfaction, site management, and quality management (Costa *et al.* 2006; Kagioglou *et al.* 2001); *v)* Little alignment of the benchmarking measures to company strategy (Bassioni *et al.* 2004; Beatham *et al.*

2004; Costa *et al.* 2006; Kagioglou *et al.* 2001); vi) Large proportion of lagging indicators and limited leading indicators that provide chances for changing performance (Beatham *et al.* 2004).

Besides these benchmarking initiatives at the national level, researchers in construction also adopt benchmarking approach to measure the performance of construction projects and firms (e.g., El-Mashaleh *et al.* 2007; Garnett and Pickrell 2000; Horta *et al.* 2010; Yu *et al.* 2007). Garnett and Pickrell (2000) present a seven-step benchmarking model to measure performance of two case study organisations, and conclude that this benchmarking model could be a powerful tool in investigating and managing change on construction projects. Luu *et al.* (2008) adopt a benchmarking approach to compare the case study construction company's overall performance with its main competitors in the construction market, and then comparative weak areas are identified. Yu *et al.*'s (2007) research aims to provide robust benchmarks for construction organisations and a practical methodology to design benchmarking system for the PM of construction organisations. El-Mashaleh *et al.* (2007) and Horta *et al.* (2010) adopt a similar benchmarking methodology by highlighting that various metrics should be integrated to measure the organisation efficiency and effectiveness.

CONCLUSIONS

PM and PMS have become a significant way of conceptualising and developing practice for business performance improvement. In construction PM has been adopted conceptually and in practice to evaluate the performance of construction projects and organisations. The literature review has shown several conclusions:

1. There are some conceptual frameworks inspired mostly by BSC and EFQM, to some extent showing effective application in construction industry. Although explicit definitions of PMS in construction are scant, strategic alignment is widely mentioned in both conceptual frameworks and practical design of PMS, indicating a mixed and vague usage of PMS. Additionally, as PMS design issues are overlooked in the construction industry, many construction companies are at the infancy stage in designing and implementing PMS (Robinson *et al.* 2005b).
2. The evolution of PM in construction is much slower than that in the management literature, which further hampers the potential of the PMS revolution across the industry. Researchers in construction started to design conceptual PM frameworks of organisations in early 2000s, and more recently, people have began to adopt various practical PM methodologies to measure the performance of construction firms. Methods of application have gained very limited attention in the construction industry, whilst no existing research adopts empirical and theoretical analysis of PM frameworks and methodologies.
3. Benchmarking approach plays an indispensible role in evaluating the performance of construction projects and companies by aggregation, but this is insufficient for "continuous improvement" for at least three reasons: *i)* benchmarking performance of projects in the industry captures very limited aspects of project performance, and most of PMs are lagging indicators, which means it cannot give project management team instant directions and suggestions to improve the performance; *ii)* any construction project is completely different with others and the management team is built temporarily, which demonstrates that previous benchmarking information can hardly present useful and accurate guidelines for them; and *iii)* benchmarking to improve industry practice as a whole assumes on

the one hand it is backward rather than different in comparison to other industries and on the other hand that project KPIs will aggregate up to sectoral improvement without demonstrating the causal link to induce such improvement.

The literature claims that there is a need to carry out further research on PM in both construction projects and firms. The analytical evaluation in this review has identified further issues that need to be addressed. Questions that have to be addressed include:

1. Given the project-based characteristic of construction industry, how do differences of management style between construction site and home office influence PM? How to integrate construction project management into the entire PMS of firms? How to stimulate performance information feedback (learning loop) from the temporary project management team to the programme and firm levels, and then spread and embed the lessons learnt to induce performance improvements?
2. Given various stakeholders involved in the construction process, how do those stakeholders influence the PM on construction site, which further influence the entity PMS within the firm? How to identify potential influencing forces and manage this effect? How to measure inter-organisational performance, such as the supply chain? Measuring and managing the performance of inter-organisations in construction will be significantly valuable.
3. The literature shows that large construction firms are at the infancy stage in implementing PMS. What are the contingencies that influence the design, implementation, and use of PMS, their associations with PM practices, and their effects on project and firm performance in the construction industry? How to present a structured process of developing and maintaining a dynamic PMS that enhance the flexibility of PMS so that they can cope with organisational and environmental changes?
4. The literature shows no empirical and theoretical analysis of PM effects in the construction industry. Does the implementation of BSC, EFQM excellence model, and/or KPIs approach really affect the performance of construction organisations? What are the mechanisms, how do they work and what improvements can be made?

Many of the above issues can be addressed through traditional research methods. However, some require high levels of industry engagement. Therefore an additional recommendation is that research methodologies and methods that facilitate high levels of engagement, such as action research, are employed.

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