PERFORMANCE INDICATORS FOR SUCCESSFUL CONSTRUCTION PROJECT PERFORMANCE

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The construction industry is generally considered to have under performed compared to other industries. Not only that, the UK construction industry has been criticised for not performing at the same level as that of other developed countries. In relation to this, the UK working groups on Key Performance Indicators (KPIs) have identified ten parameters for benchmarking projects, in order to achieve a good performance, in response to Egan's report. These consist of seven project performance indicators, namely: construction cost, construction time, cost predictability, time predictability, defects, client satisfaction with the product and client satisfaction with the service; and three company performance indicators, namely: safety, profitability and productivity. Most of these indicators can be regarded as having results orientation, except for predictability of design cost and time, and predictability of construction cost and time, which can be regarded as procurement orientated, and safety, which can be regarded as process orientated. It is the contention* of this paper that successful construction project performance can be divided along three orientations: procurement, process and result orientations. In addition, although these indicators provide a generic framework criterion for successful construction project performance, this current paper will provide a review of measurements developed to assess project performance and propose a model that will help to identify the performance of the stakeholders involved in a construction project.

Keywords: performance indicators, stakeholders, project performance, procurement, process and result orientation.

INTRODUCTION

The construction industry is vital for the development of any nation. In many ways, the pace of the economic growth of any nation can be measured by the development of physical infrastructures, such as buildings, roads and bridges. Construction project development involves numerous parties, various processes, different phases and stages of work and a great deal of input from both the public and private sectors, with the major aim being to bring the project to a successful conclusion. The level of success in carrying out construction project development activities will depend heavily on the quality of the managerial, financial, technical and organisational performance of the respective parties, while taking into consideration the associated risk management, the business environment, and economic and political stability. According to Wang (1994), as construction is becoming more complex, a more sophisticated approach is necessary to deal with initiating, planning, financing, designing, approving, implementing and completing a project.

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The common assessment of the success of construction projects is that they are delivered on time, to budget, to technical specification and meet client satisfaction (Baker *et al.*, 1983; Slevin and Pinto, 1986; Morris and Hough, 1987; Turner, 1993). However, the criteria for success are in fact much wider, incorporating the performance of the stakeholders, evaluating their contributions and understanding their expectations (Atkinson *et al.*, 1997; Wateridge, 1998). A stakeholder is an individual or group, inside or outside the construction project, which has a stake in, or can influence, the construction performance. Construction projects potentially can have different sets of stakeholders and, for the purpose of this paper; they are limited to six groups: client, consultant, contractor, supplier, end-user and the community. According to Atkinson, *et al.*, (1997), successful construction project performance is achieved, when stakeholders meet their requirements, individually and collectively. However, in order to meet their requirements and continual participation, it is important for the stakeholders to address and distinguish the three orientation criteria that exist in the life cycle of a project: the 'procurement', the 'process' and the 'result' orientation. This forms the basis for this paper.

AN OVERVIEW OF KEY PERFORMANCE INDICATORS (KPIs) AND BENCHMARKING

Performance Indicators

The UK working groups on Key Performance Indicators (KPIs) have identified 10 parameters for benchmarking projects in order to achieve a good performance in response to Egan's report (1998). However, most of these indicators, such as construction cost, construction time, defects, client satisfaction with the product and service, profitability and productivity, promote result-orientated thinking, whereas predictability of design cost and time, and predictability of construction cost and time, and safety can be regarded as process-orientated thinking. There are no suggestions for performance indicators in benchmarking projects at the project selection phase i.e., analysis stage, when the client and end-user's requirements need statements and the delivery strategy are determined. In addition, the perspective of the 'project' and 'supplier' is not clearly indicated. None of the measures mentioned in this section could identify the performance of suppliers in a project environment.

According to Dvir *et al.*, (unpublished paper, 2002), the output of the requirements at the analysis stage will most likely determine the output of the entire development process. They indicate that the origination and initiation phase, in which major decisions are made, such as decisions on the project's objectives and planning the project's execution, has the most influence on the project's success. The issue is much more serious when the kind of activities that should be undertaken depends on the outcome of earlier activities. It is therefore important to identify parameters (performance indicators) for benchmarking projects at the project selection phase in order to achieve good project performance. Posten (1985), who found that 55% of all defects in R&D projects occur during requirement analysis and specification, earlier documented this position, whereas 43% of all defects are not found until after the testing stage. It is not surprising that the same situation is applicable to construction projects.

Table 1 identifies a range of indicators for the UK construction industry from various construction task forces (Mbugua *et al.*, 1999). These indicators are targeted at assessing industry-wide performance and individual companies as well. However, the

models presented in Table 1 fail to show any explicit link between the performance factors measures based on project phases (e.g., selection phase, execution phase) and the factors that may determine the project performance during the implementation phase. There is no key factor linking one phase to another. In addition, the working groups provide no indicators on the performances of the stakeholders involved in the project and prioritise their performance in determining project success. The result criteria, in terms of stakeholders' expectations derived from their own performances throughout the phases, are not precisely discussed in terms of cause and effect relationships. According to Pillai *et al.*, (2002) a performance measurement system is required to reflect the needs and expectations of all the stakeholders. Stakeholders' performances need to be measured and assessed throughout the project phases, in order to ensure that no tremendous conflicts, disputes and blaming syndromes have occurred by the time the completion stage is reached.

Table 1: Performance Indicators for Industry Measures

Latham (1994)	**Egan (1998)**	**Construction Productivity Network (1998)**	**Construction Industry Board (1998)**
Client satisfaction	Construction cost	People	Capital cost
Public interest	Construction time	Processes	Construction time
Productivity	Defects	Partners	Time Predictability
Project performance	Client satisfaction (product)	Products	Cost Predictability
Quality	Client satisfaction (service)		Defects
Research & development	Profitability		Safety
	Productivity		Productivity
Training and recruitment	Safety		Turnover & profitability
Financial	Cost predictability (const.)		Client satisfaction
	Time predictability (const.)		
	Cost predictability (design)		
	Time predictability (design)		

Source: Adopted from Mbugua *et al.*, (1999).

Since performance is an individual contribution to the execution of the task required in completing the construction project (Liu and Walker, 1998), the performance of each participant should be measured, evaluated and prioritised at every stage of the project phases in order to determine the extent to which a project has been successful.

Given the above issues, it is the aim of this paper to examine the relationship between the stakeholders' performance and project success from the three perspectives (procurement, process and result orientation criteria) in relation to a project life cycle.

Benchmarking

Construction Best Practice Programme (CBPP) defines benchmarking as a systematic process of comparing and measuring the performance of the companies (business activities) against others, and using lessons learned from the best to make targeted improvements. Companies that engage in benchmarking do so for two basic reasons. They either are attempting to gauge where they stand against key competitors, or they are looking to learn and incorporate successful ideas from ***best*** of class companies (Acord, 2000). On the other hand, a key performance indicator (KPI) is the measure of the performance of the process that is critical to its success. The best performance achieved in practice is the benchmark. The objective is to understand the existing processes and activities and then to identify an external point of reference or standard by which that activity can be measured or judged.

Lema and Price (1994), in summarising the works of Camp (1989), Zairi (1994), Watson (1993), Karlof and Ostblom (1993), Shetty (1993), Abdul-Kadir (1996) and CBPP (1999), stated that there are basically two types of benchmarking: internal and external. Internal benchmarking is used to compare performance between units/department within an organisation. On the other hand, external benchmarking can be further categorised into two types: external/competitive and external/generic. External/competitive is used to compare a specific competitor for the product, service or function of interest, whereas external/generic is a comparison of business functions or processes that are the same, regardless of industry or country. Although there are various methods for implementing benchmarking, the ultimate goal revolves around the issue of performance. According to Abdul-Kadir (1996), the difference between benchmarking and traditional concepts of production is the shift from solely product oriented to that of product, processes and people. Competition is not confined to product alone, but extended to processes and those people involved in the process (Karlof and Ostblom 1993). Therefore, in this research a similar approach is followed in measuring the performance of the stakeholders at each project phase viz., the procurement, the process and the phase of the construction project, using the key performance indicators.

PERFORMANCE MEASUREMENT

Mbugua *et al.*, (1999) and Love *et al.*, (2000) have identified a distinction between *performance indicators, performance measures* and *performance measurement.* According to Mbugua *et al.*, (1999), performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement, it is usual to refer to performance indicators. Performance measures are the numerical or quantitative indicators (Sinclair and Zairi, (1995). On the other hand, performance measurement is a systematic way of evaluating the inputs and outputs in manufacturing operations or construction activity and acts as a tool for continuous improvements (Sinclair and Zairi, 1995; Mbugua *et al.*, 1999). In response to calls for continuous improvement in performance, many performance measurements have emerged in management literature. Some examples include: the financial measures (Kangari *et al.*, 1992; Kay 1993; Brown and Lavenrick 1994; and Kaka *et al.*, 1995), client satisfaction measures (Walker, 1984; Bititci, 1994; Kometa, 1995; Harvey and Ashworth, 1997; and Chinyio *et al.*, 1998), employee measures (Bititci, 1994; Shah and Murphy, 1995; and Abdel-Razek, 1997), project performance measures (Belassi and Tukel, 1996) and industry measures (Latham, 1994; Egan, 1998; Construction Productivity Network, 1998; and Construction Industry Board, 1998); as cited in (Mbugua *et al.*, 1999).

Cordero (1990) classifies performance measurement based on the method of measurement and area of measurement. The methods of measurement of performance can be in terms of the technical performance, the commercial performance and the overall performance. The areas of measurement are at the planning & design level, the marketing level and manufacturing level etc., and for the overall performance are at the level of a firm or strategic business unit. Furthermore, he proposes a model of performance measurements in terms of outputs and resources to be measured at different levels. Outputs are measured to determine whether they help to accomplish objectives (effectiveness) and resources are measured to determine whether a

minimum amount of resources is used in the production of outputs (efficiency). However, in his model, Cordero (1990) failed to reflect the interests of stakeholders, their needs and expectations. If construction organisations are to remain competitive in the long run, they need to develop and better understand their relations with their customers, suppliers, employees, lenders and the wider community, as suggested by Love *et al.*, (2000). Hence, performance measurement has to incorporate the interest of the stakeholders, both economically and morally.

In addition, Love *et al.*, (2000) propose a model (Table 2) known as stakeholder perspective measurement (SPM) that adequately considers relations with customers, suppliers, employees, financiers and the wider community. All of them are critical to a business's viability, both in the short and long term. SPM considers the three common perspectives of the firm:

1. As a stakeholder entity, reflecting the interest of customers and shareholders (measures of product/service performance);
2. As a goal-orientated, profit centre (measures of financial performance); and
3. As a system that engages in resources garnering, conversion and exchange with the environment (measures of competitive ability, productivity and quality).

He then concluded that the adoption of a stakeholder's perspective by business measurement will deliver optimal business performance.

Table 2: Stakeholders Perspective Measurement (SPM)

Construction Projects Perspective	**Stakeholders Entity**	**Resources**	**Profit Centre**
Performance measures/performance indicators	Measures of products Measures of service	Measures of corporate ability Measures of individuals' ability Measures of productivity Measures of quality Measures of environment	Measures of financial
Suggested Model	Stakeholders Perspective measurement (SPM) taking into consideration the interest of stakeholders viz., customers, suppliers, employees, lenders and the wider community		

Source: Adopted and Modified from Love *et al.*, (2000)

Pillai *et al.*, (2002) in their studies, proposed a model of performance measurement for R&D projects. In this model, they identify four important areas: the project phases, the performance indicators associated with each phase, the stakeholders and the performance measurements. They proposed to use the Integrated Performance Index (IPI) to reflect the performance of the R&D project at any point during its life cycle, by integrating the key factors from each project phase. The relationship between the needs, expectations and performance of the stakeholders at each phase are thoroughly discussed and formularised. The IPI model is based on the real life experience of Pillai *et al.*, (2002) and has been tested and validated in monitoring project performance of R&D projects in a manner that ensures better resources utilisation and greater stakeholders' contributions towards the successful completion. This model is summarised as shown in Table 3.

This current PhD research on construction project performance will follow a similar approach to that proposed by Pillai *et al.*, (2002), by looking at project success through the performance of the main stakeholders involved in the project. The effects of stakeholders' performance at the earlier project phases will be evaluated and

measured and the impact on the final project outcomes determined. The cause and effect relationships between the key factors will be traced out and identified.

Table 3: Performance Measurement

Integrated Performance Index – R&D Projects				
	Different Phases of a project life cycle			Overall Project Life cycle
	Project Selection Phase	Project Execution Phase	Implementation Phase	
Major Concerns	Project screening Detailed evaluation Project selection	Technology development Product development Performance demonstration	Production Sales Marketing	Customer delight ROI
Key Factors/ Performance indicators	Benefit Risk Special consideration (category)	Progress deviation Cost deviation Decision effectiveness	Production Cost effectiveness Customer commitment	Integrated Performance
Stakeholders	Sponsoring organisation	Project management team	Customer	All stakeholders
Existing Models for performance measurement	Profile charts Check lists Scoring models Economic indices Frontier models Risk models Portfolio models AHP models Fuzzy models	Gantt chart Slip chart CPM PERT Earned value	Production rate & Yield Product Quality Sales volume	Cash Flows Customer feedback Growth potential
Proposed Model	Integrated Performance Measurement for all phases of the project life cycle by linking the key factors from each phase using INTEGRATED PERFORMANCE INDEX			

Source: Adopted and Modified from Pillai *et al.* (2002)

RESEARCH METHODOLOGY

This research is based primarily on a literature review of measurement developed to assess project performance. A conceptual model is proposed with three phases of evolution, viz., the project procurement phase, the process phase and the completion phase. The relationships between the stakeholders' (client, consultant, contractor, supplier, end-user and the community) performances and success factors associated with each phase will be evaluated. The long-term aim of the research is to develop performance indicators for each of the construction project phases. The stakeholders' expectations of the final outcomes will be analysed by correlating this with their performances at the earlier project phases.

CONCEPTUAL KPI FOR CONSTRUCTION STAKEHOLDERS

According to Cooke-Davies (2002), performance predicts success and success factors affect performance. In order to identify the 'real' success factors of construction projects, Cooke-Davies highlighted the importance of the stakeholders in relation to the construction project performance. This corroborates Pinto and Slevan's (1994) argument that a project is only successful to the extent that it satisfies the needs of its intended user. They identify the fact that the element of success in a project refers to *efficiency* and *effectiveness* measures. Efficiency measures correspond to the strong management and internal organisational structures (adhere to schedule, budget and

specification) and effectiveness measures refer to user satisfaction and the use of the project. In addition, efficiency would only be achieved through having standard, systems and methodology. Figure 1 shows the relationship between success factors, project performance and project success.

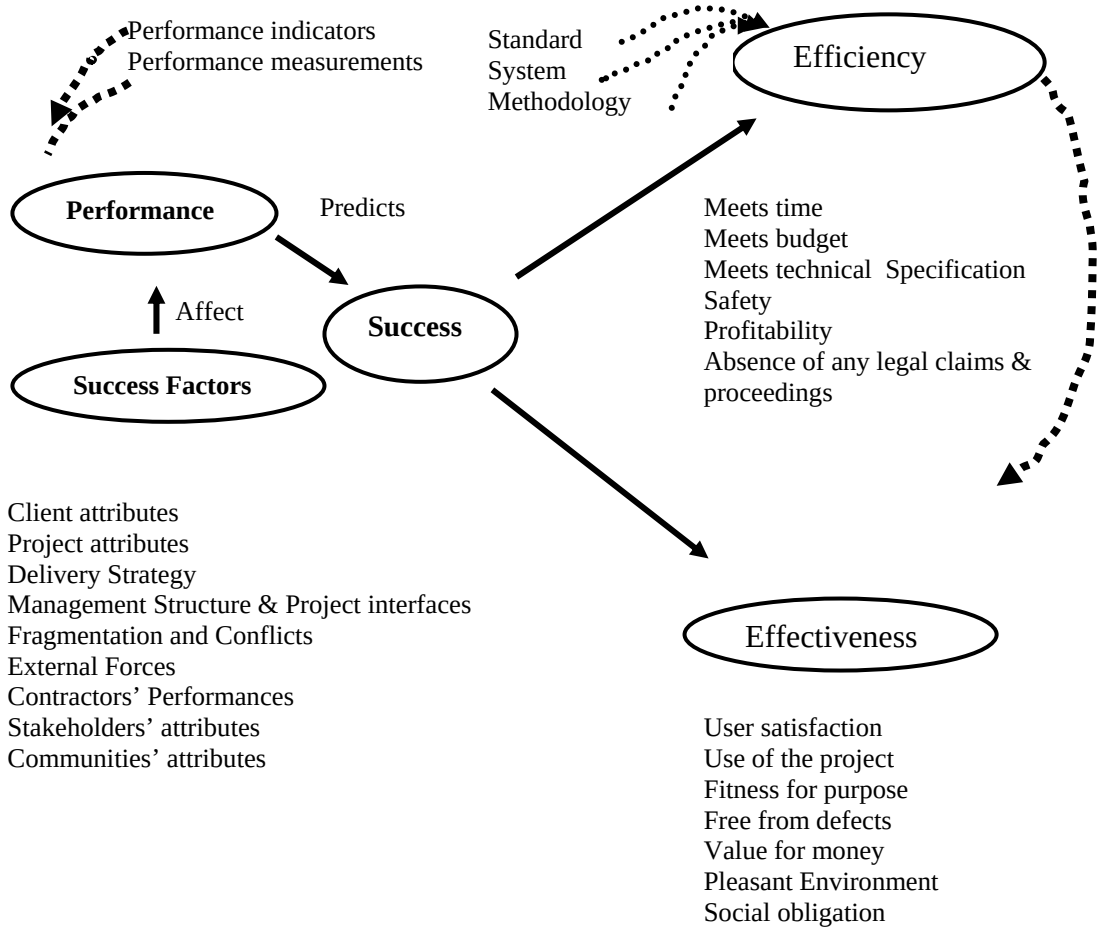

Figure 1: The Relationship between Success Factors, Project Performance & Project Success

Research conducted by Atkinson, *et al.*, (1997) reveals that clients will not be satisfied if the end product fails to meet their price, quality, time frame, functionality and delivery performance standard. In relation to that, the consultants will not develop the skill and knowledge, or make the effort to design and manage processes, unless the client meets their required employment conditions. The contractors and suppliers may not continue to deliver good products and resources to clients or to any company that fails to give them an opportunity to earn a reasonable return on the investment of their time and capital. As a result, end-users will not be happy if the end product does not meet their requirement in terms of functionality and quality of service. In essence, successful stakeholders' performance has to be measured and managed in order to ensure their continual participation and co-operation in a construction project. In addition, the construction industry has the potential to reshape communities and their environments (Moodley and Preece, 1996). The industry is no longer isolated from the pressures and demands of society. Unlike many other industries, the construction industry has the ability to have a more profound impact through its end products. The products of other industries are consumed and do not have a long-term presence, but

the impact of construction can be seen all around us. In order to function more effectively, the construction industry needs to consider different strategies when interacting with the external environment. The construction industry is inextricably linked to the communities within which it operates, through the planning processes, labour, resources, production processes and the final finished products. As communities become more sophisticated they acquire the means to disrupt, delay or ultimately stop construction projects from achieving completion, or, conversely, help expedite them. It would therefore be logical for the community and the industry to share in the potential benefits of a closer relationship and to ensure projects are completed satisfactorily. Another area that generally is poorly covered in the construction industry is the performance of the suppliers in construction projects (Kagioglou *et al.*, 2001). None of the measures mentioned in KPIs could identify the performance of the suppliers in a project environment. Given the relationship between success factors, project performance, efficiency, effectiveness, stakeholders' performances, needs and expectations, stakeholders' continual participation and the 'real' success factors of construction projects, it is possible to propose a conceptual model for successful construction projects' performance incorporating these issues as shown in Table 4. The Table represents the relevant performance indicators in relation to stakeholders' performances that could be measured based on the three phases of project life cycle: the procurement, the process and the phase out. It is expected that this will provides a basis for the performances of the stakeholders in each phase to be measured and evaluated in order to determine a project's success. The conceptual framework adopts the approach suggested by Love *et al.,* (2000) in the Stakeholders Perspective Measurement (SPM) model and Pillai *et al.,* (2002) in the Integrated Performance Index (IPI) framework. Both of these approaches focus on the project life cycle performance. However, since this PhD research is still in its infancy, it is yet to determine the performance measurement systems that could be used to measure the performances of the stakeholders at each project phase. Also, an investigation into the impact of stakeholders' performances and their expectations, and how these correlate with the key factors that link each phase to another, has still to be carried out.

CONCLUSION

The recent growth of interest in benchmarking as it relates to successful project performance can be ambiguous and becomes extremely complicated if all the parameters are not studied and the most important one identified. It is difficult to give an unequivocal verdict on the success or failure of a project, as some criteria are successfully met while others are not. In addition, the different perspectives of key players in the development of a construction project will explain the reason why one could consider the same project as being both partly successful and partly unsuccessful. It would be ideal if a project could result in an overall win-win situation for all parties involved, but in reality the ideal seldom happens.

The framework for performance indicators for successful construction project performance, documented in this paper, is a topic of ongoing research at Glasgow Caledonian University towards an award of a PhD degree. The research is still in its infancy. The overall objective of the investigation is to develop a robust framework for benchmarking construction project development that reasonably takes into account the stakeholders' objectives, their expectations and priorities for the project.

Table 4: Performance indicators in relation to stakeholders' performances based on three-phases of project life cycle

Client	Consultant	Contractor	Supplier	End-user	Community
PROCUREMENT STAGE - PERFORMANCE					
Client attribution Project attribution Procurement & delivery Strategy Project viability Contractual arrangement Briefing Process Communication Decision effectiveness Risks and opportunities Excessive bureaucracy Commitment from employees Interactive Process Social Obligations	Project management capabilities Good working relationship Competency Consultation mode Commitment Strategic cost advise Meeting functional requirements Meeting technical specification Proper communication Interactive process Efficiency of technical approval authorities	Level of experience Financial stability & financial management Past performance Management capabilities Performance of project personnel Construction method and technology Manpower and technical capabilities Project innovation	Quality assurance on products Quality control system Product life span Replacement value The concept of JIT Product mechanisation Track record Level of service Team turn-over rate Capabilities of key personnel Top management support	Involvement in need definition Contribution of ideas and requirements Commitment via representatives Involvement in decision making process Joint evaluation on procurement selection	Pressures Demands Community involvement Community Policy Battleground Closer relationship
PROJECT PHASE - PERFORMANCE					
Management structure Project interfaces Fragmentation Conflicts Control measures Political, economic, social, legal & environment influences Loyalty Quality of work life	Team Management Project interfaces Coordination Accountability Conflicts management style Communications and reporting Quality control system Quality assurance Dispute resolution process	Performance standard Good working relationship Construction method & technology Labour utilisation & relaxation Productivity rate Safety Constructability Communications and reporting Cost control mechanism Efficiency	Material Procurement Co-operation Commitment Coordination Ability to deliver Product reliability Delivery time Contractual agreement Product defects	Continuous participation Involvement in maintenance documentation	Support Co-operation Disruptions Expedite Environmental effect
PHASING-OUT STAGE - EXPECTATION					
Meets pre stated objectives Meets time Meets budget Technical specification Acceptable quality Meets Corporate priorities Harmony Absence of any claims & proceedings Reduction of conflicts/ disputes Transfer of experience Investment opportunity Value for money	Profitability Future Jobs Learning & growth Generated positive reputation Harmony Absence of any legal claims & proceedings Increase the level of professional	Profitability Achieve business purpose (strategically, tactically & operationally) Learning and growth Settlements of conflicts Minimum risk (reduction of disputes) Business relationship New market penetration Generated positive reputation Develop new knowledge & expertise	New market penetration on products Future potential Exploit technology Profitability	Meets requirements Functionality Desired outcomes Free from defects Meets quality thresholds On-time deliveries Minimum cost of ownership Required future service Safety Flexibility (for future expansion) Usable life expectancy Easy to maintain Depreciation and exploitation costs	Benefits Use of it Safety Pleasant environment (blend to the surroundings) Public image

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