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EXPLORING THE PERCEPTION OF EARNED VALUE ANALYSIS FOR THE MALAYSIAN CONSTRUCTION INDUSTRY

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Abstract

The management of construction projects are becoming more challenging for civil engineers in the 21st century due to increasingly competitive performance expectations from the project stakeholders. However, among the financial and non-financial performance indicators, time and cost monitoring of construction projects are the critical issues for an effective project management. Due to the limitations in traditional time and cost monitoring practices, Earned Value Analysis (EVA) integrates the work scope, cost and schedule to enable effective project performance measurement and as well as future analysis and forecasting. Therefore, this study has proposed EVA and extends its applications for the Malaysian construction industry. The research is based on a quantitative survey that aims to obtain a perception, understanding, enablers and barriers of EVA practices in Malaysia. Feedbacks of the survey reveals that majority of the respondents are not practicing EVA in their working environment. The study has found that there is a good degree of agreement among the respondents regarding the potential enablers of EVA. The survey has also identified the lack of EVA knowledge, expertise and experience as the most important barriers that inhibit its practices among the professionals. The overall findings of this study support the application of EVA as a standardized project control method for the Malaysian construction industry.

Keywords: Earned value, earned value analysis, performance monitoring, EVM, project monitoring

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1. Introduction

A project time is defined as the agreed duration of completion for the delivery of product or services by the contractor whereas the cost is the total expenditures that may consumed for providing the resources to produce that product physically. Time overrun is defined as the extension in time required by the contractor in order to complete the project scope of work (Salunkhe, & Patil, 2014). Similarly cost overrun is due to the spending of surplus capital as compared to the planned budgeted amount. This is also known as 'cost escalation', 'cost increase', or 'budget overrun' (Zhu, & Lin, 2004). The past research mentioned that time and cost overruns always remained foremost apprehension for the project stakeholders. These parameters directly affect the financial viability of a client's investment and negatively impact the profit margins for the contractors (Endut, Akintoye, & Kelly, 2005). In Malaysia, the Ministry of Finance issued a circular in 2009 and directed Public Works Department (PWD) and other government agencies to identify the projects that are falling in the category of time overruns. In this perceptive, the Ministry has declared criteria for distinguishing the delayed projects in Malaysia. According to this criterion, any project whose completion had been delayed by more than 20 per cent or two months is considered as delayed project. A new terminology is being used for such type of projects and called it as a 'sick' project. With this circular, the existing criterion has been changed. As the former one categorizes a project as 'sick' when the completion delay exceeded 30 per cent or three months after the scheduled completion (Ministry of Finance Malaysia, 2008). The National Audit Department of Malaysia (2008) in its Auditor's General report also highlights the time and cost overruns in public sector infrastructure projects. According to this report a total of 92,687 projects were implemented under Public Infrastructure Maintenance Programme, Basic Infrastructure Programme and Parliamentary Constituency Rural Development Projects. The audit report indicates that many programmes / projects were not delivered efficiently due to the following main causes but not limited to delay in project completion; increased project cost; unsatisfactory project monitoring and supervision; deviation from original project scope and improper payment mechanism to the contractor (The Auditor General of Malaysia, 2009).

The traditional approach of project time and cost monitoring is based on simple parameters using two data sources that is the budget (or planned) and the actual expenditures. The comparison of budget versus actual values merely indicate what was planned to spent versus what was actually spent at any given time. Beside this, it does not relate any current performance trend to forecast future performance. Due to these limitations in traditional practices, Earned Value Analysis (EVA) methodology integrates project scope, cost and schedule for an objective performance measurement (PMI, 2013). It is an emerging concept and an internationally recognized project management technique to monitor and control project performance. It provides a system to determine the actual amount of work performed on a project in order to predict cost and completion timelines. It also indicates that how well a project is performing compared to its baseline, and given the information to anticipate how well the project will perform in the future (Fleming, & Koppelman, 2006). In Malaysia, EVA has not yet become widely practiced as the current industry trend is more towards the traditional planning and controlling tools such as S-curve, progress curves etc. (Mohamad, 2003). Hence, this study investigates the current understanding and perceptions of EVA and its applications to the Malaysian construction industry.

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2. Problem Statement

An effective project performance control cannot be achieved by traditional approach as it only monitor the actual physical progress with the planned progress and actual cost expenditures with the budgeted values. Nevertheless, this approach may be deceptive as it does not consider the worth of the work which is completed during a particular period (Ahuja, Dozzi, & Abourizk, 1994). As a remedy of these limitations in traditional monitoring practices, EVA methodology integrates the work scope, cost and schedule to produce objective performance control. It allows the organizations to ensure that the project is progressing as per work plan and within the approved budget (Seshadri, 2009). The concept of EVA is widely accepted and practiced in developed countries. In United States, NASA has mandated the use of EVA on its strategic procurements (Putz et. al., 2007). South Korean Congress in 2004 passed a bill i.e. 'The Effective Plan of the Public Construction Industry Bill' which also mandated the construction firms to adopt Earned Value Management System (EVMS) in their projects (Kwon et. al., 2008).

Therefore, to study and promote the applications of EVA method in the Malaysian construction industry, it is important to investigate its current state of understanding and perceptions before a project monitoring system based on EVA methodology can be developed to suit the needs of the local construction industry.

3. Research Questions

This research reviewed available literature to give a clear and precise understanding of EVA method in time and cost performance monitoring of construction projects. It discusses the significance advantages of EVA applications with respect to the limitations of traditional time and cost monitoring approach. This data is further used for the development of research questions that aims to explore the understanding of EVA methodology in the Malaysian construction industry and investigate its current level of applications.

- What is the current level of EVA usage and its perception as a monitoring and controlling method?
- What are the enablers and barriers of EVA implementation for the Malaysian construction industry?

4. Purpose of the Study

The purpose of this research is to highlight the importance of EVA method as an integrated time and cost monitoring approach for the Malaysian construction industry. The encouraging results towards the acceptance of EVA method envisage its further application for the project organizations. The survey analysis would help the project planners and practitioners to establish confidence level in order to successfully integrate EVA method in their project monitoring practices. In addition, the ranking of EVA barriers also facilitate the senior management to prevail the key underlying issues that hinder the EVA usage in the current scenario. The EVA benefits as outlined in this research may be adopted by project organizations in improving the effectiveness of their overall project planning process.

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5. Research Methods

The primary data required for this study was collected through questionnaire survey. For the purpose of achieving the desired research objectives, a structured or close-ended questionnaire was designed to gain the views from the industry practitioners. The information that elicited from the questionnaire is primarily a form of descriptive survey. Its main concern was to explore the existing usage of EVA approach in the Malaysian construction industry, its enablers and barriers, and the perception about its implementation among the project professionals. A four-page structured questionnaire was developed to meet the initial research objectives. The format consists of two sections i.e. Section A comprises of general information about the responder and his associated organization whereas Section B focuses on usage of EVA technique. A five-point Likert scale is used for rating the respondent's feedbacks. The data collected in this research was analysed by using SPSS and several types of statistical analysis were applied such as frequency analysis, cross-tabulation, average index analysis, spearman's correlation and Kendall's coefficient of concordance to establish findings. A pilot test was conducted prior to carrying out the actual questionnaire phase. Its main purpose is to refine the contents and reduce the ambiguity that overall effect the validity of data. A total of 130 questionnaires were sent to two groups of respondents including government ministries; Construction Industry Development Board (CIDB) of Malaysia and Public Works Department of Malaysia (24 Nos.) and private sector contractors (106 Nos.). The respondents were selected due to their direct involvement in major infrastructure developments and key construction projects during the Tenth Malaysian Plan Period (2010 – 2015). The questionnaires were sent to these targeted respondents by using postal, fax and electronic-mail. The private sector organizations are concerned with heavy/civil engineering, industrial, general/commercial buildings, housing and expressways construction. The respondents include senior managers, project managers, contract managers, quantity surveyors, procurement managers, financial managers and estimators. The majority of them have experience of more than 15 years in the industry. Beside this survey, a semi structured interview was also conducted from the senior government official of Malaysian Public Works Department for getting substantial arguments in this research work.

6. Findings

A total number of 130 questionnaires were sent to the professionals of different trades. Out of which, 30 complete responses were received, leading to a return rate of 23%. The findings of the survey are as follows;

6.1. Respondents background

In context of Malaysian construction industry, it is very much important that questionnaire must send to the relevant construction organization. So, demographic information will assist the researcher to fix this constraint. As the aim of research is focused on the construction phase of the project, so it was envisaged to get on board all the key players of a project management team from varying civil contracting companies having satisfactory professional experience in different domains of construction industry. The information was assessed by using frequency analysis and in the form of percentages and numeric values.

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This mixed distribution of respondents represents an appropriate involvement of managerial positions in the survey. Figure 01 shows their pie-chart distributions which describe their percentage as primary job function. The data analysis indicates that the feedbacks from senior management are relatively higher (39%) as compared to the other categories of respondents.

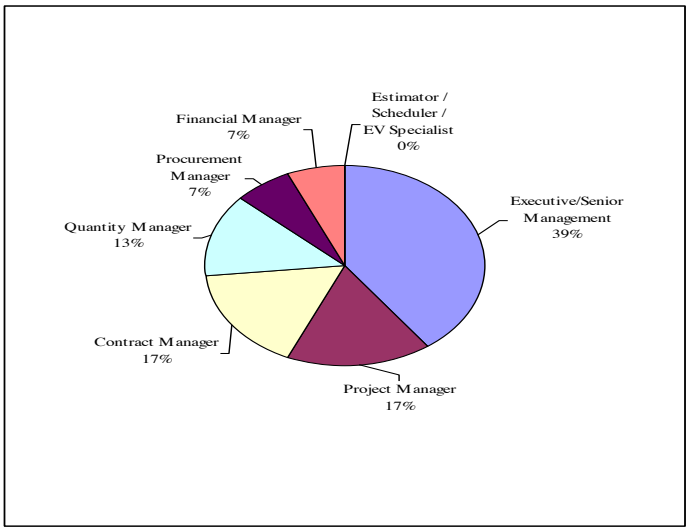

Figure 01. Distribution of respondents primary job function

6.2. Organizations role in projects

The role of organizations involved in construction projects were also sought through the survey. Figure 02 represents pie chart distribution of the participating organizations. The findings show that 47% of the respondents belonged to turnkey contractors. Whereas, participation from the private sector consortiums and non-turnkey contractors remained 23% and 20% respectively. It is noteworthy that inputs from government ministries / public sector clients were relatively very low.

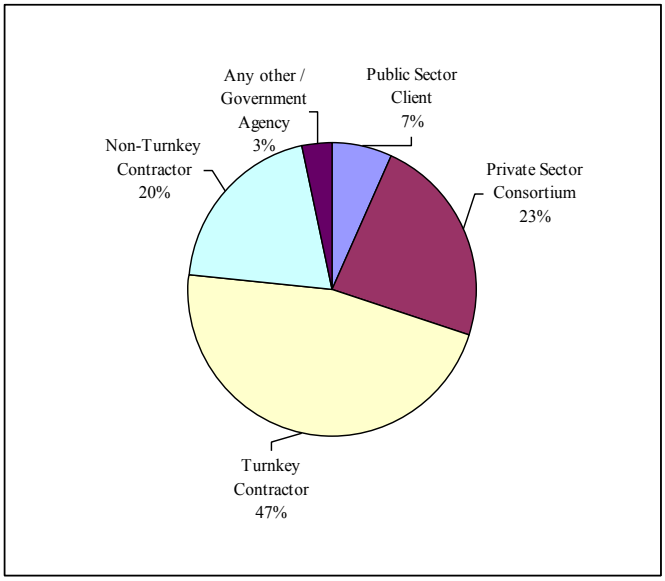

Figure 02. Pie-chart distribution of organization role

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6.3. EVA usage and perception for implementation

The percentage wise distribution for this data is shown Table 01. The response of the questionnaire survey indicated that the understanding of EVA method was already established in the Malaysian construction industry as 23% of the respondents sent their complete feedbacks. However, the survey analysis revealed that the application of EVA method is still in its infancy as 80% of the respondents from public and private sector did not practice the EVA methodology in their working environment. The remaining 20% of the respondents are using EVA method mostly on large scale projects. According to the survey, the current perception of organizations towards the implementation of EVA method is vague. From the findings, 20% of the respondents rated their awareness about the implementation of EVA as 'difficult' compared with the majority i.e. 80% who remain neutral. No organization rated their perception about EVA implementation as "quite easy" or "very easy". This nil percentage shows the respondents unclear view about the processes of EVA system. Based on the analysis, it is also encouraging that 60% of the respondents from the private sector are interested to adopt EVA method within the next five years. This result shows the respondents future inclination towards the EVA methodology. This status of EVA acceptance in Malaysian construction industry is satisfactorily as compared to the other developed countries like USA where 82% of the project manager accept or strongly accept EVA methodology and this ratio is common in both public and private sectors (Kim et. al., 2003).

Table 01. Distribution of EVA usage

S. No.	Respondents	EVA Usage			Total
		Not used at all	Used only for few non- PPPs/PFI projects	Used for large critical/infrastructure projects	
i.	Public sector	3	0	0	3
ii.	Private sector	21	2	4	27
Frequency		24	2	4	30
Percentage		80	6.7	13.3	100

6.4. Enablers for EVA implementation

The respondent's inspirational view towards implementation of EVA in their future practices was also sought in the survey. The results indicate that the respondents generally agree on EVA enablers in improving project performance measurement. Table 02 shows the mean rating ranges between 3.02 and 3.83 which depict the respondent's agreement as "average" and "high" for EVA enablers. The "high" ranking EVA enablers identified by the respondents are as follows.

- It contributes to achieving project schedule objectives
- It provides early warning of performance problems.
- It allows people to communicate objective progress to stakeholders, and keep the project team focused on achieving progress.

In regards to ascertaining current survey agreement on EVA enablers, the results of a similar survey conducted in South African context shows that the participants have mostly "neutral" to "strong" agreement that EVA performance indices contributed positively to controlling scope, schedule, cost and

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managing changes of a project (Vertenten, Pretorius, & Pretorius, 2009). Table 02 represents the results of tests for Kendall's coefficient of concordance (w) and the ranking of the supportive factors of EVA as perceived by all the respondents. Kendall's coefficient of concordance (w) for the ranking of constraints among all the respondents is 0.050 (w). The Kendall's coefficient of concordance is significant at the 0.000 level and therefore it can be concluded that there is a good degree of agreement among the respondents regarding the potential advantages achieved by using EVA method.

Table 02. Ranking of EVA enablers and Kendall's coefficient of concordance

S. No.	EVA Enablers	Mean	Rank
i.	EVA contributes to achieving project schedule objectives.	3.83	1
ii.	EVA provides early warning of performance problems.	3.78	2
iii.	EVA allows objective communication among project stakeholders	3.53	3
iv.	EVA contributes to achieving project cost objectives.	3.47	4
v.	EVA is a cost-effective tool for performance management.	3.37	5
vi.	EVA contributes to improving project scope definition and prevents scope creep.	3.02	6
	Kendall's coefficient of concordance (w)	0.050	
	Level of Significance	0.000	

6.5. Barriers of EVA Implementation in Malaysia

As a part of the survey, the respondents were asked to select the barriers from a list of seven common barriers drawn from literature review. In this regard, the respondents have stated different reasons for the limited usage of EVA method. Table 03 shows the details of number of respondents' assessment for each question. It also contains the average index as well as the awareness assessment of each question. From the Table 03, it is shown that the "Lack of EVA knowledge, expertise and experience" and "Too many rules and requirements to learn and implement" have high average index values i.e. 4.0 and 3.60 respectively and considered as the important barriers. Among other "High cost and time commitment", "Current control system works, no need to change", "Not suitable for your organization" and "Not cost effective to implement" have average level of significance. The low usage and application of EVA method in the Malaysian construction industry is related to significant barriers that inhibit its implementation. In this regard, the average index rating of seven common barriers (drawn from literature review) range between 1.76 and 4.0, indicating that respondents who understand or have used EVA perceive these problems as "low" to "high". Especially, "lack of EVA knowledge, expertise and experience" and "too many rules and requirements to learn and implement" are considered as the important and high ranking problems. These two high ranking barriers were also established in the past research (Kim et. al., 2003). This survey was carried out from the 2500 members of Project Management Institute (USA) and the former Performance Management Association (PMA). According to them, these EVA problems have been considered as "minor" to "insignificant" respectively. This is due to the fact that majority of the respondents (PMI and PMA members) who have participated in that survey was practicing EVA method in their projects. That's why they do not believe in these two "high" ranking EVA barriers as revealed from the current survey of Malaysian scenario. Furthermore, "lack of EVA

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knowledge, expertise and experience" and "too many rules and requirements to learn and implement" were also identified as important barriers and ranked by the respondents as 2nd and 3rd choices respectively in the earlier study (Bower, 2007).

Table 03. Average Index Ranking for EVA Barriers

S. No.	EVA Barriers	Not suitable for your organization	Current control system works, no need to change	Not cost effective to implement	Lack of EVA knowledge, expertise and experience	High cost and time commitment	Too many rules and requirements to learn and implement	Lack of computer and software infrastructure
i.	Not suitable for your organization	1.000	.078	.465**	.151	.211	.071	.268
ii.	Current control system works, no need to change	.078	1.000	.135	.198	.114	-.140	.150
iii.	Not cost effective to implement	.465**	.135	1.000	.438*	.119	-.091	.259
iv.	Lack of EVA knowledge, expertise and experience	.151	.198	.438*	1.000	.164	-.132	-.080
v.	High cost and time commitment	.211	.114	.119	.164	1.000	.358	-.229
vi.	Too many rules and requirements to learn and implement	.071	-.140	-.091	-.132	.358	1.000	.053

The barriers to EVA implementation were also analyzed through correlation analysis by using Spearman's correlation test. It is a non-parametric measure of the strength and direction of association that exists between two variables measured on at least an ordinal scale. It is denoted by the symbol rs (or the Greek letter, pronounced rho). As shown in Table 04, not all independent variables (i.e. EVA barriers) were significantly related to each other. This shows a non-monotonic relationship between the variables. However, among the significant factors, there was a strong, positive correlation between "Non-suitability of EVA" with respect to its "Cost effectiveness" and it was statistically significant at (rs= .465, P = .010). In addition, the cost of EVA validation has also a high correlation with "Lack of EVA knowledge, expertise and experience". This shows that the initial start-up cost to validate EVA can be higher for contractors/users that are new to this approach.

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Table 04. Spearman' Correlation Test for EVA Barriers

No.	EVA Barriers	Not suitable for your organization	Current control system works, no need to change	Not cost effective to implement	Lack of EVA knowledge, expertise and experience	High cost and time commitment	Too many rules and requirements to learn and implement	Lack of computer and software infrastructure
i.	Not suitable for your organization	1.000	.078	.465**	.151	.211	.071	.268
ii.	Current control system works, no need to change	.078	1.000	.135	.198	.114	-.140	.150
iii.	Not cost effective to implement	.465**	.135	1.000	.438*	.119	-.091	.259
iv.	Lack of EVA knowledge, expertise and experience	.151	.198	.438*	1.000	.164	-.132	-.080
v.	High cost and time commitment	.211	.114	.119	.164	1.000	.358	-.229
vi.	Too many rules and requirements to learn and implement	.071	-.140	-.091	-.132	.358	1.000	.053

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

7. Conclusion

The time and cost are the critical parameters that can be monitored to measure the success or failure of a construction project. Any overruns in these performance indicators affect the overall economic viability of the project which is one of the important pillar of sustainable construction. This exploratory study has investigated the current perception level of EVA, its usage and understanding among a group of local construction firms in Malaysia. Based on the results of survey, it was revealed that EVA is relatively a less accepted project performance measurement technique for the Malaysian construction industry. It has a low level of usage as 80% of the respondents are not using EVA at all. The respondents have stated different reasons for this limited usage of EVA in their practices. According to the survey, the lack of EVA knowledge and expertise are the most dominating factors. It was also found that the current perception about the implementation of EVA in construction projects is vague. EVA is still not fully understood by many personnel involved in the construction industry. It is not widely utilised especially for projects in Public Works Department of Malaysia. Thus there is still a long way to go to have it understood throughout the government and private organizations. The results also indicates that about 8% of respondents rated their perception about the implementation of EVA as 'very difficult' compared with the majority of them i.e. 80% who remain neutral. Nevertheless, this technique has encouraged the majority of the construction organizations in Malaysia who are largely motivated with its potential benefits and envisage for using it in their monitoring practices. About 60% of the respondents have shown their interest to adopt the procedures of EVA within next 5 years. In this regard, the primary

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motivation that attracts the respondents is better project monitoring and controlling that can be achieved through EVA.

In order to enhance the acceptability of EVA on a wider scale, there is a need that industry practitioners must be aware with the utilities of EVA that can be derived by this method. Moreover, EVA if adopted, could support the financial sustainability of construction organizations by effectively monitoring time and cost performance measures. Thus, benefits are in direct relation to the successful completion of the project then it may be received by the industry players. This research helped to identify the views of project professionals about EVA as a standardised technique to estimate time and cost. Above all, the applications of EVA and its perception among the Malaysian construction industry support its anticipated usage for time and cost estimates during project execution.

References

Ahuja, H. N., Dozzi, S. P., & Abourizk, S. M. (1994). "Plan Implementation, Monitoring, and Control" in Project Management Techniques in Planning and Controlling Construction Projects, 2nd edition. New York: Wiley, 274 – 277.

Bower, D. C. (2007). New Directions in Project Performance and Progress Evaluation," PhD. thesis, School of Construction, Property and Project Development, RMIT University, Australia.

Endut, I. R., Akintoye, A. and Kelly, J. (2005). Cost and time overruns of projects in Malaysia. Proceedings of the 2nd Scottish Conference for Postgraduate Researchers of the Built and Natural Environment (PRoBE); 17 November 2005, Glasgow, UK.

Fleming, W. Q., & Koppelman, J. M. (2006). Earned Value Project Management. 3rd edition, Project Management Institute, USA.

Kim, E., Wells, Jr. W. G., & Duffey, M. R. (2003). A model for effective implementation of Earned Value Management methodology, International Journal of Project Management, 375 – 382.

Kwon, O., Kim, S., Paek, J., & Eom, S. (2008). "Application of earned value in Korean construction industry – a case study," Journal of Asian Architecture and Building Engineering, 7, 69 – 76.

Mohamad, R. (2003). "The need for systematic project management in construction industry Malaysia," Macro works. [Online]. Available: http://www.straits-engineers.com/publications.html

Ministry of Finance Malaysia. (2009). Treasury Circular No. 8. http://www.treasury.gov.my, accessed 15 September 2015.

Putz, P., Maluf, D. A., Bell, D. G., MGurram, M. H., Hsu, J., Patel, H. N., & Swanson, K. J. (2007). "Earned Value Management at NASA: an integrated, lightweight solution," presented at IEEE Aerospace Conference, Montana.

Project Management Institute. (2013). A Guide to the Project Management Body of Knowledge, 5th edition.

Seshadri, P. (2009). "rEVaMp: Risk Elicited Earned Value Management Procedure – A Systematic Framework for Accounting for Project Uncertainties," MSc. thesis, Dept. of Engineering and Management., Massachusetts Institute of Technology, USA.

Salunkhe, A. A., & Patil, R. S. (2014). Effect of construction delays on project time overrun: Indian scenario. Int. J. Res. Eng. Technol, 3, 543-547.

The Auditor General of Malaysia. (2009). Synopsis on the audit of the federal government's financial statement, financial management and activities of federal ministries/ departments and management of government companies 2008. National Audit Department Malaysia, Putrajaya.

Vertenten, M., Pretorius, L., & Pretorius, J. H. C. (2009). Earned value as a performance measurement tool for small and large construction projects in a South African Environment, presented at IEEE AFRICON, Kenya.

Zhu, K. and Lin, L. (2004). A stage by stage factor control framework for cost estimation of construction projects. Paper presented at the Owners Driving Innovation International Conference, Queensland, Australia.