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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. The traditional approach of project time and cost performance measurement is generally based on direct monitoring in which there is a split-up between them. Both of these parameters are measured and reported in isolation with each other by comparing their planned and actual values. Therefore, the traditional monitoring approach does not truly relate the time versus cost performance of the project. Furthermore, this approach is not so much efficient to provide early warning indicators and forecast future performance trends. As a remedy of these limitations in traditional monitoring practices, Earned Value Management (EVM) methodology integrates the work scope, cost and schedule to enable effective project performance measurement. EVM is based on three data sources and is able to compare the budgeted value of work scheduled (PV) with the Earned Value (EV) of physical work completed and the Actual Cost (AC) of work completed. Hence, performance data achieved by using EVM is an objective measure of actual work performed and can be used for the future performance analysis and forecasting. Due to these advantages, this study has proposed EVM method and extends its knowledge and applications for the Malaysian construction industry. The proposed study is based on a mixed methodology that incorporates both quantitative and qualitative methods and is designed into three phases. The first phase is based on a quantitative survey that aims to obtain a perception, understanding, barriers and enablers of EVM method for the local construction industry. The second and third phases will subsequently employ qualitative data collection and analysis of EVM applications through case studies and semi structured interviews. The questionnaire feedbacks were analyzed by using statistical tools such

as frequency analysis, cross-tabulation, average index analysis, spearman's correlation and Kendall's coefficient of concordance to establish findings. This survey reveals that although the EVM methodology is recognized by the practitioners of local construction industry, nevertheless it is not very much in use. As 80% of the respondents are not practicing EVM method in their working environment. The survey has identified the "lack of EVM knowledge, expertise and experience" as the most important barriers. The study has found that there is a good degree of agreement among the respondents regarding the potential enablers of EVM method. The analysis of descriptive case studies explores the applications of EVM in different project scenarios. The study has also determined from the perspective of construction experts that EVM methodology would facilitate the clients and contractors in terms of integrated cost, schedule, and technical performance measures. The overall findings of this study support the application of EVM as a standardized project control method for the Malaysian construction industry.

ABSTRAK

Pengurusan projek pembinaan semakin mencabar bagi jurutera awam dalam abad ke-21 ini kerana ekspektasi prestasi semakin kompetitif dari pihak yang berkepentingan saham projek. Namun, di antara penunjuk prestasi kewangan dan bukan-kewangan, masa dan kos pemantauan, projek pembinaan menjadi isu kritikal dalam pengurusan projek yang berkesan. Pendekatan aplikasi konvensional (tradisional) terhadap jangka masa sesuatu projek dan kos pemantauannya secara umumnya bergantung pada pemantauan terus di mana terdapat pemisahan di antaranya. Kedua-dua parameter ini diukur dan dilaporkan secara berasingan dengan membandingkan angka nilai asal (kiraan) dengan nilai sebenar. Oleh itu, pendekatan tradisional ini kurang menunjukkan prestasi sebenar terhadap masa dan kos projek. Seterusnya, teknik ini kurang cekap untuk memberikan penunjuk amaran awal dan trend anggaran prestasi masa hadapan. Oleh kerana batasan yang terhad itu, kajian ini telah mengemukakan kaedah *Earned Value Management (EVM)* menggabungkan skop kerja, kos dan jadual untuk merealisasikan projek mengukur prestasi ini efektif. Kaedah *EMV* dirangka berdasarkan kepada 3 sumber data dan ia mampu untuk membandingkan antara *budgeted value of work scheduled (PV)* dengan *Earned Value (EV)* daripada kesempurnaan kerja-kerja fizikal dan juga *Actual Cost (AC)* daripada kerja yang sempurna. Data prestasi yang diperolehi menggunakan *EVM* merupakan objektif kayu ukur terhadap keseluruhan kesempurnaan kerja tersebut. *EVM* juga boleh digunakan untuk menganalisis dan membuat ramalan terhadap data tersebut di masa akan datang. Dengan kelebihan tersebut, kajian ini telah mengemukakan kaedah *EVM* dan mengembangkan kajian ilmu pengetahuannya beserta pengaplikasiannya untuk industri projek pembinaan di Malaysia. Kajian yang dikemukakan adalah berdasarkan campuran kaedah yang menggabungkan kedua-dua kaedah kuantitatif dan kualitatif, di mana ia direka bentuk menjadi 3 fasa. Fasa pertama adalah berdasarkan survei kuantitatif untuk mendapatkan respon terhadap persepsi, kefahaman, halangan-halangan beserta kelebihan menggunakan kaedah *EVM* untuk industri tempatan. Fasa kedua dan ketiga menggunakan data kualitatif

dan analisis kepada aplikasi EVM terhadap kajian kes beserta temuduga separa berstruktur. Maklumbalas responden dianalisis dengan menggunakan alat statistik seperti *frequency analysis*, *cross-tabulation*, *average index analysis*, *spearman's correlation* dan *Kendall's coefficient of concordance* mengukuhkan penemuan. Survei ini menunjukkan bahawa metodologi *EVM* masih belum banyak diaplikasikan di dalam industri pembinaan tempatan. 80% responden tidak mengaplikasikan kaedah *EVM* di dalam lingkungan kerja mereka. Keputusan dari kaji selidik ini menunjukkan bahawa ilmu pengetahuan, kepakaran dan pengalaman mengenai *EVM* masih kurang. Kajian ini juga mendapati bahawa responden bersetuju dengan kelebihan dan kepentingan menggunakan kaedah *EVM*. Analisis ini juga telah mengembangkan aplikasi *EVM* di dalam pelbagai senario projek berbeza. Kajian ini juga telah mendapati bahawa ahli-ahli pakar di dalam bidang *EVM* ini akan membantu klien dan kontraktor untuk proses mengukur gabungan kos, jadual dan aplikasi kaedah ini. Secara keseluruhan penemuan kajian ini mendapati ia menyokong aplikasi *EVM* sebagai kaedah kawalan standard untuk industri pembinaan di Malaysia.

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