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An Overview of Construction Performance Measurement Toward Productivity Improvement

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Abstract

The awareness of construction performance measurement which involves setting new operating targets and standards has been raised among majority of construction organizations. This is so because of the ever-increasing requirements and expectations of the clients which necessitated continuous improvement in the cost, timing and quality of construction output. Productivity as an important issue in any industry can only be improved when the effect of changes applied on method, effort and system that can be measured. This paper reviewed internal performance measurement which makes a construction organization focuses on identifying improvement areas within its structure through comparing its business operations with others who do it better, through setting new targets to meet. The paper identified key performance indicators of internal performance measurement which include; time, cost, quality, client satisfaction, effective communication, safety and health and risk management. Lastly, the paper reviewed external performance measurement which makes the construction industry as a whole attempt to improve its productivity through designing tools and techniques applicable to construction. The paper concluded that, in order to improve construction performance, it is essential to have accurate measurement reflecting current trends and practice toward effective productivity. The construction industries should effectively take up internal performance measurement and be more open to external performance measurements that have been successful in other industries and assess if adaptable to construction projects.

Keywords: *Construction Performance, Performance measurement, Productivity improvement*

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Background to the Study

The construction industry deals with different key players who have massive effects on a nation's economy. These players include; consultants, clients and contractors, the roles play by stakeholders in the construction industry have effects on the performance of projects (Auma, 2014). The construction industry is one of the important economic sectors in the world, which bring opportunity as a source of employment for about 70% of the labour force, promoting the countries national economy (Amusan, 2016). In developing countries, efficient construction projects through deploying necessary performance criteria such as cost time and quality can contribute a solid platform for reviving the its economy, and for building a more balance and independent economy especially during stable political and economic conditions (Helen *et al.,* 2015).

In addition, performance of construction projects can be improved through knowledge in the construction industry, where men, materials, machinery, money and management work together to build a facility. This is because the capability in terms of efficient labour will be increased which in turn produce a quality facility that will satisfy the owner (Amade *et al.,* 2005). Furthermore, there is need for the construction industry to lay much emphasis on performance of construction project by focusing on the key factors bedevilling cost, time, quality, client satisfaction, productivity and health and safety performance, with the aim of counteracting its effect to the project construction (Jiboye, 2011).

Performance

According to Henry (2012), performance is defined as the measure of the ability of contractors to execute work on time, cost and quality. There are numerous aspects to performance, and the purpose of getting most from the system is to keep each of the components in the same level, not allowing any of the operations to be delayed. Appelbaum *et al.* (2015), further defines performance as a successful achievement of an assigned undertakings measured against pre-set known recognised excellent of accuracy, accomplishment and within cost and time. In addition, the performance of construction project achieved its requirement, when it freed the contractor from all liabilities under the contact. Moreover, project performance is defined as attainment of estimated cost and time objectives while conforming to a project specification. Planning, formulating and implementation of complete strategic management practice in construction firms accelerate the rate of performance by ameliorating effectiveness, flexibility and efficiency (Dzeng and Wen, 2005). To perform is to take a complex series of actions that integrate skills and knowledge to produce a valuable result (Romero *et al.,* 2014). Project performance has been defined as the degree of achievement of certain effort or undertaking which relates to the prescribed goals or objectives that form the project parameters (Al-Dhaafri *et al.,* 2013).

Theory of Performance

According to Auma (2014), theory of performance contributed six (6) foundational concepts that form a process which can be used to explain performance and performance improvements. Developing performance is a journey, whereby level of performance describes location in the journey (Golini *et al.,* 2014). However, current level of performance depends holistically on six (6) components which include; context, level of knowledge, levels of skills,

level of identity, personal factors, and fixed factors (Romero *et al.,* 2014). These levels of performance are proposed for effective performance improvements through a performer's mindset, immersion in an enriching environment, and engagement in reflective practice.

Key Performance Indicators (KPIs)

According to Ali *et al.* (2013), Key Performance Indicators (KPIs) is defined as a gathering of measured data to examine the rate of performance of activities. In addition, Key Performance Indicators (KPIs) are instruments that the head of organisation uses to evaluate the performance of worker base on the specific activity. However, these assessments measure the actual and estimated performance based on efficacy, quality of workmanship and effectiveness. The aim of KPIs in project construction is to provide evaluation of project's and company's performance in the entire construction process (Iyer and Jha, 2005). In addition, the information obtained can therefore be utilised for benchmarking purposes, and will be regarded as an important ingredient toward achieving the company's best practice (Horta et *al.,* 2009).

Construction projects are unique in nature and involve different activities and handling process in one way or another. This often led to problems for even the most skilful project managers (Pheng and Chuan, 2006). Therefore, project performance can be measured by using a different number of performance indicators that could be related to different aspect (groups) such as time, cost, quality, client satisfaction, client changes, business performance, health and safety (Akanni *et al.,* 2015). Cheung *et al.* (2004) enumerated various key performance indicators groups affecting project performance such as time, cost, quality, client satisfaction, client changes, and safety and Health. Iyer and Jha (2005), argued that cost, time, quality, productivity, client satisfaction, safety and health, people, innovation and learning and environment as a key indicators main group affecting performance.

Performance Criteria of Construction Project

According to Idrus *et al.* (2011), the concept of construction project performance is regarded as criteria for measuring the success of project outcome and it depend on the construction companies to select what they anticipated would provide the best to sustain their construction activities now and in future. Thus, it is essential to know which of the criteria the project parties should be adopted in practice during project execution to examine the performance of their construction projects. Hence, the outcome of the evaluation will be used by the project parties to enhance performance while attaining the success of the project (Egemen and Mohammed, 2006). Ajeet *al.* (2009) identified the following as construction project performance criteria:

Project Team Relationship

According to Pheng and Chuan, (2006), project team is defined as a group of people where their individual members have willingness to work as a team in order generate the required result by using the parent's organisation resources. In addition to this, human factor was found to be worthy in sustaining the performance of construction project. Moreover, attitude of employees has important impact toward achieving individual task performance in construction organisation. Motivation of employees and recruitment of competent staff play

an important role in attaining the performance of an organisation (Mamman and Omozokpia, 2014). Inadequate skills of manpower, insufficient supervision and lack of site management, unsuitable leadership, inadequate and breakdown of equipment among others were regarded by (Pheng and Chuan, 2006) as factors that deserved to be given attention during execution of project. However, they are the same factors contributed to delays especially in the United Arab Emirates.

Construction Time

Pheng and Chuan (2006), remarked that people, cost, time, quality, health and safety, environment, client satisfaction and communication as a major criterion that should be given much priorities in order to attain the project objective. According to Memon *et al.* (2012), unavailability of resources, insufficient planned time of construction, and supply of the defective materials are among the factors contributed to delay during project execution. Moreover, site preparation should be carried out ahead of project commencing, so that not to alter the planned time or sequence of operations during construction of project (Sweis, 2013). Ahadzie and Olomolaiye (2008), established that quality and attitude to service are some of the key factors constraining successful project delivery in South Africa. Aje *et al.* (2009) argued that construction time is very essential as it usually form a basis for crucial benchmarking in evaluating the performance of construction project and the effectiveness of project firm.

Management Capabilities

Capability Management is an approach to the management of a firm based on the theory of the organisation, especially a business organisation or construction firm. It is a gathering of capabilities that may be utilised to gain income return on investment in the market perspective and make the firm to have competitive advantage over their rivals (Belov, 2013). Capability Management is striving to manage the available capabilities within the organisation with the aim of ensuring maximum consideration is given to its status in the firm and its on-going advantage and survival (Simon *et al.,* 2013). According to Forbes and Ahmed (2010), modelling and simulating of realistic strategic, scenarios and contexts from others have been helpful to management capability in construction organisation particularly in handling business process and decision making. Through these considerations and practices, the company and its performance can be incessantly evaluated and projected into the future.

Complexity of Project

Carter and Smith (2006) remarked that, majority of the large and complex construction projects are associated with significant cost and schedule overruns. The complexity of a project is increasing as project size increases. Therefore, the rate of complexity in projects during construction is based on a magnitude of project. It often leads to difficulties in the coordinating contractors (Wang and Huang, 2006). However, in rating the success factors criteria, project managers in project that has enormous complexity in comparison with project of average complexity. It was found that in projects of average complexity managers were rated significantly higher importance than a project of medium complexity and especially on their own performance criteria and achieving customer needs (Muller and Turner, 2007).

Job Condition Related Variables

According to Pheng and Chuan (2006), enumerated the criteria under the job condition related variables that are involve during construction of projects which required much attention such as team relationship, wages, job satisfaction, cost control, job security, working hours and adequacy of architectural drawings. Moreover, attitude of employees and Leaders, recruitment of competence employees and development, motivation of employees as well as attitude of employees were regarded as criteria for employee's performance during execution of project (Khan *et al.,* 2014).

Time Availability

Availability of time in construction of project according to Yang (2013), can be defined as the availability of time required to execute the allotted task within the schedule. Time is a resource that cannot be seen or touch because of its unique and finite in nature, proper utilisation of time is an important practice to the firms that can contribute toward successful completion of project within the stipulated duration (Yang, 2013). Project construction can only achieve the time performance when the planned time is sufficient, proper planning and adequate resources are put in place (Moura *et al.,* 2007). Therefore, any project that fails in terms of planned time of construction is failed in performance. Time, cost and quality are referring to as golden triangle which regarded as some necessary criteria toward achieving project performance as it was always included in any project performance assessment (Idrus *et al.,* 2011).

Materials and Supplies of Project

According to Omoregie and Radfort (2005), material procurement is an important activity in the construction industry that consume much productive working time, material and supplies affect the time performance of construction since it often takes longer time during construction of projects. Moreover, shortage of materials, fluctuation price of materials, and unavailability of resources and supply of defective materials were regarded as factors affecting both cost and quality during project execution (Enhassi *et al.,* 2009).

Standard of Quality

According to Schwalbe (2013), project quality management is a practice which when employ will convey the project to the promise land by meeting its intended purposes. Conversely, failure for a project to achieve the standard of quality required, project is said have been failed in performance. Construction of projects is also anticipated to achieve standard quality despite the incessant challenges of performance in the construction industry. Conformance to specification, proper monitoring and feedback and adequate involvement of owner during construction are among the major criteria for quality performance that need much attention in order to overcome challenges associated with project quality (Iyer and Jha, 2006).

Relationship with Clients

Maintaining good relationship with client is one of the performance criteria of construction project. Securing client is an evidence of a good performance. It is a business strategy that is used to maintain and sustain long-term client relationships (Maister, 2007). According to Bolton and Tarasa (2007), companies are incessantly laying emphasis on managing customer

relationships, the customer asset, or customer value. In addition, Customer Relationship Management (CRM) specifically acknowledged the long-run degree of firm's potentiality which plays a prominent role in increasing income return of an investment, profits, and shareholder value through goal of marketing operations directed toward developing, maintaining and improving fruitful and effective company-customer relationships. Since revenue or return on investment is absolutely a basis for evaluating the firm performance and it depend on the management of relationship with customers (Maister, 2007). Therefore, without a thorough knowledge of how the relational management procedures between the firm and customer cannot be sustained, success from Customer Relation Management (CRM) initiatives will be rarely seen (Akerlund, 2005).

Strategies to Improve Construction Project Performance

There are several strategies that can be recommended to be used by both contractors and consultants in order to overcome or mitigate the effect of poor performance during projects execution. These are; time management practice, quality management practice, cost management practice, client satisfaction management practice, safety management practice, risk management practice and effective communication practice.

Time Management Practice

According to Memon *et al.* (2014), time improving practice involves proper planning work closes monitoring and committed to leadership and management, which required to be deployed during execution of project to avert the occurrence of time overrun. However, completion of project within the stipulated time is often considered by clients, contractors, and consultants as a major criterion toward achieving project performance (Bowen *et al.,* 2012). However, it is apparent that effective time management in entire project management concept is all about planning, scheduling, monitoring, control, and reporting as well as conducting decisions on what need to be changed and their implementation during construction of project (Kerzner, 2013).

An effective time management that consists of establishment of the planned sequence of works, application of logic to planned activities and estimating the duration of planned activities play an important role during construction of project because it manages the risk of the delayed completion project (Chin and Hamid, 2015). Moreover, time management practice is needed during construction to maintain proper allocation of time in carrying out project construction throughout the entire successive stages of its natural life-cycle, (i.e., concept, development, execution, and finishing) by means of a number of processes of time planning, time estimating, time scheduling and schedule control (PMBOK Guide, 2008).

Quality Management Practice

According to Auma, (2014), quality improving practice that are found worthy while execution of projects is; quality of workmanship, proper sampling and testing, and maintaining sequence of construction. In addition, for adequate quality of workmanship to achieve, it is necessary for the workers to exhibit commitment by adhering to quality standard. Elghamrawy and Shibayama (2008), identified customer focus, team work, continuous improvement, management commitment, partnering, employee involvement and effective communication

as important focal points of Total Quality Management (TQM). However, quality management practice in construction is a distinct feature that needs to be given much attention in any construction work. It is regarded as holistic approach to manage a project, and it pays in ensuring effort to achieve and improve the required standard of quality through well planning and organising of projects so as to obtain customer's satisfaction, provides value for money and fit for purpose. Quality management process needs to be implemented in the entire project lifecycle of any project in order to achieve the desired level of quality as planned. Tang *et al.* (2016) remarked that, the purpose of quality assurance and control in construction of project is to quest for successful achievements of all quality requirements in order to attain a desired result at the end of the project construction by ensuring adherence to the actual design and planning decisions, technical and project specifications, codes and standards and statutory stipulations.

Client Satisfaction Management Practice

Client's management practice involves meeting project deadline, within the estimated cost and achieving the quality needed. Therefore, it is necessary to ensure that, the project is closed out within the stipulated time in order to avoid cost escalation, and hence satisfy client's objectives (Bowen *et al.,* 2012). Furthermore, client satisfaction is achieved through improvement of quality which will result to superior product and service quality. Maintaining the quality during construction of project is found worthy to a company by obtaining competitive advantages through satisfying customer needs when delivering quality product to the market place (Leong *et al.,* 2014). Moreover, quality improvement effort during construction will lead to a higher product and service quality, which will contribute toward improving customer satisfaction (Egemen and Mohamed, 2006). They further argued that implementation of Total Quality Management (TQM) is positively associated with homebuyer satisfaction. According to Karna *et al.* (2004) effective implementation of agreed quality assurance procedures such as; use of quality material and adherence to specification is an important aspect of quality management in construction industry.

Safety Management Practice

According to Hassanein ***et al.***(2007), safety orientation and training is regarded as safe work procedures to all workers and particularly to new entrants toward safety work in construction. It must be ascertained that workers do use safety devices and follow safe procedures of work. In addition, retraining and reorienting workers to use safe work procedures contributes directly to safer site performances. Management and planning during project construction is one the necessary tasks to be considered when avoiding unplanned events. Since accidents are unplanned events, an effective safety management can help avoid job injuries. Safety management should be carried out thoroughly, and must be enforced to all categories of the job right from initial stage of the project up to the time last worker will vacate construction site at the completion of the project. Risk Management Practice

According to Banaitiene and Banaitis (2012), effective risk management is an essential element leading to success of management strategy. The advantage of implementing effective risk management involves recognising and analysing the risks, improvement of construction process and efficient utilisation of resources to achieve project performance (Eskesen *et al.*,

2004). Moreover, Nieto-Morote and Ruz-Vila (2011) remarked that, effective risk management practice facilitates achieving success in projects construction; it involves risk identification, risk assessment, risk response and risk monitoring and reviewing. In order to achieve project objectives, the portfolio of risks connected with all players throughout the project life cycle should be given utmost consideration (Cleland and Gareis, 2006).

Cost Management Practice

Managing construction cost effectively is one of the essential undertaken toward a successful project completion. Cost management process is regarded as a necessary activity during project execution because when properly adopt, it will ensure that the existing planned design and procurement of a project in respect of cost of construction achieve value for money and clients' target (Potts and Ankrah, 2014). According to Memon *et al.* (2012), the cost management practice required to be given attention for managing the budget of project are; proper project planning and scheduling, effective site management and supervision, frequent progress meeting and effective strategic planning. They further added that, effective site management and supervision is a cost management practice that involves planning, organizing of resources as well as controlling the productivity and progress of employees toward executing the project within a budget (Memon *et al.,* 2012).

Effective Communication Practice

According to Dainty and Murray (2007), establish clear lines of communication; choose the most effective communication method for your team and make concise, clear communication points to get team members understood are regarded as strategies to improve communication during construction of project. However, effective communication is vitally important for maintaining the support and commitment of all members in the organisation. Effective communication with all members of the project team is necessary in order to achieve project success (Yang *etal.,* 2009). According to Westland (2007), project managers should have skills of negotiation and communication and ability to manage individual stakeholder's expectations and generate an important culture change throughout the organisation with aim at achieving project performance.

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 reviewed paper, is a topic of contemporary research. 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.

Recommendations

It is evident that, for a project to achieve golden triangle, there is need for project parties to focus on meeting the stipulated time, cost and quality requirement. It has become necessary to improve construction project performance in developing countries. This could also grant the construction industry the ability to extend beyond the current state of GDP's contribution to many nations. Therefore, the following recommendations were put forth:

i. In order counteract the effect fluctuation of price of material during construction of projects, it is recommended that, contractor should strive hard to ensure that project deadline is not exceeded, so that to avoid fluctuation of material price that can leads to variation and fluctuation claim.
ii. Consultant of a project should intensify effort particularly on monitoring and feedback in order to ensure that specification given in a particular project is completely adhered to.
iii. A standard material with reference and catalogue number of the company specified to be used should be procured, erected and installed by the contractor under the supervision of consultants in order to avoid rework and time overrun.
iv. Due process office of procurement unit should re-energize their effort in supervising the procurement activities in the construction industries, and to enforce the use of code of ethics while selecting the contractors.
v. Human resources play a prominent role toward achieving quality and productivity performance of construction project. It is therefore recommended that; the productivity of human resources should be enhanced in the construction industry through proper and continuous training programs to improve employee's performance.

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