A Review of Factors Affecting Construction Labour Productivity in Developed and Developing Countries

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Abstract:
The construction industry remains a major player in the economic development of any nation. As a result, a number of studies have addressed construction productivity over decades. However, schedule overruns, cost overruns, and quality challenges remain the recurring issues that impair the optimum performance of the construction sector. This paper reports on a survey of the literature constrained in terms of selected construction productivity research conducted during the last twenty-nine years. The findings obtained in the articles reviewed are presented under related headings to determine the frequency of each factor. The study determined that management-related, design-related, and material-related factors are the underlying issues influencing construction productivity in developed and developing countries. The study presents the need to measure the impact of productivity-influencing factors against each of cost, quality and time as this has been unheeded in construction labour productivity related research. Subsequently, a review of the existing body of knowledge in terms of the factors influencing construction labour productivity across developed and developing countries is presented. It is concluded that improved construction labour productivity will engender cost effective, quality, and timeous project delivery to increase construction stakeholder satisfaction. This will ultimately improve the contribution of the construction industry to the Gross Domestic Product (GDP) in both developed and developing countries.

Keywords: construction, labour, overruns, productivity, quality

1 Introduction

In the global construction sector, labour productivity has a major effect on a nations' economic development (Chia *et al.,* 2014). As such, the construction industry plays a strategic role in the economic development of developed and developing countries (Kazaz *et al.,* 2008), although the factors influencing construction productivity in developed countries differ from those of developing countries (Alinaitwe *et al.,* 2007). Due to the significant contribution of construction operations to the economic activities of developed and emerging economies, a number of studies have addressed factors affecting construction productivity in the construction industry. In spite of these studies, the construction industry continues to grapple with the challenges of schedule overruns, cost overruns, and challenges related to the quality of construction, which constitute part of the essential project objectives for successful project delivery. These essential project objectives drive construction stakeholder satisfaction and therefore, their performance is fundamental to the performance of construction projects. In simple terms, schedule overruns, cost overruns, quality of project delivery, and the non-satisfaction of stakeholders are significantly related to poor productivity in the construction sector. As such, the importance of construction labour productivity to achieving construction project goals necessitates the need for a considerable effort to salvage the deteriorating state of labour productivity in the construction environment. The extant studies relative to construction productivity have broadly explored critical productivity-influencing factors, however, there is

still much to be done to improve labour productivity in the construction industry. Sezer and Brochner (2014) maintain that official statistics have proven productivity in the construction industry to grow more slowly than productivity in the manufacturing industry. In view of this, researchers have proposed diverse interventions relative to their findings. However, it becomes almost impossible to deliver a construction project without overrunning its predetermined budget and schedule. Although the complexity of the construction sector in terms of its multi-disciplinary nature is a contributing factor to this poor project performance. Notwithstanding, the economic impacts of construction on project participants, the business of construction and nations necessitate the need for more scientific research to mitigate the negative effect of poor productivity in the construction industry. Essentially, the existing productivity related research have not considered measuring the critical factors influencing labour productivity against each of construction cost, quality, and time. Measuring the impact of construction productivity-influencing factors on each of these project objectives will reveal the relationship of the productivity-influencing factors and the project objectives. Thus, the question of which productivity-influencing factors have more impact on each of cost, quality and time will be answered to allow for further interventions. However, this research question will be best answered through a measurable quantitative approach rather than qualitative means. The main objective of this study, therefore, is to present the review of extant literature relative to factors influencing construction productivity in developed and developing countries to determine the significant productivity-influencing factors.

2 Literature Review

2.1 Labour productivity

Productivity is a multi-dimensional concept that could be understood in different contexts depending on the objectives involved; the objective, in turn, defines the parameters required in its assessment in relation to the benchmark used for its comparison (Durdyev & Mbachu, 2011). The phenomenon is not the measurement of the specific contribution of labour as a single production factor, however, the term depicts the combined effect of materials, tools and equipment, capital investment, managerial skills and the effect of the construction workforce (cidb, 2015). Owing to the growing knowledge that productivity improvement is an essential tool to sustain a thriving economy, assessing productivity is becoming more vital to economists and policy makers of industries (Fadejeva & Melihovs, 2009). One of the most significant factors that determine the entire performance level of organisations, regardless of its size, is the productivity level of organisations (Kazaz & Ulubeyli, 2007). In essence, poor productivity will adversely affect an economy as organisation systems and structures become ineffective (Van Ark, 2014). Most commonly, productivity is widely expressed as the ratio of output to input or vice-versa (Enshassi *et al.*, 2007; Park *et al.*, 2005; Phusavat, 2013), where both output and input are mostly expressed in cost (Rivas *et al.*, 2011). However, in the simplest sense of the word, productivity implies the period of time spent by an employee who is actively involved in a job being hired to do for the underlying purpose of producing the *desired outcome* based on *the predetermined job description* (Ferreira & du Plessis; 2009; Teng, 2014). The ability to satisfy the condition of time in producing the required or predetermined job description by considering necessary requirements forms the baseline for determining productivity. The subject is used as a determinant factor of how best the resources available are being utilised for necessary decisions to be made within an organisation (Phusavat, 2013). Consequently, the level of productivity of an organisation significantly depends on the way its production processes are organised and coordinated (Caliendo & Rossi-Hansberg, 2012). Although, the subject has become a common term that is widely employed by individuals and organisations

with different knowledge and perceptions in terms of its meaning (Tangen, 2005). Holistically, individual or group productivity is said to increase when the said individual or group produce(s) more or better goods or services from the usual resources, or produce the same goods or services from lesser resources (Tangen, 2005). Teng (2014) considers an increase and loss in organisation productivity and therefore remarks that increased organisational outputs relative to reduced corresponding inputs leads to improved productivity and vice-versa. Durdyev *et al.* (2014) maintain that much significance is accorded to productivity due to its relevance to organisation performance, its correspondent impact on the economy, and general standard of living. Productivity has been widely categorised into two forms: (i) Partial factor productivity (PFP) or single factor productivity (SFP) - considers single or selected input of an organisation and, (ii) Total factor productivity (TFP) or multi-factor productivity (MFP) – considers all organisation inputs and outputs (Jarkas, 2015). Notably, there are a considerable number of input resources in the production process of an organisation. Workers play a significant role as they determine the amount of goods produced within per labour unit of an organisation (Bures & Stropkova, 2014). Chau (2009) note that labour productivity as single factor productivity is a biased measure of productivity as long as there are other inputs that are ignored. Chau (2009) state the need to compare organisation output to its inputs in order to determine the actual organisation productivity. Park (2006) contends that TFP is commonly employed in economics studies and has proved to be the sustainable source of long-term economic growth (Van Ark, 2014). Considering the complexity of the construction industry, total factor productivity might be challenging as identifying all the input resources for construction operations may be unrealistic. Certainly, construction productivity-influencing factors further influence the conventional project objectives at varying magnitudes. However, the magnitude of the impact of productivity-influencing factors on each project objective would better be quantitatively determined.

2.2 Construction project schedule

Exceeding the date of project completion as specified in contract documentation, or exceeding the agreed delivery time determined by the parties to the project, stems from different forms of delay during project executions (Assaf & Al-Hejji, 2006). Project managers are saddled with the responsibility of ensuring that activities are delivered as previously scheduled (Sambasivan & Soon, 2007). However, delays have become a common experience during the delivery of construction projects (Kaliba *et al.*, 2009; Borse & Khare; 2016; Sambasivan & Soon, 2007). Josephson and Chao (2014) determined that non-value adding time (waste) constitutes approximately 35 % of the available time between activities, while the time spent on value adding activities is significantly less. Borse and Khare (2016) attribute the underlying causes of delays on construction projects to factors such as design errors, unexpected site conditions, increases in project scope, weather conditions, and other project changes. Lack of proper tools and equipment leads to an unproductive time of employee which is a direct consequence of inappropriate site preparation, the unwillingness of company to purchase quality tools and equipment and poor financial capacity of the company (Ghoddousi & Hosseini, 2012). Sambasivan and Soon (2007) note that inadequate experience of contractors affects construction project delivery time. Aibinu and Jagboro (2002) maintain that contractors and clients jointly or separately contribute to delays on construction projects. The different forms of delay that slow down the pace of construction operations include: (1) Excusable delays – these are delays resulting from unforeseen factors outside the control of contractor and are not attributed to their negligence (Akinsiku & Akinsulire, 2012); (2) Non-excusable delays – the contractor is responsible for this category of delay, and (3) Concurrent delays - delays that

occur simultaneously with other delays, which could contribute to the formation of other delays (Arditi & Pattanakitchamroon, 2006).

2.3 Cost overruns

Cost overrun denotes escalation in the amount of money required to deliver a project considering the original budgeted amount (Kaliba *et al.,* 2009). Memon *et al.* (2011) identify cost as a major consideration during the project management life cycle and can also be considered as one of the essential parameters for achieving project success. The effective implementation of a construction project by keeping the execution under the control of the predetermined cost is, however, reliant on an approach that requires sound engineering judgement (Enshassi *et al.,* 2010). Despite the awareness of the need for cost control, it is not uncommon to see a construction project unable to achieve its objective relative to effective cost delivery (Memon *et al.,* 2011). Successful organisations, therefore, adopt policies to develop a long-term cost effective business. Through prioritising the reduction of defects and disturbances related to the project, several organisations expand their chances to oversee the processes in order to reduce production cost (Josephson & Chao, 2014). Enshassi *et al.* (2010) note that overrunning construction budget is predominant in the traditional or adversarial form of contract, where the contract is awarded to the lowest bidder particularly in developing countries. Memon *et al.* (2011) maintain that the trend of cost overrun is more severe in developing countries where the phenomena occasionally exceed 100 % of the anticipated cost of the project. Borse and Khare (2016) remark that the occurrence of construction cost overruns is usually as a result of friction between clients, project managers, and contractors. Inadequate allocation of funds and poor financial management by contractors are some of the underlying causes of budget overrun on construction projects. Sun and Meng (2009: 566) maintain that rework contributes to cost escalation through wasted labour and materials.

2.4 Quality in construction

Quality improvement is one of the important subjects of discourse in virtually all sectors (Forsythe, 2015). According to Alinaitwe *et al.* (2007), quality is an essential parameter for assessing construction project performance. Productivity does not only have to do with completed task(s) over a period of time but also the quality of task(s) completed i.e. task(s) completed in compliance with the specification. A poorly undertaken activity would attract additional time and cost to rework such activity. As such, productivity determinant measures should consider the quality of outputs. Therefore, it is safe to conclude that workers who have completed their tasks at the required time but without the required quality are not productive. Construction organisations, workers, and the general public have lost billions of dollars due to the compromising of the quality of work (Loushine, *et al.,* 2006). Dudek-Burlikowska (2011) note quality as an important tool in market competition, as it serves as a dependable license of obtaining the loyalty of the customer. The act of meeting the expectations of customers or compliance with customers' requirement is simply termed quality (Iyer & Jha 2005). Alinaitwe *et al.* (2007) posit that some construction contractors are not quality management certified, which indicates the likelihood of quality management standards being compromised. In construction productivity related research, the effort to improve construction productivity has been mostly concentrated on achieving timeous and cost effective delivery of construction projects with minimum consideration for quality. Chen and Luo (2014) identify that the process of quality control in the construction industry should begin with the preparing of quality management plans that are based on construction documents, an explicit reference to the quality of material and equipment, the accepted standards of work, and the inspection and testing to be performed. Kazaz *et al.* (2008) state that productivity improvement could be

achieved through development in managing quality. Non-conforming materials and management engender higher construction costs than expected as a result of the loss of materials during construction (Memon *et al.*, 2011). This could contribute to rework on construction sites and hamper the progress of operations. Chen and Luo (2014) maintain that one of the difficulties in quality management is that the current focus of quality control is the final component with much less attention given to quality control during the construction process. Besides, the practice of awarding construction contracts to contractors with the lowest tender price is one of the challenges that affect quality in construction as the lowest bidders are mostly unqualified contractors with a shortage of human and capital resources to deliver the required service. Adequate training and development plans are also required of contracting organisations to improve the skills of workers which would contribute to the quality of outputs.

3 Research Methodology

The study is based on the existing research relative to the factors affecting construction labour productivity in developed and developing countries. The research reviewed labour productivity studies undertaken in developed and developing countries over a period of twenty-nine years (1987-2016). The selected and reviewed construction labour productivity journal papers were published in highly rated journals. *The journals include the International Journal of Productivity and Performance Management, Journal of Construction Engineering and Management, Journal of Civil Engineering and Management, International Journal of Project Management, International Journal of Construction Management, Journal of Building and Environment, Journal of Construction Economics and Building, Journal of Construction Management and Economics*. The headings under which literature search was conducted across the journals include productivity in construction, construction labour productivity and factors affecting construction labour productivity. The review of factors influencing construction labour productivity was undertaken to determine trends in terms of the factors affecting construction labour productivity in developed and developing countries. The highest rated factors influencing labour productivity were identified in each of the studies. The factors were subsequently examined, synthesised, and categorised under twelve different headings, namely material, tools and equipment, design, management, labour, supervision, motivation, external, health and safety, project finance, rework and technology related factors. To determine the frequency of each labour productivity-influencing factor as identified in the studies, the findings are presented in tabular form while each of the factors related to the aforementioned headings was accordingly placed under relevant headings.

4 Findings and Discussion

Factors influencing construction labour productivity in developed and developing countries

Year	Authors	Argument	Country	Respondents	Instrument	Major findings
1987	Olomolaiye *et al.*	Unproductive time causes loss of productivity	Nigeria	Craftsmen	Observation and Questionnaire	Lack of material, lack of tools, repeat work, instruction delays, inspection delays
1995	Lim and Alum	Low technology and large number of unskilled workers affect output	Singapore	Contractors	Questionnaire survey	Difficulty in recruitment of supervisors, difficulty in recruitment of workers, high rate of labour turnover, absenteeism at the worksite, communication problems with foreign workers
1997	Kaming *et al.*	Construction productivity research is typically in its infancy with regards to developing countries	Indonesia	Craftsmen	Observation and Questionnaire	Lack of material, lack of tools, equipment breakdown, rework, changing of workers, interference, absenteeism, supervision delay
2004	Makulsawatudom *et al.*	Productivity improvement will assist the industry and nations to make significant savings	Thailand	Project managers	Structured questionnaire survey	Lack of material, incomplete drawings, incompetent supervisors, lack tools and equipment, absenteeism,
2007	Chan & Kaka	There are needs to consider and the differences in the perspectives of White-collar managers and Blue-collar workers to improve productivity in construction	United Kingdom	Managers and Employees	Questionnaire and observation	Poor supervision, simplicity of building design, level of site experience, information flow, communication with sub-contractors
2007	Die *et al.*	Craftworkers' input and their perception of the factors that influence their daily productivity has rarely been sought by managers and researchers	United States of America	Journeymen, apprentices and foremen	Focus group and questionnaire	Lack of monetary bonuses for good performance, younger craft workers are not as motivated as the older ones, delays in work because of the absenteeism of other workers, errors on drawings, lack of materials
2007	Enshassi *et al.*	Positive and negative productivity-influencing factors should be identified and controlled	Palestine	Contractors	Qualitative questionnaire	Material shortages, lack of labour experience, lack of labour surveillance, miss-understanding between labour and superintendents, drawings and specifications altered during execution
2009	Die *et al.*	Craftworkers' perspective on productivity will enhance craft workers' motivation	United States of America	craft workers	Focus group and questionnaire	Construction equipment, project management, craftworkers' qualifications, training, foremen competency
2010	Dai & Goodrum	There is a need to examine the categories of language of construction workers for necessary interventions	United States of America	craft workers	Focus group and questionnaire	Errors on the drawings, late response to drawing related questions, project management pays monetary bonuses for good performance, inadequate information from supervisors, other than toolbox meetings, there is no health and safety training on this project
2011	Durdyev & Mbachu	Addressing on-site productivity constraints will provide the much-needed productivity improvement in the industry.	New Zealand	Project managers, contractors and sub-contractors	Interview and questionnaire	Project management / project team characteristics, project finance, workforce, project characteristics, unforeseen events
2011	Rivas *et al.*	There is no enough research on factors influencing productivity in construction industry	Chile	Craftsmen	Qualitative questionnaire	Material related problems, tools related, equipment and truck related, rework, interference among crews,
2013	Thomas & Sudhakumar	Perception of upper management and lower management employees will better contribute to productivity improvement	India	Project manager, site engineer, site supervisor and labour	Questionnaire survey	Unavailability of material on time at the workplace, delayed material delivery by the supplier, unavailability of drawings on time at the worksite, equipment necessary to do the job not available on time, poor pay
2015	Jarkas *et al.*,	In spite the availability of construction resources, schedule overruns and cost overruns are predominant in the construction sector	Oman	Contractors	Structured questionnaire	Unrealistic design schedules imposed on designers, construction methods, unrealistic scheduling, low design fees, payment delays
2016	Hiyassat, *et al.*,	Due to the cultural differences between countries, the findings of research conducted in one country may not be applicable to another	Jordan	Surveying engineer and foremen	Questionnaire survey	Planning, worker–management relationships, education and experience, climate, technology and equipment
2016	Naoum	Due to the contribution of the construction industry to Gross Domestic Product, construction productivity must improve to be the Holy Grail of construction research and development	United Kingdom	Contract managers and site managers	Questionnaire	Ineffective project planning, delays caused by design errors and variation orders, communication system, work environment, constraints on a worker's performance

Source: Researcher

5 Conclusions and recommendations

Material-related, tools and equipment-related, design-related, management-related, labour-related, supervision-related and motivation related factors were determined to have considerable influence on construction labour productivity. However, design and management-related factors have the highest impact on construction labour productivity as each of these group has a frequency of (9). Material-related factors follow with a frequency of (8), tools, equipment and labour-related factors have frequencies of (7), supervision-related has a frequency of (5) and motivation-related factors, a frequency of (4). The study, therefore, recommends construction management to take cognisance of effective management of construction projects through consistent employee training, adequate constructability review of construction drawings, specifications and communication management at business and project levels. Effective material procurement, planning and scheduling are essential to prevent delays that stem from waiting for materials. The management should ensure the availability of the right tools and equipment with effective maintenance plans and training of operatives to ensure the right application. Essentially, the management should consider construction labour and their line supervisors relevant to achieving construction project objectives. Thus, provide the appropriate motivational system and participation in decision making to drive their productivity. Future research should consider measuring the impact of productivity-influencing factors on each of the conventional project parameters (cost, quality and time). This will reveal the relationship of the productivity-influencing factors and the project parameters. Finally, preliminary investigations are essential in any construction labour productivity related study to determine the productivity-influencing factors peculiar to the region or country. This is because the factors influencing construction labour productivity vary from country to country due to a wide range of factors such as cultural inclinations.

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