Chapter 47
Construction Work Productivity in South Africa: A Case of Gauteng Province Construction Industry

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47.1 Introduction

Yan Aw, explains that small and medium sized contractors often make huge losses because of being less productive. Productivity is a major issue because it determines the future lifespan and profitability of a company relating to the amount of work being done. Contractors face problems when it comes to improving productivity because of the few number of skilled workers they have (Yan Aw 2001). According to Refaat, Hany, and Mohamed, a company that mostly minimizes input and maximizes output has the highest productivity improvement because profit is gained and then excellent quality of work is delivered (Abdel-Razek et al. 2006).

The enhancement of productivity in the construction industry suggests that by improving productivity, projects are completed more quickly, projects costs are lowered and the profit increases. Improving productivity also has an advantage of the contractor's winning more bids (Hammad et al. 2011). Productivity guarantees long term growth and development of the company. It has a positive effect to the society because as the productivity grows in the companies, the finance of the company also grows. This means that there might be an increase in the wages or salaries of the workers involved (Yan Aw 2001).

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The existence of situations that stifle the contractors from pursuing there set goals causes demotivation to the workers. These factors are: workers having poor interpersonal relationships, poor work attitudes, poor workmanship. These effects of demotivation slow down the rate of production in construction projects, therefore not completed on time and in good quality. These effects will lead to the company's reputation being dented. This should be improved or mitigated through acknowledgement of work that the labourers do in order to make them feel confident about their work and contributions (Ng et al. 2011).

There are many issues facing the construction industry globally and in South Africa, one of which is poor productivity on construction projects. Poor productivity can have significant impact on companies losing millions of rands in profit. In line with poor productivity, the construction industry is faced with poor quality of work, cost and time overrun, which is coupled by incompetent employees (Construction Industry Development Board 2015). Hence, this research focuses on the investigation of the factors that affect productivity in the construction industry, the effects of low productivity on construction projects, and the mitigation methods that can be used to improve productivity in the Gauteng Province in South Africa. In order to answer the problem statement. Three specific research questions were suggested, namely;

- What are the factors affecting contractors in achieving the required productivity in South Africa construction industry?
- What are the effects of poor productivity in the construction industry?
- What are the mitigating methods used to improve productivity in the South Africa construction industry projects?

47.2 Literature Review

47.2.1 Factors Affecting Construction Project Productivity

According to Horner and Talhouni, they opined that the causes of poor productivity in the construction industry, include; reduced supervision; absenteeism at work; increased accidents on site; decreased morale; and poor workmanship which results in the reworks on projects (Horner and Talhouni 1995).

Overtime is also an issue, much as it increases the output of work delivered, it also increases costs and at times reduces productivity. Further, schedule compression due to early delays in the projects causes compression of time for activities to compensate interruptions and to complete the assigned tasks on schedule. Therefore, when overtime is linked with schedule compression, this causes productivity losses because of shortage of materials or the equipment used for working. This will affect the planning and coordination of the tasks and unavailability of skilled labourers. Furthermore, mismanagement of construction teams on the

construction sites, affects productivity. For example, steel fixture crew that has to wait before they can fix the reinforcement rods if the carpenter's framework is incomplete (Gudecha 2012).

According to Thomas, small accidents from nails and steel wires on site can also stop the work and this in turn decreases productivity. Further, insufficient lighting in the working space decreases productivity. This is because workers will not be able to see clearly in a darker working environment. The lack of equipment and poor quality of material are the factors resulting in poor productivity. The use of old equipment is a reason for a number of breakdowns happening on construction sites, also for the labourer to finish work on time is difficult because it take them a longer period and this reduces productivity (Thomas 1991). The use of poor material which is used for conducting work is also a problem because it leads to unsatisfactory work and this can be rejected by the supervisors after inspection which reduces productivity as well (Gudecha 2012).

The lack of compensation and increased labour age also affects productivity negatively (Odesola and Idoro 2014). Gundecha, explains that past literatures show that the lack of site experience on labourers is also a factor which affects productivity negatively, this means that in order to achieve good productivity, it is important to pay particular attention to the labour experience because this play a major role in the improvement of productivity (Gudecha 2012). According to Odesola and Idoro, the absenteeism of supervisors stifles productivity due to supervision and delegating duties (Odesola and Idoro 2014).

If improper tools and equipment are provided to the labourers, this will affect productivity. Further, the material storage location can be far from where the work is done due to a bigger size of construction site. Furthermore, the improper scheduling of the works, and the shortage of equipment which result in loss of productivity. Poor site layout contributes to loss of productivity. For example workers driving or walking long distances to the cafeteria, rest areas, washrooms or entrances. It has also been inferred that natural factors i.e. weather conditions and the geographical conditions could affect productivity on projects. If the weather conditions are too extreme (e.g. heavy rainfall or too cold) and last for a longer period, this could causes delay of work, thus affecting productivity (Thomas and Sudhakumar 2014).

External factors: External factors also include the weather conditions which is a significant factor that contractors and the management team need to consider for the completion of any construction project. Works such as formwork, concrete casting, external plastering, external painting and external tiling also affect construction productivity negatively because during winter seasons, they take time to dry (Gudecha 2012).

Political factors: Political factors especially when disputes arises during construction, delay the project proceedings because of court cases, etc. The government's taxation policies also influence the willingness to work and expansion of plants (Kumar 2004).

47.2.2 Effects of Poor Productivity on Construction Projects

Gundecha explains that clients end up terminating contracts with the contractors because of poor productivity, this in turn gives the company a bad name which makes other clients to not want to make relationships with company. He further explains that overtime adds on to poor productivity and the effects of this is that there will be a huge increase on costs because of the added hours on labour productivity meaning that overtime will have to be paid for (Gudecha 2012).

The other effect is that construction employees are only productive for 3.5 h of the 8 h shift they spend working on construction sites, this means that the money paid for the full 8 h of the shift does not mean that the construction team or workers were productive for that long. Cost overrun is also experienced due to over time, hence might lead to disputes (Aibinu and Jagboro 2002).

47.2.3 Mitigation Methods Used to Improve Productivity

Lim expressed the importance of various programmes for on-site performance improvement of a medium-sized construction. These programmes included problem identification, data collection and data analysis. This means that the methods of placing these various programme phases which are taken into practice and identify the problems, this needs to be examined as well so that the improvement of productivity can be easier (Lim 1996).

A report by McGraw-Hill Construction Research & Analytics, suggests that addressing risk management early in the project is imperative. This needs to be an ongoing process and it is critical because this will increase the opportunity for innovative solutions that are also less costly, thus improving the productivity of the company as well. Further, they indicated the use of Alternative Dispute Resolution (ADR) systems that include adjudication, mediation, conciliation, negotiation, mini-trial and arbitration. These methods avoid litigation and thus improving productivity because the contractors will abstain from court cases that drag for a long time (McGraw-Hill Construction Research & Analytics 2011).

Proper planning is one of the top priorities that contractors must consider and it is a necessity to get it right the first time. This means that the site setup is supposed to be seen as the most crucial part of the project. Bad planning could mean a reduction of productivity in the later parts of the project in terms of double handling or rework (Chan 2002).

Gupta and Kansal, explained that clarification of technical specifications is important to improve productivity in the construction projects. Supervision of construction works must be improved as well so that work can have progress, thus improving productivity. Supervisors are in this case responsible for the productivity and activity of labours. They have to manage the workforce and also make sure that work is completed in time as per specifications. The methods of construction also

have to be managed in order to improve productivity. The construction method is mostly related to ways of working. This is because it depends mostly on the intelligence of people who are involved on the construction project. The use of wrong methods will result in cost and time overrun so it is important to improve and use more productive construction methods (Gupta and Kansal 2014).

47.3 Research Methodology

Quantitative method was used, hence a deductive approach. A structured questionnaire was used for collecting the data. A total of 65 questionnaires were distributed to a random sample of respondents, of which 42 usable questionnaires were returned, representing 64.6% response rate. According to Fellows and Liu, random sample is mainly used where there is no evidence of variation in the structure of the population and therefore each member of the population has an equal chance of being selected (Fellows and Liu 1997). The target population were the construction workers i.e. architects, quantity surveyors, civil engineers, construction managers, project managers and other professionals in the construction industry in the Gauteng Province in South Africa. The questionnaires were distributed using emails and drop and collect method. The two methods were used in order to improve the response rate of the respondents. The data was analysed using statistical package for social science (SPSS) version 22. The questionnaire was divided in four sections; section A explored the demographic data like the sex, age level of education, education qualification of respondents, etc. Section B looked at the factors affecting productivity of workers in the construction industry; Section C aimed at evaluating the effects of worker productivity in the construction industry; Section D explored the mitigation methods to improve productivity in the construction industry. Section B, C and D were on a 5-point Likert scale. The Likert-scale questions are discussed based on mean score. Therefore, the difference between the upper and lower ends of the used scale is 4.0 since there are five points. Hence, each range can be equated to 0.80 because the extent of the range is determined by a division between 4.00 and 5 (4/5). In this current study the meanings of the range are: $>4.21 \leq 5.00$ strongly agree; $>3.41 \leq 4.20$ Agree; $>2.61 \leq 3.40$ Neutral; $> 1.81 \leq 2.60$ Disagree; $> 1.00 \leq 1.80$ strongly disagree.

47.4 Findings and Discussions

47.4.1 Profile Data Results

The profile of the respondents suggest that, 59.5% of the respondents were male and 40.5% were female. On age group, 33.3% were in the age group 20–25 years,

16.7% of the respondents were in the age group 26–30 years, 28.6% were in the age group 31–35 years, 7.1% of the respondents were in the age group 36–40 years, 11.9% were in the age group 41–45 years, and 2.4% in the age group of 51–55 years. In relation to professional qualification, results showed that 28.6% were quantity surveyors, 16.7% were civil engineers, 9.5% were project managers, 19% were construction managers, 16.7% were architects and 9.5% selected others, which included an artisan and a site agent.

The respondent's years of experience, suggest that 23.8% of the respondents had 1–5 years of experience, 31% had 6–10 years of experience, 21.4% had 11–15 years, 14.3% had 16–20 years, and 9.5% had 20 years and above of experience in the construction industry. Furthermore, the results indicated that 9.5% of the respondents had Matric Certificates (grade 12), 26.2% had a diploma, 57.1% of the respondents had Bachelor's Degree, and this also includes respondents with B-Tech Degrees. The last 7.1% of the respondents had a Master's Degree. Further, the number of construction projects that were finished on time, suggests that 14.3% were 1–2 projects, 16.7% were 3–4 projects, 14.3% were 5–6 projects, 19% were 7–8 projects, 35.7% were more than 8 projects.

47.4.2 Factors Affecting Construction Work Productivity in the Construction Industry

Table 47.1 indicates that the most dominant factors affecting productivity include: delay in arrival of material and equipment (SD = 0.622; M = 4.95), and the attitude and morale of workers (SD = 0.177; M = 4.21). The respondents strongly agreed that they affected the projects productivity. The respondents were undecided or neutral on overtime (SD = 0.962; M = 3.38), and site access (SD = 0.869; M = 3.31) as factors that affected productivity. The findings were similar to the findings by Thomas and Sudhakumar, where unavailability of material on time at workplace, delayed material delivered by supplier, strikes, harsh weather conditions are the major factors that affects productivity on the construction industry(Thomas and Sudhakumar 2014). Also, the findings concurred with those of Gundecha, where lack of required construction material were ranked first, the lack of required construction tools/equipment was ranked second, and poor site conditions was ranked fourth which are the major factors affecting productivity (Gudecha 2012). The results were also in line with those of Gupta and Kansal, where lack of construction manager leadership, clarification in technical specifications, labour supervision, labour skills, labour fatigue and method of construction were the major factors affecting productivity in the construction industry (Gupta and Kansal 2014). However the, results were not in agreement with research by Odesola and Idoro, where the craft worker's pride, lack of skills of workers, rework and incompetent supervisors were rated as major factors affecting productivity(Odesola and Idoro 2014).

Table 47.1 Factors affecting construction work productivity in the construction industry

Factors affecting construction work productivity	Std. dev. (SD)	Mean (M)	Rank
Delay in arrival of material and equipment	0.622	4.95	1
Attitude and morale	0.717	4.21	2
Conflicts among colleagues and other construction parties	0.715	3.98	3
Incompetent labourers	0.640	3.93	4
Health and safety factors	0.850	3.90	5
Shortage of equipment and materials	0.850	3.90	5
Labour strikes	0.906	3.90	5
Use of alcohol and drugs	0.814	3.86	6
Project site location	0.864	3.71	7
Delay in handing in of Site	0.944	3.71	7
Mobilization/demobilization of resources	0.687	3.67	8
Weather and season changes	0.954	3.67	8
Crew size inefficiency	0.862	3.48	9
Inadequate planning	0.968	3.45	10
Reassignment of manpower to other work	0.801	3.43	11
Overtime	0.962	3.38	12
Site access	0.869	3.31	13

Source Fieldwork 2015

47.4.3 Effects of Productivity in the Construction Projects

The findings in Table 47.2 indicates that the most critical effect of productivity in the construction industry was: poor quality of work delivered because of time (SD = 0.634; M = 4.50), bad reputation as a company (SD = 0.791; M = 4.36), loss of capital from client (SD = 0.650; M = 4.33), increased project cost because of extension of time (SD = 0.721; M = 4.33), and profit loss (SD = 0.813; M = 4.21). These findings are in line with the findings of Aibinu and Jagboro, where time overrun, cost overrun, disputes, and litigation were major effects of productivity on construction projects (Aibinu and Jagboro 2002). The results were also similar to the findings by Sambasivan and Soon, where also time overrun, cost overrun, disputes, and litigation were major effects of productivity on construction projects (Sambasivan and Soon 2007).

47.4.4 Measures to Improve Productivity

The vital mitigation methods to improve productivity in Table 47.3 were: adherence to construction specifications (SD = 0.594; M = 4.52), ensuring quality of

Table 47.2 Effects of low productivity in the construction projects

Effects of low Productivity	Std. dev. (SD)	Mean (M)	Rank
Poor quality of work delivered because of time	0.634	4.50	1
Bad reputation as a company	0.791	4.36	2
Loss of capital from client	0.650	4.33	3
Increased project cost because of extension in time	0.721	4.33	3
Profit loss	0.813	4.21	4
Arising of disputes	0.794	4.17	5
Termination of contracts by the clients	0.608	4.14	6
Litigation (Solving disputes by the use of Courts)	0.838	4.07	7
Construction project delay	0.825	4.05	8
Company insolvency	0.680	4.02	9
Increased Claims due to breach of contract (e.g. finishing in time)	0.808	3.93	10
Health and safety factors	0.958	3.90	11
Loss of employees (Skilled and unskilled employees)	0.696	3.83	12

Source Field work 2015

works delivered (SD = 0.539; M = 4.38), proper flow of communication with other construction parties (SD = 0.697; M = 4.38), construction works according to the specified specification (SD = 0.665; M = 4.26), use of modern construction technology to save time e.g. new equipment (SD = 0.701; M = 4.26), site management and supervision (SD = 0.692; M = 4.24), and frequent progress meeting (SD = 0.790; M = 4.24). These findings corroborate with the findings of McGraw-Hill Construction (2011) where communication with other members throughout the project lifecycle, engaging in activities that reduce litigation, use of measuring techniques and technology were a major productivity methods used in the construction industry. Further, the results were similar to the findings of Lim, where there is use of new technology, quality material, frequent communication and following the drawing specifications are major mitigation methods for the improvement of productivity (Lim 1996). The results were also similar to those of Gupta and Kansal, where clarification in technical specifications, labour supervision, labour skills, labour fatigue and method of construction were the major factors for the improvement of productivity in the construction industry (Gupta and Kansal 2014).

47.5 Conclusion and Recommendations

The current study suggests that the factors that overwhelmingly affect productivity in the construction projects are, delay in arrival of material and equipment and the attitude and morale of workers. The study also established that the effects of poor

Table 47.3 Measures to improve productivity in the construction industry

Measures to improve productivity	Std. dev. (SD)	Mean (M)	Rank
Adherence to construction specifications	0.594	4.52	1
Ensuring quality of works delivered.	0.539	4.38	2
Proper flow of communication with other construction parties.	0.697	4.38	2
Constructing works according to the specified specifications.	0.665	4.26	3
Use of modern construction technology to save time e.g. new equipment.	0.701	4.26	3
Site management and supervision.	0.692	4.24	4
Frequent progress meeting.	0.790	4.24	4
Proper material procurement.	0.762	4.17	5
Managing health and safety factors.	0.824	4.17	5
Proper project planning and scheduling.	0.881	4.17	5
Target planning according to the work programmes.	0.803	4.12	6
Implementing appropriate construction methods.	0.790	4.10	7
Providing training for workforce.	0.826	4.00	8
Proper planned structure for the flow of information.	0.715	3.98	9
Use of measuring techniques on site e.g. Activity Sampling Technique.	0.731	3.95	10
Employing skilled labour.	1.011	3.95	10

Source Field work 2015

productivity were; poor quality of work delivered because of time, bad reputation as a company, loss of capital from client, increased project cost because of extension of time, and profit loss. Lastly the study found that in order for the construction industry to improve its productivity it must adherence to construction specifications, ensuring quality of works delivered, proper flow of communication with other construction parties, work according to the specified specification, use of modern construction technology to save time e.g. new equipment, site management and supervision, and frequent progress meeting.

47.5.1 Implications of the Study

The study was conducted in the economic hub of South Africa i.e. Johannesburg. Hence, the findings are of importance to the entire country. The researchers believe that the other eight provinces in South Africa can use these findings to develop policies that can improve the productivity in construction projects. It can therefore be suggested that the stakeholders should ensure that all participants involved in construction projects should be properly trained and have technical skills relevant to

their work. This will ensure that the projects will be properly planned and effectively executed. Therefore it is recommended that the stakeholders in the construction industry should:

- adhere to the construction specifications;
- ensure quality of the work delivered;
- ensure proper flow of communication with other construction parties;
- use of modern construction technology to save time e.g. new equipment;
- ensure proper site management and supervision; and
- frequently have progress meeting.

47.5.2 Further Study

Recommendation for further study is to test the causal relationship of the strategies proposed to improve productivity and the project outcome in order to develop a model. The study further suggests that the construction companies should concentrate on the strategies in order to stifle poor productivity.

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