



CCC 2018

Proceedings of the Creative Construction Conference (2018)

Edited by: Miroslaw J. Skibniewski & Miklos Hajdu

DOI 10.3311/CCC2018-074

Creative Construction Conference 2018, CCC 2018, 30 June- 3 July 2018, Ljubljana, Slovenia

Investigating the Productivity Based System of Labour Intensive Works in Delivering Road Infrastructure in Rural Communities in Ghana

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Abstract

The Labor-intensive Public Works (LIPW) has rehabilitated 792km Feeder Roads, 192 Small Earth Dams & Dugouts (that is ensuring the harvesting of 21,195,764 cubic meters of water for the rural poor) and 2,550 hectares of degraded public/community land through tree planting and other biodiversity restoration activities. However systematic operations risk-rating on Technical Design of Project was rated low. The aim of this paper is to investigate the Productivity based system of Labour Intensive Works in delivering road infrastructure in rural communities in Ghana. The objectives are to identify the drivers affecting performance of management- and control-related activities that occur in during labour intensive works and to determine the characteristics of workers that affect the performance of labour intensive works. Purposive sampling technique was adopted to select 12 districts where the labour intensive projects on road construction were carried out. Random sampling technique was adopted to select 24 contractors from the study population which has total contractors of 180. Furthermore stratified sampling method was adopted to select 120 participants of which 24 of them are facilitators, 24 time keepers, 24 site engineers, 24 contractors, 12 district engineers, 12 GSOP Desk officers. The study adopted the exploratory factor analysis. The exploratory factor analysis was used in this research study to confirm the reliability and validity of labour productivity. Attitude of site personnel was ranked as the leading factor influencing the management related activities with a mean score of 3.81 while Knowledge of project technology and Accuracy of technical information followed having a mean score of 3.60 and 3.50 respectively.

Keywords: Ghana; labour intensive works; productivity; road; task.

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1.0. Introduction

The Labour Intensive Public Works (LIPW) is one of the strategies that various governments have employed to curtail the aforementioned problem. Bentall [1] defined labour-intensive approach as an approach where labour is the dominant resource for carrying out works, and where the share of the total project cost spent on labour is high (typically 25% - 60%). It is observed that the LIPW can aid the provision of needed material and financial resources to promote rural development programs that are geared toward reducing rural-urban migration as being championed in Ghana by the District Assembly concept introduced in the 1980's. The Government of Ghana through the

Ghana Social Opportunities Project (GSOP) has instituted a number of social protection interventions as a safety net for the poor and vulnerable in the society.

The Labour Intensive Public Works (LIPW) projects have two main objectives; one is the quick generation of employment to the poor unskilled labour. The second objective is ensuring that government performs its mandate of providing and maintaining infrastructure in order to promote the development of the country. Recently, due to global economic crisis, LIPW projects have assume larger importance as major safety nets providing income for the poor people and ensuring that they have adequate food that can sustain them. [2] proposed three models for LIPW projects. The first model sees LIPW as a safety net intended to provide cash income to self-selected participants in times of need e.g. seasonal income shortages or to respond to nation-wide or region-wide shocks such as a drought [3]. The second model also sees LIPW project as a longer term safety net intended to provide a cushion, mainly as a poverty alleviation project but not totally eliminating poverty.

[4] define labour productivity as the rate at which tasks are produced, especially the output per unit of labour. Concise dictionary defines it as “work performed per unit of time” or “time to perform unit of work.” The goal in managing construction tasks is to produce the optimum output per labor hour. The output desired naturally complies with project requirements for materials, construction techniques, appearance, performance, and workmanship. Productivity rates should be established in the estimate regarding perception of conditions and project requirements. The productivity rates used in the estimate are generated from historical data, both from the contractor’s own records and from a variety of available references.

1.1 Problem Statement

In recent years the rate of delays in the construction ‘industry seems to have raised a general concern by the general public as they are striving to find out what actually is happening considering the basic resources available to construction firms. Due to the increasing level of constructing a building, the general public continues to complain that the average cost of designing and building a house is of high cost. Most Building construction companies are trying to find ways which might improve labour output constants in the industry. Labour being one of the greatest risks encountered in the construction sector, it should be controlled and continued improvement of sites is necessary to determine its performance.

[5] argues that investment in infrastructure has a huge potential to redress the high unemployment and poverty levels in South Africa and also to correct the skills deficits in disadvantaged communities. Experience elsewhere in Africa, there are reasons for considering that properly formulated labour-intensive public works programmes and projects could be established to construct and maintain the required physical infrastructure, thus creating employment, skills and institutional capacities [5].

The methods used in measuring productivity in the construction company cannot be the same for other workplaces. This is due to the very nature of labour productivity as a qualitative category [6].

[7] asserted that inefficiency in the construction industry is attributed to labour factors which appear to lead many projects overrun across the globe. Labour being more unpredictable than other project-cost components, it is necessary to understand the effects of different factors on labour productivity. Previous researchers had claimed that an increase in productivity can reduce the labour cost in a direct proportion and an increase in idle time of workers waiting on material. The construction industry is labour-intensive and relies heavily on the skills of its workforce while the workforce is the industry’s most valuable asset, which at the very least, accounts for over a

quarter of the total project cost. Labour can significantly influence the cost, schedule, and quality of a construction project [8].

[9] asserted that the construction industry's performance in terms of cost, time, quality, safety and health of its workers, the durability of its products and the satisfaction of its stakeholders, are inadequate due to the low productivity.

The impact that may occur is the need for new or additional material, constraints and equipment, which affect the sequence, duration and schedule of work packages. Low productivity is common in the construction industry in developing countries like Ghana and this could be attributed to poor labour productivity due to the labour-intensive nature of construction activities in these countries ([10] and [11]). Often, labor productivity is a key factor contributing to the inability of many contracting organisations to achieve their project goals, which include, most importantly, the profit margin.

1.2 Aim of the study

The aim of this paper is to investigate the Productivity based system of Labour Intensive Works in delivering road infrastructure in rural communities in Ghana.

1.3 Objectives

The objectives are to identify the drivers affecting performance of management- and control-related activities that occur in during labour intensive works and to determine the characteristics of workers that affect the performance of labour intensive works.

1.4 Scope of the study

The study focused on the drivers affecting productivity of labour intensive public works on feeder roads construction in Ghana hence the study concentrated mainly in five regions where labour intensive public works are carried out in the Accra zone (Eastern region, Greater Accra, Central Region, Volta region, and Western Region) 24 road construction sites were considered.

2.0 Drivers Affecting Labour Productivity Performance of Projects

[12] suggest that many different factors can affect labour productivity on a project. Project supervisors should be familiar with the most common factors affecting labour productivity, which include the following:

- i. Lack of supervision or poor supervision
- ii. Lack of coordination of subcontractors with work activities
- iii. Improper or insufficient material available for tasks
- iv. Poor jobsite layout
- v. Lack of proper tools for work activities
- vi. Congested work areas
- vii. Poor housekeeping
- viii. Accidents and unsafe conditions on the jobsite
- ix. Adverse weather conditions
- x. Poor lighting in the work area
- xi. Inadequate heat or ventilation in the work area

- xii. Tardiness of excessive absenteeism
- xiii. Uncontrolled starting time, quitting time, and lunch and breaks
- xiv. Shortage and location of close parking, changing rooms, restrooms, and drinking water
- xv. High employee turnover
- xvi. Use of improperly or poorly trained craftspeople
- xvii. Supervisors not making timely decisions
- xviii. Poor attitude among employees
- xix. Construction mistakes caused by complexity, poor drawings, or lack of communication
- xx. Impact of changes on production work

2.1. Poor Weather

Bad weather often is not adequately anticipated, forcing changes in schedules, production, and damage to completed work. Productivity decreases in poor weather to varying degrees, depending upon the severity of the weather and the work tasks. Weather can affect some construction materials, such as concrete and mortar; as well as the efficiency of the labour. When protective clothing, such as rain gear or cold-weather gear, is necessary, labour is impeded. [13]

Initial project planning should consider seasonal weather conditions. Anticipating bad weather and Rainy weather requires protection of the work area, maintenance of haul roads and jobsite access, and dry shack provisions for changing clothes and eating lunch. In fine-grained soils, rain will produce mud, which slows work considerably. Preparation for these conditions can be made, with provisions such as preparing haul roads and jobsite access with a gravel surface and adequate drainage. Planning weather-sensitive activities around it can reduce some of the impact.

2.2 Material Problems

Late deliveries require crews to move to other work areas, halting the production at one area and requiring startup of new work activities. Also, shortages can stop crews from working, forcing workers to be laid off for short periods of time. If crews are required to carry materials long distances before work can occur, productivity is affected. Double handling of materials will result in damage to materials, increased waste, and lost time.

2.3 High Labor Turnover

High labour turnover may be an indication of poor planning, general unrest, and lack of leadership by the foreman and/or superintendent. New training may be required each time this situation occurs, and high levels of unrest or low morale can lead to a slowdown of work.

Jobsite management must employ the correct labor for the project. It is important that jobsite management be experienced in the type of construction on the project.

Despite the fact that foremen are technically considered labour rather than management, they are an important bridge between management and labour, leading the crew in techniques, methods, and productivity. Trained foremen in labor techniques, safety procedures, crew management, productivity control, and cost control are essential for effective labor management.

2.4 Accidents and Unsafe Conditions

All work will quickly come to a halt when an accident occurs on a jobsite. Employees who do not feel safe tend to be overly cautious when performing their work tasks, thus noticeably slowing

production. A clean and safe jobsite is conducive to obtaining maximum productivity from labor crews.

Many construction companies realize the importance of safety on jobsite production. Contractors are required by state and federal regulations to have in place an active construction safety program, but the degree of implementation on the jobsite is a matter of commitment by the construction company. The impact of a safe and clean jobsite on productivity cannot be understated. The cost of keeping a clean jobsite is considerably less than the cost of lost productivity, accidents, and safety fines associated with poor housekeeping.

2.5 Working Overtime

Working longer days or adding additional days of work on a prolonged basis will result in increased injuries and safety problems. As workers become tired from longer periods of work, they begin to adjust their pace or slow their productivity to avoid fatigue. When forced to work overtime, an employee may become disgruntled, causing low morale among other employees. In the same respect, if overtime is offered to one employee and not another, jealousy may become a problem among employees [14].

3.0 Research Methodology

3.1 Population

The study population is 60 district assemblies in Ghana where the labour intensive public works is carried out in Ghana and all contractors who are registered with the Ghana Social Opportunity Project. They are 200 of them and maintain a total workforce of 12,000 participants.

3.2 Sample size and Sampling Techniques

Purposive sampling technique was adopted to select 12 districts in Accra zone that comprises districts in five regions out of the ten regions in Ghana namely Eastern Region, Greater Accra Region, Central Region, Volta region and Western region out of the 60 districts where the labour intensive projects on road construction were carried out. Simple random sampling technique was adopted to select 24 contractors from the study population which has total contractors of 36 in the Accra zone. Furthermore, stratified sampling method was adopted to select 120 participants of which 24 of them are facilitators, 24 time keepers, 24 site engineers, 24 contractors, 12 district engineers, 12 GSOP Desk officers.

3.3 Data Analysis

Exploratory factor analysis would be adopted. Factor analysis would be used to classify the factors into components. At this stage, components classified on the basis of the relevant literature review (the equipment, workers, work characteristics, materials, and management and control components). The components that would be properly classified need to be examined. Regression analysis would be the last stage of the statistical analysis in which the components that significantly influenced labour productivity satisfaction in labour intensive works would be identified. The significance of the components would be analysed, and insignificant components need to be discarded at this stage.

4.0. Findings and Discussion

Table.1: Performance of management- and control-related activities in Labour intensive works

Item	Activities relating to management and control	Level of performance for in your company Least Influential Most Influential					Total	Mean	Ranking
		1	2	3	4	5			
1	Delegation of responsibilities	19(19)	19 (38)	23 (69)	27 (108)	32 (160)	394	3.28	7th
2	Integration of project information	30 (30)	27(54)	19 (57)	42 (168)	2 (10)	319	2.65	11th
3	Use of incomplete drawings	29 (29)	24 (48)	31 (93)	22(88)	14(70)	328	2.73	9th
4	Use of complex designs in the provided drawings	35(35)	17(34)	31 (93)	21 (84)	16 (80)	326	2.71	10th
5	Presence of variations in the drawings	30 (30)	15 (30)	37 (11)	21(84)	17(85)	240	2.00	12th
6	Project planning	19(19)	18(36)	23 (69)	26 (104)	34 (170)	398	3.32	6th
7	Scheduling of project activity	18 (18)	19(38)	20(60)	38(152)	25 (125)	393	3.28	7th
8	Supervision of subordinates	18 (18)	17 (34)	18(54)	37 (148)	30 (150)	404	3.37	5th
9	Communication between head office and site	15(15)	15(30)	25(75)	35(140)	30 (150)	410	3.42	4th
10	Involvement of site managers in contracting meetings	20(20)	19(38)	25(75)	30(120)	26(130)	383	3.19	8th
11	Attitude of site personnel	7(7)	8(16)	20(60)	50(200)	35(175)	458	3.81	1st
12	Knowledge of project technology	8(8)	16(32)	24(72)	40(160)	32(160)	432	3.60	2nd
13	Accuracy of technical information	10(10)	19(38)	26(78)	30(120)	35(175)	421	3.50	3rd

Among the thirteen drivers affecting the performance of management- and control-related activities in labour intensive works attitude of site personnel was ranked as the leading factor influencing the management related activities with a mean score of 3.81 while Knowledge of project technology and Accuracy of technical information followed having a mean score of 3.60 and 3.50 respectively. Presence of variations in the drawings was the least ranked with mean score of 2.0 this is because most of the drawings for the construction are always complete hence no difficulty in such situation.

Table 2 Performance of Characteristics of workers in Labour intensive works

Item	Characteristics of workers	Level of performance for in your company Least Influential Most Influential					Total	Mean	Ranking
		1	2	3	4	5			
1	Workers' having formal training in labour intensive works	18(18)	18 (36)	20(60)	29 (116)	35 (175)	405	3.38	11th
2	Employees' level of experience to do their work	12 (12)	20(40)	26 (78)	40(160)	25 (125)	415	3.46	9th
3	The number of multi skilled project personnel in the company	14 (14)	19 (38)	20 (60)	47(188)	20(100)	400	3.33	12th
4	Employees' knowledge of scientific techniques	16(16)	17(34)	35(105)	23(92)	29 (145)	392	3.27	14th
5	Promotion opportunities for employees	18 (18)	18 (36)	28 (84)	34(136)	22(110)	384	3.20	15th
6	Employees level of awareness of company policy	16(16)	22(44)	35 (105)	22 (88)	25 (125)	378	3.15	17th
7	The company's incentive scheme for good performance	7(7)	18(36)	15(45)	45(180)	35 (175)	443	3.69	8th
8	Opportunities for employees to exercise their skills	25 (25)	20 (80)	28(84)	28 (112)	19 (95)	396	3.30	13th
9	Management response to settle employee's grievances	4(4)	15(30)	21(63)	30(120)	50(250)	467	3.89	3rd
10	Workers' knowledge of career prospects	13(13)	20(40)	40(120)	28(112)	19(95)	380	3.17	16th
11	Workers' attitude towards the job they have to execute	6(6)	10(20)	12(36)	52(208)	40(200)	470	3.92	2nd
12	Likelihood workers are paid on time	0(0)	0(0)	15(45)	60(240)	45(225)	510	4.25	1st
13	Quality of transportation facilities for workers	25(25)	45(90)	0(0)	28(112)	22(110)	337	2.80	20th
14	Level of safety achieved on projects	10(10)	10(20)	25(75)	35(140)	40(200)	445	3.71	7th
15	Degree to which safety standards on a project comply with legislated criteria	2(2)	19(38)	45(135)	35(140)	19(95)	410	3.42	10th
16	The usage of safety wear on site	0(0)	2(4)	48(144)	50(200)	20(100)	448	3.73	6th
17	Likelihood older workers will be replaced by younger workers	15(15)	32(64)	19(57)	40(160)	14(70)	366	3.05	19th
18	Employment of young workers on projects	7(7)	10(20)	15(45)	48(192)	40(200)	464	3.87	4th
19	Employment of older workers from villages	22(22)	19(38)	30(90)	20(80)	29(145)	375	3.12	18th
20	Incentives used to attract young people into sector	0(0)	0(0)	18(54)	47(188)	55(220)	462	3.85	5th

As seen in table 2 Likelihood workers are paid on time had a mean score 4.25 indicating as the most influential drivers of Characteristics of workers that affects the productivity of labour intensive works. Workers' attitude towards the job they have to execute, management response to settle employee's grievances and incentives used to attract young people into sector had mean score 3.92, 3.89, and 3.85 respectively also had impact on the performance of the labour intensive works. Quality of transportation facilities for workers had the least mean score of 2.80 since most of the labourers were living in the communities where the projects were carried out hence did not have any bearing on their productivity at site.

5.0 Conclusion

Many people who claim to be discussing productivity are actually looking at the more general issue of performance. While productivity is a fairly specific concept related to the ratio between output and input, performance is a term which includes almost any objective of competition and manufacturing excellence such as cost, flexibility, speed, dependability and quality.

A successful construction project is one that is completed on time, within budget, meets specified standards of quality, and strictly conforms to safety policies and precautions. All of these are feasible only if the premeditated levels of productivity can be achieved. All the same, productivity or lack thereof, is one of the construction industry's most prevalent problems. Due to the nature of construction projects, its importance to society and the existing economic resources, more emphasis should be given to improving productivity.

References

- [1] Bentall P, Beusch A, de Veen J (1999). *Employment-Intensive Infrastructure Programmes: Capacity Building for Contracting in the Construction Sector*. International Labour Organisation: Geneva, Switzerland.
- [2] Subbarao, K., del Ninno, C., Andrews, C. and Rodríguez-Alas, C., 2010. *Forum 2010 Edition The Design and Implementation of Public Works Programs A Toolkit for Practitioners*. World.
- [3] Amoah, S.T. and Eshun, S.N. (2013) *Tackling Rural – Urban Drift in Ghana: Labour Intensive Public Work as a Tool in the Wa East District- Research on Humanities and Social Sciences* ISSN 2222-1719 (Paper) ISSN 2222-2863 (Online) Vol. 3 No. 22, www.iiste.org
- [4] Mincks, W.R. and Johnston, H., (2010). *Construction jobsite management*. Cengage Learning.
- [5] Thwala, W.D. (2011) *Public works programmes as a tool to address unemployment and skills shortages among the youth in South Africa*. *African Journal of Business Management* Vol. 5(15), pp. 6011-6020, 4 August, 2011 Available online at <http://www.academicjournals.org/AJBM> DOI: 10.5897/AJBM10.1178 ISSN 1993-8233 ©2011 Academic Journals
- [6] Parrotta, P., Pozzoli, D., and Pytlikova, M. (2014). *Labor diversity and firm productivity*, *European Economic Review*, 66, pp. 144-179.
- [7] Ghoddousi, P., Poorafshar, O., Chileshe, N. and Hosseini, M.R., (2015). *Labour productivity in Iranian construction projects: Perceptions of chief executive officers*. *International Journal of Productivity and Performance Management*, 64(6), pp.811-830.
- [8] Han, S.H., Park, S.H., Jin, E.J., Kim, H. and Seong, Y.K., 2008. *Critical issues and possible solutions for motivating foreign construction workers*. *Journal of Management in Engineering*, 24(4), pp.217-226.
- [9] Ofori, G. and Toor, S.U.R., 2012. *Leadership and Construction Industry Development in Developing Countries*. *Journal of Construction in Developing Countries*, 17.
- [10] Kazaz, A. and Ulubeyli, S., 2004. *A different approach to construction labour in Turkey: comparative productivity analysis*. *Building and environment*, 39(1), pp.93-100.
- [11] Jarkas, A. and Bitar, C. (2012), "Factors affecting construction labor productivity in Kuwait", *Journal of Construction Engineering and Management*, Vol. 138 No. 7, pp. 811-820.
- [12] Mincks and Johnston (2011) suggest that many different factors can affect labour productivity on a project.
- [13] AbouRizk, S., Knowles, P., and Hermann, U.R. (2001). "Estimating labor production rates for industrial construction activities." *Journal of Construction Engineering and Management*, 127(6) 502 -511.
- [14] Ghoddousi, P., Poorafshar, O., Chileshe, N. and Hosseini, M.R., 2015. *Labour productivity in Iranian construction projects: Perceptions of chief executive officers*. *International Journal of Productivity and Performance Management*, 64(6), pp.811-830.