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THE EFFECT OF MANAGEMENT CONTROL ON LABOUR PRODUCTIVITY OF LABOUR-INTENSIVE WORKS IN GHANA

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ABSTRACT

In Ghana, many construction projects end in dispute, because contractors are unable to meet the completion time. As many construction operations are labour intensive, the question of labour productivity becomes paramount, especially as higher productivity levels usually translate into superior profitability, competitiveness, and income. This article aims to examine the management control factors affecting construction labour productivity in Ghanaian construction firms. It assesses the measuring techniques that are used to improve labour productivity in the construction firms. The article also determines the relationship between management control and labour productivity on labour-intensive works in Ghanaian construction firms. The study adopted a quantitative research design that used a questionnaire-based descriptive survey. Records available at the Ghana Social Opportunity Project (GSOP) indicate that 920 professionals are involved in labour-intensive works on road infrastructure. A purposive sampling technique was used to select 40 districts involved in road construction projects; 560 respondents were considered for the study. The summary of the data consisted of means, standard deviations,

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percentages, cross-tabulations, and frequencies. Principal axis factor analysis revealed three (3) components with eigenvalues above 1 that may influence labour productivity of labour-intensive works on road construction. These components are effective communication, supervision technique, and design inadequacies. Construction managers must monitor workforce performance by ensuring that the three factors influencing management control are considered.

ABSTRAK

In Ghana eindig baie konstruksieprojekte in dispuut, omdat kontrakteurs nie in staat is om die voltooiingstyd na te kom nie. Aangesien baie konstruksie-bedrywighede arbeidsintensief is, word die kwessie van arbeidsproduktiwiteit uiters belangrik, veral aangesien hoër produktiwiteitsvlakke gewoonlik omskakel in winsgewendheid, mededingendheid en inkomste. Hierdie artikel het ten doel om die bestuursbeheerfaktore wat konstruksie-arbeidsproduktiwiteit in Ghanese konstruksiefirmas beïnvloed, te ondersoek. Dit assesseer die meettegnieke wat gebruik word om arbeidsproduktiwiteit in die konstruksiefirmas te verbeter. Die artikel bepaal ook die verband tussen bestuursbeheer en arbeidsproduktiwiteit op arbeidsintensiewe werke in Ghanese konstruksiefirmas. Die studie het 'n kwantitatiewe navorsingsontwerp aangeneem wat 'n vraelys-gebaseerde beskrywende opname gebruik het. Rekords beskikbaar by die *Ghana Social Opportunity Project* (GSOP) dui aan dat 920 professionele persone betrokke is by arbeidsintensiewe werke aan padinfrastruktuur. 'n Doelgerigte steekproeftegniek is gebruik om 40 distrikte te kies wat betrokke is by padbouprojekte; 560 respondente is vir die studie oorweeg. Die opsomming van die data het bestaan uit gemiddeldes, standaardafwykings, persentasies, kruistabelle en frekwensies. Hoof-as faktor analise het drie (3) komponente met eiewaardes bo 1 aan die lig gebring wat arbeidsproduktiwiteit van arbeidsintensiewe werke op padkonstruksie kan beïnvloed. Hierdie komponente is effektiewe kommunikasie, toesigtegniek en ontwerpontoereikendheid. Konstruksiebestuurders moet werksmagprestasie monitor deur te verseker dat die drie faktore wat bestuursbeheer beïnvloed, in ag geneem word.

Sleutelwoorde: Arbeidsintensiewe werk, beheer, bestuur, konstruksiebedryf, padbou, produktiwiteit

1. INTRODUCTION

As the backbone for growth and development, the construction industry provides infrastructure that is needed for other sectors of the Ghanaian economy (Amoatey *et al.*, 2015: 199).

Ofori (2015: 115) indicates that construction industry development is a deliberate and managed process to improve the capacity and effectiveness of the construction industry. The industry supports and sustains national economy and social development objectives.

Despite the conscious efforts made by the government over the years, the country continues to witness construction project failure (Amoatey *et al.*, 2015: 202; Damoah & Akwei, 2017: 35). Attar, Gupta and Desai (2012) note that ineffective management is a primary cause of low labour outputs. They identify the following barriers to improving intensive labour outputs: a lack of alignment among goals; contractual conflicts; difficulties in measuring productivity; weak commitments to continuous improvement, and a lack of labour force focus.

There is hardly any research on frameworks reflecting the relationship between management and construction labour productivity in Ghana. These frameworks further fail to demonstrate accurately the productivity performance in road construction. This article examines the factors affecting management control of construction labour productivity on road construction sites.

2. LITERATURE REVIEW

This section reviews the literature relating to the theoretical and conceptual perspectives on labour productivity in the construction industry. It also examines some of the historical developments leading to a definition of the term ‘productivity’; develops the concept of productivity into the various definitions, and discusses the accepted definitions in general and in construction at industry-, project- and site-production level. This section also reviews the major labour productivity theories on labour intensiveness in early and recent times and considers the factors influencing labour productivity in construction at both industry and activity level. It also examines the categorisation of factors affecting construction labour productivity such as delegation of responsibilities; integration of project information; use of incomplete drawings; use of complex designs in the provided drawings; variations in the drawings; project planning; scheduling of project activities; supervision of subordinates; communication between head office and site, as well as involvement of site managers in contracting meetings.

2.1 Theories of management

The management theories of Thomas and Sakarcan (1994: 228) and those of Durdyev, Ismail and Kandymov (2018: 7) underpin the study. Thomas and Sakarcan (1994) identify management as influencing labour productivity, whereas Durdyev *et al*. (2018: 7) identify management control to be the most significant factor impacting on labour productivity in infrastructure projects in Malaysia.

Barnard’s (1938) theory observes the role of the management of a company. His primary target is not to increase labour productivity, but rather to make meaningful use of the efficiency of an organisation as a whole, in order to increase the productivity of the organisation of the company (Barnard, 1938: 182). This increases labour productivity.

Barnard’s theory considers the authority to be ineffective if there are no consequences for not obeying the supervisors’ instructions. In an organisation, the management must consider both the subjective perceptions and the objective aspects of their actions and these may not be disregarded (Brem, 2013: 30). For this reason, it is fundamental for management to be willing and able to understand the needs of the organisation.

2.2 Definition of labour-intensive works

Bentall, Beusch and de Veen (1999: 5) define the 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.

Within the South African context, Thwala (2011: 6011) defines labour intensive as the combination of labour and appropriate equipment, which is generally light equipment.

In other words, programmes based on the principles of labour-intensive work aim to devote as high a proportion of programme costs to unskilled and semi-skilled labour without jeopardising the technical quality of the product/project demanded by the specification. Value for money is achieved by the intensive use of labour often employing innovative techniques of work and control.

2.3 Conceptual framework on management control

In developing Taylor's theory, Liu, Ballard and Ibbs (2011: 238) explain that management control contributes to the labour productivity of the firm. The task system is identified as one of the techniques in measuring the productivity of labour-intensive works on road construction. Bender *et al.* (2018: 378) describe a management control system as consisting of a device for measuring what is happening; for assessing the significance of the measured quantity relative to a standard, and for influencing the behaviour of managers, with an evaluation of performance based on this measure and standard. Similarly, a productivity measurement system requires first a proper definition and the development of a productivity index.

Nguyen *et al.* (2017: 205) note that the management control system provides a means of gathering and processing information to assist managers in planning, control, and performance evaluation throughout the organisation. The information generated by the management control system serves two main purposes: to influence decision and to facilitate decision. Managers can use the information generated from a comprehensive performance measurement system to assist them in managing their organisation's operations (Nguyen *et al.*, 2017: 210).

Luft and Shields (2001: 565) indicate that managers can use more comprehensive performance information to verify, confirm, and validate their beliefs about cause-and-effect relationships embedded in a firm's strategy and action plan. As a performance measurement system becomes more comprehensive, information will be needed to assist managers in their decision-making processes.

The labour productivity framework to be tested in the postulated hypothesis based on prior study includes delegation of responsibilities; supervision of subordinates; communication; accuracy of information, and project planning. This is a multidimensional structure. Figure 1 presents the postulated framework. The theoretical underpinning of this priority is derived from the works of Thomas and Sakarcan (1994: 228) as well as from the works of Durdyev, Ismail and Kandymov (2018: 7). Bamfo-Agyei, Aigbavboa and Didibhuku (2018) adopt these frameworks of construction labour productivity and the approach.

Essential in the conceptualised framework is the notion that firms' labour productivity is related to the evaluation of many variables. While the principal variable under consideration is the firm's productivity, it is difficult to discuss it without reference to variables affecting labour productivity in the construction industry, and the inclusion of other exogenous variables.

The outcome of labour productivity is expressed by the construction industry in Ghana's subjective evaluation of their productivity as defined by them. It is an empirical question as to which components are most relevant and they may differ under different circumstances. How firms assess productivity in a particular industry, for instance, is considered to be dependent on industry-specific characteristics. This is meant to include all experiences of the factors in the Ghanaian construction industry that influence their evaluations. In this study, the objective evaluation of construction labour productivity is assessed by measuring the actual performance of firms on labour productivity outcomes.

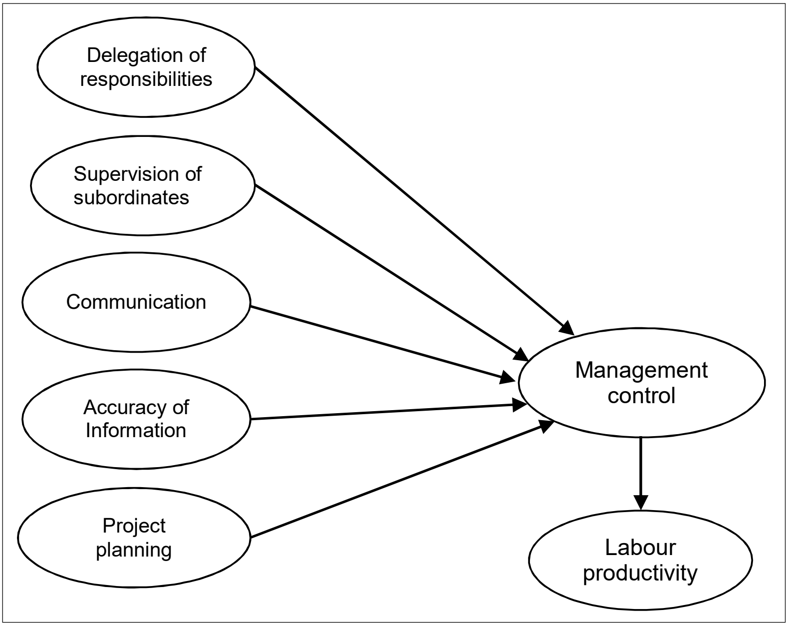

Figure 1: Conceptualised management and control framework
Source: Bamfo-Agyei, Aigbavboa and Didibhuku, 2018: 516

2.4 Management control factors affecting labour productivity in the Ghanaian construction industry

Famiyeh *et al.* (2017: 182) identify management control as a key component affecting the productivity of the construction industry in Ghana. The management control factors affecting productivity include unrealistic contract durations imposed by clients; poorly defined project scope; client-initiated variations; poor inspection/supervision of projects by consultants; poor site management; variations in designs; lack of communication plans, and poor financial management on site.

Cultural and partisanship politics factors may influence the failure of the Ghanaian government construction projects. There is evidence that Ghanaians' approach to government work is poor, due to cultural orientation inherited from the colonial era, when public sector work was perceived as belonging to the 'Whiteman', hence, could be handled haphazardly (Damoah & Akwei, 2017: 35).

Asunka (2016: 6) found that the Ghanaian compliance with formal rules and procedures by public and/or government officials is significantly lower in districts where voters show strong commitments to partisan politics and *vice-versa*.

Table 1: Management control factors affecting labour productivity

Factors	*Authors*
Crowdedness, crew size, work quantity, job type, supervision and information flow tools and concrete pumping; factory conditions, material condition, materials transport, material procurement delay	Thomas and Sakarcan (1994)
Non-payment to suppliers causing the discontinuation of material delivery to the site, late issuance of progress payment by the client to the main contractor, and coordination problems between the main contractor and the subcontractor	Abdul Kadir *et al.* (2005)
Decision-analysis techniques	Durdyev *et al.* (2018)

2.5 Measuring technique of labour productivity

Work measurement provides the basic information necessary for all the activities of organising and controlling the work of an enterprise in which the time element plays a part. Cornwell and Cornwell (2006: 5) assert that measurement is crucial prior to a management activity. However, it should be noted that an incorrect measurement of labour performance can lead to incorrect and distorted decisions by the management team. Therefore, the importance of measuring the right productivity at the right time to reflect the true conditions of a company cannot be overemphasised. The measurements should offer the management an opportunity to make effective and accurate decisions. The various techniques available to supply information need to be explored, in order to identify the right measurement technique for the prevailing conditions. These techniques include time studies, work sampling, subjective evaluations, and personal recording of activities (Grund & Przemeck, 2012: 2150). The use of technological advances makes it easier to acquire accurate results efficiently.

2.5.1 Task-measuring technique

Tasks can be simply defined as units of work activity that produce output (Autor & Handel, 2013: 59). In the task framework, human labour has some primacy over machine input in the production process. Because it is intrinsically flexible and adaptable, human labour has historically preceded machine input in the performance of most types of tasks (Autor & Handel, 2013: 78).

The task framework extends both delay and activity frameworks into a concept of site factors (Agrawal & Baruah, 2018: 5). The concept of site factors recognises that, in the construction process time utilisation, certain activities are basic or necessary, others are additional but necessary, while there are unnecessary activities. The concept of site factors was developed by combining the assessment of time utilisation, work rate and allowing for relaxation.

Fernández-Macías and Bisello (2022: 827) argue that measuring task dimensions and indicators as continuous variables, and with separate and potentially overlapping scores, allows for a more nuanced analysis of the distribution of tasks across jobs, including the combination and clustering of tasks in particular task bundles.

This framework allows for the assessment of the performance gap on a construction site by quantifying site factors. However, rating and allowances to be given for recovery from fatigue and other purposes are still largely matters of judgement and, therefore, fairly subjective, despite the various studies and guidelines that exist. Where such subjectivity is likely to have a significant influence on the study results, it is best to utilise other methods less likely to incorporate subjectivity. This framework is likely to produce subjective results in this research, owing to a complete lack of work-study experiences, not only in construction but also in manufacturing.

2.5.2 Activity-measuring technique

The frameworks are based on work measurement, using an activity sampling approach. They measure the time spent in different pre-defined activities and can be applied to most of the construction activities. The main objective is to identify the proportion of unproductive time on site. It is assumed that the reduction of unproductive time will make more time available for direct work.

How construction workers spend their working time is of great concern to construction companies. Under the influence of lean thinking, in the construction industry, interest in labour time utilisation and eliminating waste is increasing (Yi & Chan, 2013: 216). Work sampling (WS), a widely used work-study method in the construction industry, uses random observation to investigate how a workforce uses its work time.

The activity framework is based on work sampling and is readily applicable to labour-intensive activities. A valid activity framework is required to show that direct work times and outputs are related in some predictable fashion (Tsehayae & Fayek, 2016: 212). However, past studies have shown that the definition of work categories and the subsequent task classifications can significantly affect the different proportions and subsequently their relationships with construction labour productivity (CLP) (Tsehayae &

Fayek, 2016: 220). Josephson and Björkman (2013: 595) also conclude that work sampling studies provide hardly any value in measuring productivity.

Table 2: Techniques for measuring labour productivity

Measuring technique	*Main objective*	*Suitability*	*Ease of application in this research*
Task	Identification of site factors (site production efficiency factors)	This is essentially a benchmarking model; it requires specific training for effective utilisation	Specific knowledge and experience required for effective study
Activity	Identification and reduction of unproductive time	Suitable and detailed enough but does not focus directly on productivity	Can be applied effectively

3. RESEARCH METHODOLOGY

3.1 Research design

The study adopted a quantitative research design that used a questionnaire-based descriptive survey to report on the factors influencing the labour productivity of labour-intensive works. It also reports on the productivity performance of the firms doing labour-intensive work. The descriptive survey attempts to provide large volumes of data that can be analysed for frequencies, averages, and patterns (Bless, Higson-Smith & Sithole, 2018: 16; Fellows & Liu, 2008: 222; Dixon *et al.*, 2020). This design is ideal, because it gives the researchers the opportunity to generalise their findings from a target population (Creswell, 2014: 11; Bryman, 2012: 232; Newman *et al.*, 2020). In the questionnaire, thirteen items were set as the variables that management should use to measure labour productivity. Principal component analysis (PCA) was used to analyse factors and to reduce these measured variables to smaller factors critical for labour productivity. Rossoni, Engelbert and Bellegard (2016: 201) affirm that PCA can be used to extract factors, in order to summarise the data into a manageable number of factors based on the highest eigenvalues.

3.2 Population, sampling and response rate

The target population for this study includes all contractors, site engineers, facilitators, timekeepers, district engineers, and Ghana Social Opportunity Project (GSOP) desk officers involved in labour-intensive works in road construction in Ghana. Records available at the GSOP indicate that 920 professionals are involved in labour-intensive works. These are considered to be the study population.

The GSOP is divided into five zonal offices, namely Bolgatanga, Wa, Temale, Kumasi, and Accra. Since the country has been divided into zones, the stratified sampling technique was used, based on the diverse nature of the population. There are 60 district offices for all the zonal offices: Bolgatanga has 12 district offices, Wa has 10, Temale has 11, Kumasi has 14, and Accra has 13 district offices.

Since not all the district offices were handling road-construction projects, the purposive sampling technique was used to select 40 districts that were involved in road-construction projects. Of the 40 districts, one district engineer and one GSOP desk officer were selected from each district, thus totalling 80 respondents. Three (3) sites from each district were selected, making a total of 120 districts. Of the 120 sites, one facilitator, one timekeeper, one site engineer, and one contractor from each site were selected, making a total of 480 respondents. In all, 560 respondents were considered for the study. Out of 560 respondents, 543 gave a complete response to the questionnaire, thus a response rate of 97%. The table by Krejcie and Morgan (1970: 608) recommends a sample size of 175 for a population of 950. This recommendation validates the sample size of 560 as excellent for the population of 920.

3.3 Data collection

Using the drop-and-collect and email methods, 560 questionnaires were distributed to the prospective respondents who did labour-intensive work on road-construction projects in Ghana from November 2016 to August 2017. Some items on labour productivity used in the questionnaire were extracted from reviews of the literature, and others were developed by the researcher, resulting in the compilation of a questionnaire divided into two sections. The first section obtained demographic information of the respondents such as age, gender, occupation, educational background, experience level, and geographical location.

The second section set 13 Likert-scale items on the construct ‘factors critical for management control’. The respondents were requested to rate their level of agreement on how critical these items are that influence productivity of labour-intensive works in Ghanaian firms. The data from these measurements form the Likert-scale items used in the descriptive analysis and the variables used in the inferential statistics tested the validity and reliability of the factors. To reduce the respondents’ bias, closed-ended questions were preferred for section two (Harlacher, 2016: 9-10).

3.4 Method of analysis and interpretation of the data

The data were analysed using the Statistical Products and Service Solutions (SPSS) version 24.0 program and presented in tables and diagrams (Pallant, 2013: 134). Using descriptive statistics, frequencies and percentages were generated and reported in rder to analyse the respondents' background characteristics.

The ranking of the mean scores of the management control factors (measuring tools) was done using a five-point Likert scale to rate the quality of the initial 13 items for measuring labour productivity. Likert-type or rating scales use fixed choice response formats and are designed to measure opinions (Singh, 2006: 202). The following scale measurement was used regarding mean scores, where 1 = Very poor (≥1.00 and ≤1.80); 2 = Poor (≥1.81 and ≤2.60); 3 = Average (≥2.61 and ≤3.40); 4 = Good (≥3.41 and ≤4.20), and 5 = Excellent (≥4.21 and ≤5.00).

Cronbach's *Alpha* values were conducted in line with Wahab, Ayodele and Moody (2010: 67) to determine the internal reliability of the 13 items. Acceptable Cronbach's *alpha* ranged from 0.70 to 0.95 (Tavakol & Dennick, 2011: 54-55). Thus a cut-off value of 0.70 was adopted for this study.

For factor loadings to be reliable, Pallant (2013: 134) suggests a range from 0.2 to 0.4 as the optimal inter-item correlations mean (factor loading). This study adopted a value of 0.4 and above.

The Meyer-Olkin (KMO) (Lorenzo-Seva, Timmerman & Kiers, 2011), and Bartlett's Test of Sphericity (Hair *et al.*, 2014: 110) were conducted to determine the suitability of the data for factor analysis. For this study, values above 0.7 are required for applying EFA (Hair *et al.*, 2014) as the KMO test values vary between 0 and 1. A statistically significant Bartlett test ($p<0.05$) indicates that sufficient correlations exist between the variables to continue with the analysis (Pallant, 2013: 190).

For factor extraction and rotation, Oblimin with Kaiser normalisation and PCA was adopted to reduce the initial factors into a minimum number of factors, by concentrating the explanatory power on the first factor (Rossoni *et al.*, 2016: 102).

4. FINDINGS

4.1 Demographic profile of the respondents and firms

Table 3 presents the profile of the 543 respondents. Based on frequency of occurrence, most of the respondents (87%) were males, aged between 26 and 35 years (51.1%). The majority of the respondents (27.8%) were engineers and others were also employed as contractors, timekeepers, and facilitators (22.1% each). Most of the respondents (66.9%) had either a bachelor degree (36.3%) or a technical qualification (30.6%), and 16.9% had matriculated. Although 47% of the respondents have between two and five years' work experience, a slight majority (53.1%) have six years' work experience or more. This proves that the respondents are qualified to work in the construction industry and have adequate experience to give information that could help in making deductions on factors measuring labour productivity. Respondents were almost equally distributed for the geographical locations with 20.6% from Bolgatanga, 20.6% from Wa, 20.3% from Tamale, 20.1% from Kumasi, and 18.4% from Accra. A greater percentage (61.5%) of the respondents work in the three northern regions of Ghana, namely Bolgatanga, Wa, and Tamale.

Table 3: Respondents' profile

Demographic	*Characteristic*	*Frequency (N=543)*	*Percentage*
Gender	Male	472	87
	Female	71	13
Age	<20 years	26	4.8
	20-25years	52	9.6
	26-30 years	148	27.3
	31-35 years	129	23.8
	36-40 years	106	19.5
	41-45 years	73	13.4
	46 years or above	9	1.7
Occupation	Contractors	120	22.1
	Site engineers	119	21.9
	Timekeepers	120	22.1
	Facilitators	120	22.1
	GSOP desk officers	32	5.9
	Director of Public Works	32	5.9
Education level	Masters degree	16	2.9
	Bachelor degree	197	36.3
	National diploma	72	13.3
	Technical/SSCE	166	30.6
	Matriculation certificate/BECE	92	16.9
Experience	2-5 years	255	47
	6-10 years	202	37.2
	11-15 years	51	9.4
	16-20 years	22	4.1
	20 years and above	13	2.4

Demographic	*Characteristic*	*Frequency (N=543)*	*Percentage*
Geographical location	Bolgatanga	112	20.6
	Wa	112	20.6
	Tamale	110	20.3
	Kumasi	109	20.1
	Accra	100	18.4

4.2 Descriptive analysis

In Table 4, an average MS of 3.88 shows that all 13 identified management control factors influence labour productivity of the firms in labour-intensive works in road construction in Ghana. The Cronbach's *alpha* values for each factor was greater than 0.70, indicating acceptable internal reliability, as recommended by Hair *et al*. (2014).

Table 4: Ranking of management control factors

Factors (N=543) 1 = very poor … 5 = excellent	*MS*	*Cronbach's alpha*	*Rank*
Attitude of site personnel	4.33	0.806	1
Project planning	4.23	0.819	2
Supervision of subordinates	4.19	0.732	3
Delegation of responsibilities	4.19	0.829	4
Accuracy of technical information	4.15	0.916	5
Knowledge of project technology	4.01	0.778	6
Scheduling of project activities	4.01	0.762	7
Involvement of site managers in contracting meetings	3.76	0.874	8
Presence of variations in the drawings	3.71	0.823	9
Integration of project information	3.64	0.842	10
Communication between head office and site	3.59	0.765	11
Use of incomplete drawings	3.41	0.812	12
Use of complex designs in the provided drawings	3.28	0.789	13
Composite score (average)	3.88		

With means score ratings above 4.21, attitude of site personnel (MS=4.33) and project planning (MS=4.23) were ranked top two and perceived by respondents as excellent factors when measuring labour productivity in their firms. Supervision of subordinates (MS=4.19), delegation of responsibilities (MS=4.19), and accuracy of technical information (MS=4.15) were ranked three to five, respectively, and were rated by respondents as 'good' in their firms. Other management control factors that were rated by respondents as 'good' were knowledge of project technology (MS=4.01), scheduling of project activities (MS=4.01), involvement of site managers in contracting meetings (MS=3.76), presence of variations in the drawings (MS=3.71), integration of project information (MS=3.64), and communication between head office and site (MS=3.59). Use of incomplete drawings (MS=3.41) and use of complex designs in the provided drawings (MS=3.28) were rated as 'average' and ranked the lowest of all the items.

4.3 Inferential statistics

4.3.1 Principal component analysis

The 13 management control factors that can promote labour productivity of labour-intensive works in road construction were subjected to PCA, in order to assess their validity and reliability. The results report the suitability of the data to be analysed, factor extraction and rotation, as well as interpretation.

As shown in Table 5, the KMO measure of sampling adequacy achieved a value of 0.802, exceeding the recommended minimum value of 0.7. Bartlett's test of sphericity was also statistically significant (<0.05), thus supporting the factorability of the data.

Table 5: KMO and Bartlett's test of management control

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.802
Bartlett's test of sphericity	Approx. *Chi*-square	5643.636
	df	78
	Sig.	.000

The pattern matrix in Table 6 shows that, out of the initial 13 variables, PCA extracted 11 variables in four components with factor loadings above 0.4 with the potential to influence labour productivity of labour-intensive works in road construction in Ghana. Two variables (MC1 and MC12) had scores of less than 0.4 and are thus regarded as not reliable to influence labour productivity. These were excluded from the rotation.

Table 6: Pattern matrix of management control variables (MC)

Variables	*Component*			
	1	*2*	*3*	*4*
MC2 Integration of project information	**0.915**	-0.211	0.138	0.048
MC6 Project planning	**0.796**	0.244	-0.253	-0.049
MC9 Communication between head office and site	**0.792**	0.004	0.235	0.077
MC10 Involvement of site managers in contracting meetings	**0.748**	0.044	-0.093	**0.403**

Variables	*Component*			
	1	*2*	*3*	*4*
MC13 Accuracy of technical information	**0.746**	-0.04	0.024	-0.678
MC11 Attitude of site personnel	-0.089	**0.901**	-0.082	0.090
MC8 Supervision of subordinates	-0.094	**0.830**	0.149	-0.310
MC7 Scheduling of project activities	**0.546**	**0.584**	-0.223	0.201
MC4 Use of complex designs in the provided drawings	0.068	-0.173	**0.878**	0.207
MC3 Use of incomplete drawings	-0.377	0.098	**0.659**	-0.434
MC5 Presence of variations in the drawings	0.303	0.120	**0.787**	-0.672

Extraction method: PCA; rotation method: Oblimin with Kaiser normalisation

Table 7 shows that, after rotation, three components with eigenvalues exceeding 1.0 were extracted and are meaningful to retain. Factor one explains 34.74% of the total variance; factor two, 21.33%, and factor three, 13.44%. Thus, the final statistics of the PCA shows that three extracted factors explain a cumulative variance of approximately 69.5%.

Table 7: Total variance explained of management control variables (MC)

Component	*Initial eigenvalues*			*Extraction sums of squared loadings*			*Rotation sums of squared loadings*[a]
	Total	*% of variance*	*Cumulative %*	*Total*	*% of variance*	*Cumulative %*	*Total*
1	4.517	34.743	34.743	4.517	34.743	34.743	4.179
2	2.773	21.329	56.071	2.773	21.329	56.071	2.417
3	1.747	13.438	69.509	1.747	13.438	69.509	1.709
4	1.371	10.549	80.058				
5	.772	5.942	86.001				
6	.591	4.548	90.548				
7	.343	2.640	93.189				
8	.291	2.241	95.429				
9	.150	1.157	96.586				
10	.145	1.117	97.703				
11	.128	.981	98.685				
12	.099	.763	99.448				
13	.072	.552	100.000				

Extraction method: PCA; [a.]When components are correlated, sums of squared loadings cannot be added to obtain a total variance

Table 8 reveals the correlation of variables based on their factor loadings after rotation in PCA. Three components with eigenvalues above 1 (see Table 4) were examined on the inherent relationships among the variables under each factor. Variables with the highest factor loading in one component belong to that component; the highest factor loading must be of significant value of 0.4 and above (see Table 4). Component 1 was labelled Effective communication; Component 2, Supervision technique, and Component 3, Design inadequacies. The names given to these factors were derived from a close examination of the variables within each of the factors.

Table 8: Rotated factor matrix for management control variables (MC)

Variables	*Component*		
	1	*2*	*3*
	Effective communication	*Supervision technique*	*Design inadequacies*
MC2 Integration of project information	0.915		
MC6 Project planning	0.796		
MC9 Communication between head office and site	0.792		
MC10 Involvement of site managers in contracting meetings	0.748		
MC13 Accuracy of technical information	0.746		
MC11 Attitude of site personnel		0.901	
MC8 Supervision of subordinates		0.830	
MC7 Scheduling of project activities		0.580	
MC4 Use of complex designs in the provided drawings			0.878
MC3 Use of incomplete drawings			0.659
MC5 Presence of variations in the drawings			0.787

Extraction method: PCA; Rotation method: Oblimin with Kaiser normalisation

Component 1: Effective communication

This component with five sub-factors accounts for 34.7% of the total variance. As presented in Table 7, correlation exists between variables 2, 6, 9, 10, and 13 as they are loaded onto Component 1. The variables that had high loading are Integration of project information (0.915), Project planning (0.796), and Communication between head office and site (0.792). The results obtained in this research were further endorsed by Gerges (2015), who positions communication issues among workers and supervisors. It should be noted that poor correspondence and coordination among projects parties, in turn, influence the flow of project activities and indirectly affect labour productivity in road construction.

Component 2: Supervision technique

Supervision technique accounts for 21.3% of the total variance and comprises three correlated variables that load onto Component 2. Attitude of site personnel (0.901) and Supervision of subordinates (0.830) have the highest factor loadings. Scheduling of project activities had a loading of 0.580. The outcome is justified because, when there is a lack of supervision and performance monitoring, change orders, poor management style, lack of coordination among the construction parties and client influence result in decreased construction productivity (Durdyev *et al.*, 2018). The related impact of this result is in agreement with the outcomes reported by Jergeas (2009) who indicates that construction managers must provide properly detailed and realistic schedules to on-site supervisors so that they can follow and coordinate site works. Jergeas (2009) recommends that construction managers supervise planned activities, whether they are properly implemented or not, and monitor workforce performance by asking their suggestions regarding productivity improvement. This will go a long way in achieving high productivity.

Component 3: Design inadequacies

This component with three sub-variables accounts for 13.4% of the total variance. Correlation exists between variables 3, 4, and 5 as they are loaded onto Component 3. Use of complex designs in the provided drawings (0.878), and Presence of variations in the drawing (0.787) had high loadings. Use of incomplete drawings had a loading of 0.659.

For management to play its role in ensuring productivity at sites, three factors need to be considered, including effective communication (EC) from management to the sites, supervision technique (ST) which needs to be effectively done while there is a need to avoid or reduce the frequency of design inadequacies (DI), as shown in Figure 2.

For effective communication to take place from management to the workers at sites, five key associated attributes need to be observed, including the integration of project information (EC1); project planning (EC2); communication between head office and site (EC3); involvement of site managers in contracting meetings (EC4), and accuracy of technical information (EC5). Instructions can be given either directly to the labourers who are doing the work or indirectly through the gang leader. Direct instructions should be used as much as possible, especially when artisans are involved.

Supervision technique (ST) also had three key associated attributes that need to be observed. These include the attitude of site personnel (ST1); supervision of subordinates (ST2), and scheduling of project activities

(ST3). The supervisors should demonstrate how the work should be done by actually doing the work for a short period. This is the best way to make the instructions understandable. It is always important to use simple words and clear expressions. Inspecting is important after giving instructions to determine whether the instructions are being understood and followed. Before the gangs are released for the day, the construction supervisor must inspect and approve their work. The supervisor must have good knowledge of the construction processes; the sequence of activities; the estimated time required for mobilising; starting up activities, and final clearance of the site.

Three key associated attributes formed the design inadequacies (DI). If the following inadequacies are avoided, there will be effective management and control on sites. The attributes that constitute design inadequacies are the use of complex designs in the provided drawings (DI1); the use of incomplete drawings (DI2), and the presence of variations in the drawing (DI3).

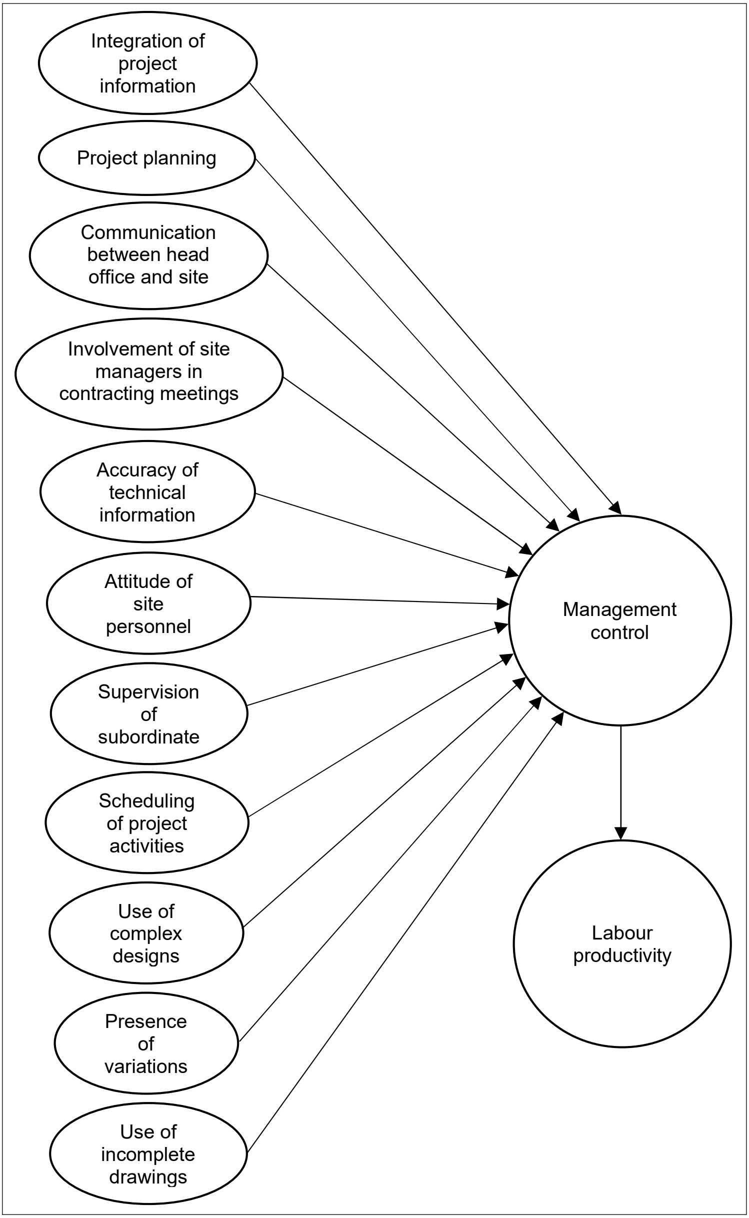

Figure 2: Management control labour productivity framework

5. DISCUSSION

The results of the descriptive analysis show that 13 variables listed of the management control factors were identified. The findings indicate that 'Attitude of site personnel' was ranked first, with a mean score of 4.33; 'Project planning' was ranked second, with a mean score of 4.23; 'Supervision of subordinates' was ranked third, with a mean score of 4.19; 'Delegation of responsibilities' was ranked fourth, with a mean score of 4.19, and 'Accuracy of technical information' was ranked fifth, with a mean score of 4.15.

'Knowledge of project technology' was ranked sixth, with a mean score of 4.01; 'Scheduling of project activities' was ranked seventh, with a mean score of 4.01; 'Involvement of site managers in contracting meetings' was ranked eighth, with a mean score of 3.76; 'Presence of variations in the drawings' was ranked ninth, with a mean score of 3.71, and 'Integration of project information' was ranked tenth, with a mean score of 3.64. Finally, 'Communication between head office and site' was ranked eleventh, with a mean score of 3.59. 'Use of incomplete drawings' and 'Use of complex designs in the provided drawings' were the least ranked, with twelfth and thirteenth position, respectively. They had mean scores of 3.41 and 3.28, respectively.

The results from the PCA analysis identified three main factors (Effective communication; Supervision technique, and Design inadequacies) that can influence management control in promoting labour productivity of labour-intensive works in road construction.

The outcome is, therefore, justified because, when there is a lack of supervision and performance monitoring, change orders, management style, lack of coordination among the construction parties and client influence result in decreased construction productivity (Durdyev *et al.*, 2018). The management and control component plays a significant role in transferring tasks and instructions to workers. The related impact of this factor is in agreement with the outcomes reported by Jergeas (2009), who indicates that it is crucial for construction managers to provide properly detailed and realistic schedules to on-site supervisors so that they can follow and coordinate site works. The results obtained in this research are further endorsed by Gerges (2015), who positions communication issues among workers and supervisors as his main 33 factors. It should be noted that poor correspondence and coordination between projects parties influences the flow of project activities and indirectly affects labour productivity in road construction.

The findings from the descriptive analysis results agree with the preliminary findings of Jarkas & Bitar (2012); Ghoddousi & Hosseini (2012); Lessing, Thurnell & Durdyev (2017). They note that external factors can hardly influence the actual physical quantity and working hours; the hourly output measurement of productivity can provide an accurate proxy for construction activity efficiency. A successful construction project is completed on time, within budget, meets specified standards of quality, and strictly conforms to safety policies and precautions.

6. CONCLUSION AND RECOMMENDATION

There is a need for management to effectively communicate with their workers. The construction project management team plays a significant role in transferring tasks and instructions to workers. Attention should be paid to the supervision technique to ensure the quality of the job executed.

The novelty of this study also lies in the labour productivity framework for labour-intensive works in road construction; it informs as to the components, including effective communication; supervision technique, and design inadequacies that determine management control factor on labour productivity of labour-intensive works in road construction in the Ghanaian construction industry. Similarly, the latent variables, which led to the labour productivity outcome variables, could be used for the firms' labour-productivity measurement in the Ghanaian construction industry.

Construction managers need to find ways to improve the communication skills on the task system of the job.

Moreover, construction professionals could use this knowledge to help with decision-making in the firm. The results of this study can also be introduced as an important tool in planning, in order to fast-track the effective utilisation of road construction work using the labour-intensive approach to improve on productivity by completing the work as scheduled in the contract. It can also assist contractors in forecasting the time it will take to construct a given road, using the labour-intensive method.

The study results also demonstrate the level of influence of the three constructs towards indigenous construction firms' labour productivity in the Ghanaian construction industry. The results may help the Association of Building and Civil Engineering Contractors of Ghana (ABCECG) make decisions about the criteria to be given priority in providing the relevant support towards indigenous construction firms' productivity in the Ghanaian construction industry. It will ultimately enable the ABCECG to know the vital areas to which to commit resources towards contractors' capacity development.

Further, the management control framework (Figure 2) may be used as a guide to ensure that all elements necessary for achieving high labour productivity of road construction firms are in place.

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