

Determinants of Labour Productivity of Site Operatives in Ghana: Perception of the Site Managers

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Abstract

The study sought to establish the determinants of labour productivity of Site operatives in Ghana. Increasingly, there is labour unrest in the construction industry in most developing countries including Ghana, and productivity has become a matter of concern, because there is a demand for higher wages, while the facts on the ground is loss of man hours due to bad management practices and general attitude of workers, and construction also demand intensive labour. The main outcome from the literature is that there is no standard definition of productivity. The study adopted a quantitative design drawn from two previously studied literatures of industrial economics and labour economics. It reports on a survey made on project managers and experienced foremen of building projects in three regional capitals, namely Accra, Kumasi & Tamale. Random stratified sampling was employed to select contractors in the regions for the quantitative study. Whiles survey strategy was adopted in the collection of data. As a result, a questionnaire was developed and administered to project managers of selected construction companies. The PCA extracted four factors namely, quality leadership, communication, motivation and experience supervisors. The analysis revealed that, among 28 critical factors, the 4 extracted factors had great effect on operatives' labour productivity. This has implications for designing managerial strategies for improving labour productivity since the extracted factors are all managerial related factors. Based on the findings, the study has made recommendations for improving the productivity of site operatives in Ghana. Recommendations have also been made for further research.

Keywords: Labour Productivity, Site Operatives, Constructions Management

INTRODUCTION

1.1 Background of the Study

There is increasingly labour unrest in the construction industry in most third world countries including Ghana. Parallel to labour unrest is low productivity because of loss of man hours due to bad management practices and general attitude of operatives. The efficient utilization of resources, particularly labour, sadly remains one most important measure of management performance (Shehata & El-Gharry, 2011). In construction, productivity is usually taken to mean labour productivity, that is, units of work placed or produced per man-hour. The inverse of labour productivity, man-hours per unit (unit rate), is also commonly used (Shehata & El-Gharry, 2011).

Formulating effective plans to increase productivity has remained a priority for the construction industry (Dainty & Loosemore 2013). In this perspective, many research studies have been conducted recently to establish the main determinants of productivity in a wide range of countries (Durdyev & Mbachu 2011; Ghoddousi & Hosseini 2012; Gudiené et al., 2013). Given that there is an association between productivity and wages, it is important that construction project managers and contractors have a fair knowledge of the methods leading to the evaluation of productivity of equipment and labour, in the various crafts (Shehata & El-Gharry, 2011) also, Iyer and Jha (2005), inferred that skills and quality of leadership affects strongly and directly on productivity or performance of construction project. As they bemoaned, "If project managers have strong leadership skills, the project performance can be monitored controlled and managed with high quality".

Studies show a great variety of methods used for measuring productivity in the construction industry. The main resources to manage in the construction industry are labour, material and plant (capital investment). In order to maximize profit and make gains, it is important, as mentioned earlier, to have a controlling hand of the determinants of productivity which contributes to production in general, like labour, equipment, material, cash flow, etc. Literature revealed in Egypt that the second performance criteria, out of 12, by which construction managers would like their performance to be evaluated is "the efficient utilization

of resources" (Shehata & El-Gharry, 2011). An effective and efficient management of construction resources can result in increased productivity and profit, whilst ineffective and inefficient management of these same resources might lead to low productivity and loss of man hours.

As stated earlier, young site engineers working in contracting organizations ranked utilization of resources the second out of 12 factors that affect the performance of construction organizations in Egypt (Abdel-Razek, 2004, p. 4; Shehata&El-Gharry,2011). Labour productivity is an important indicator of economic performance. The measures that we choose and how we apply them determine how effectively we manage our resources.

According to McTague *et al.*, (2002); Thomas *et al.*, (2003); Akindele, (2004), they have found labour to account for a third of the total direct capital cost of construction projects. However, only a third to one and a half of worker's time is spent directly on work activities productively (Thomas *et al.*, 2003). The cost of construction labour has risen in recent years since workers always make demand for higher pay and fringed benefits. Improvement in the contribution of labour to productivity is the result of a healthier, better education, better nourished labour force and at times shorter work week (Heizer & Render, 1990). There is enough evidence that suggests that productivity measurements should be the basis for making productivity improvement decisions (Oglesby *et al.*, 1989; McCullouch, 2007; Carlos &Paul,2010). Hence the need for this study, to identify the determinants of labour productivity of operatives in Ghana.

1.2 Statement of the Problem

Globally, labour has been found to account for a third of the total direct capital cost of construction projects (Mac Tague *et al.*, 2002; Thomas *et al.*, 2003; Akindele & Adebo, 2004). Hanna *et al.*, (2005), also propounded that the cost of labour in construction industry is estimated to be about 33%- 50% of the entire project cost. In the construction industry productivity loss is one of the greatest and severe problems. Example, when workers embarked on strike action or lay down their tools, the result is a decreased in labour productivity. A decrease in productivity is an increase of labour cost. Impliedly, an increase in productivity can reduce the labour cost in a direct proportion. It can either benefit or reduce a project's profit, and that making it vital importance to the construction industry (Hanna *et al.*, 2005). The antecedents of low productivity or high productivity have been established by a number of researchers. As mentioned earlier, in the construction industry productivity loss is primarily a serious problem. Currently, construction contracts lack enough to classify recompense for productivity loss due to field factors (Construction Industry Institute [CII], 2000; National Electrical Contractors Association [NECA], 1989). Since labour is more variable and unpredictable than other project-cost components, it has become essential to understand the effects of determinants of labour productivity. Preceding research confirmed that productivity loss results from diverse factors, which includes but not limited to various variation in drawings, long hours of extra work, poor field management, and extreme climatic conditions (Alarcon & Borcharding, 1991; Leonard, 1987; Sanders & Thomas, 1991; Thomas & Oloufa, 1995).

It is not only these; other determinants or factors underpin low productivity. As mentioned earlier, the labour front in Ghana is often characterized by industrial strikes in demand for improved working conditions. If workers in the construction industry embark on strike action or lay down their tools, it is likely to cause reduction in productivity and time overruns which in effect will cause labour, and material cost to increase when there are delays due to labour strikes. Studies by Borcharding and Oglesby (1974), showed increase construction cost because mostly construction projects have deadlines to meet with cost penalties attached. Mbachu and Olaoye (1999), also discovered that Nigerian construction industry is bedevilled by projects that complete much longer than they are mutually planed. It has become extremely important or necessary to improve the productivity of labour in the Construction Industry in Ghana. Firstly, the construction industry is an important economic sector. Secondly, increasing labour productivity will lead to growth of the construction sector and also affect other related sectors. Thirdly, labour is a resource in construction industry. Finally, there is little study/research on construction labour productivity in developing countries, particularly Ghana. Thus the reason it has become extremely important to find out the determinants that affect the construction labour productivity of operatives.

The construction industry plays an important role in any economy and its activities are also vital to the achievement of socio-economic development goals of providing shelter, infrastructure and employment (Anaman & Amponsah, 2007). It is worth noting that one of the main agenda of the Millennium Development Goals (MDGs) and The Ghana Poverty Reduction Strategy II (GPRSII), is to address human development issues of which, Cotton et al., (2005) noted that the agenda is achievable by the provision of infrastructure for services and employment through the construction industry, if productivity on construction sites are improved to promote and sustain efficiency. Furthermore, increasing labour productivity will lead to growth of the construction sector and other related sectors of the national economy. These and many reasons make it extremely important to find out the determinants that affect the construction labour productivity of operatives.

Despite the above facts, there is very little research work on determinants that affect labour productivity (Construction Industry Institute [CII], 2000; National Electrical Contractors Association [NECA], 1989). The onus, therefore, lies on construction managers to improve productivity of workers on construction projects by making sure that, supervisors at all levels are sufficiently skilled in handling tasks (The Business Roundtable, 1989). There is therefore the need to identify the determinants that affect labour productivity in relation to the construction industry and manage them to improve productivity among workers.

1.3 Aim and Objectives of the Study

The main purpose of this study is to examine the determinants that affect labour productivity of operatives of the construction industry in Ghana and to find out the perception and practices that promote labour. The specific objectives of the research are as follows:

- To assess current practices by Ghanaian contractors to improve productivity,
- To identify factors that correlates labour productivity of operatives in the Ghanaian construction industry,
- To identify key constraints to construction labour productivity of site operatives in Ghana and,
- To develop a framework for improving construction labour productivity.

1.4 Research Questions

- What are the current practices by Ghanaian contractors to improve productivity in Ghana?
- What are the factors that predict or correlate labour productivity of operatives in the Ghanaian construction industry?
- What are key constraints to construction labour productivity of site operatives in Ghana?
- What is the framework for improving construction labour productivity of operatives?

1.5 Significance of the Study

Labour Productivity has a greater significance in the construction industry in Ghana. It constitutes a significant part of production input for projects in the industry (Kazaz & Ulubeyli, 2007). However, this study would contribute to literature on determinants of construction labour productivity of site operatives in Ghana. It would provide essential information about determinants of labour productivity to Project Managers. This will lead to increased profit and eventually lead to high wages that will boost the morale of workers in the industry. It will again serve as a basis for planning, for all stakeholders in the construction industry, including the Ministry of Water Resources, Works and Housing, members of the Association of Building and Civil Engineering Contractors of Ghana (ABCECG). The significance of the study cannot be under estimated. In fact, it would eventually lead to high productivity and growth which would affect other areas of the economy. More importantly, it will benefit future researchers on determinants of labour productivity issues.

1.6 Limitations and Delimitation of the Study

The study is meant to cover the entire nation but due to time space and financial constraints, it limits itself to three stratum or regions instead of ten regions. The regions are Northern; Tamale, Ashanti; Kumasi, and Greater Accra region for Accra. The three major cities mention in the regions have been selected for the study because of its population, commercial

and business activities, especially construction activities and above all, their geographical locations in the mapping of the regions.

1.7 Organization of the Study

The structure of this research comprised of six chapters. Chapter one deals with the introduction, which forms the beginning of the main body of the study (background), including the problem statement, the purpose and objectives of the study, the research questions, significance of the study, limitation and delimitation, then the organization of the study. Chapter two focuses on the review of related literature, while the methodology of the study is the subject of chapter three. The chapter on methodology describes the research design, the population, sample techniques and sample size, data gathering instrument, pilot study and data collection procedure of the study. Also covered in the chapter are the variables of the study and the methods of data analysis. Chapter four presents the analysis of the outcome and discussion of findings with tables, figures and graphs. Chapter five presents the discussion of results. The discussion shall highlight the major findings of the study and inferences made from them in view of findings from related previous studies. The apex of the research is the chapter six. The chapter brings to bear the summary of findings, conclusions and recommendations. The major research findings would be itemized and show how it contributed to body of knowledge (BOK).

2.0 REVIEW OF LITERATURE

2.1 Introduction

This study draws its literature from two previously separate branches of economics; industrial economics and labour economics. Drawing upon these two distinct sources of economic analysis has important implications for the structure, content and methodological approach adopted for this research. In bringing these two elements together it is possible to achieve a more comprehensive and more fully integrated treatment of determinants of construction labour productivity in a less developed economy like that of Ghana. In terms of constraints and determinants of labour productivity, there are two schools of thought. First, industrial economics has traditionally been more concern with analysis at the level of the individual establishment, firm, market and industry, whereas labour economics has focused primarily upon industry's sectorial relationships within the developmental and effectual use of human resources. Second, it has typically focused upon issues of central concern to mature industrial economics serving large domestic markets; their competitiveness, the transmission of new knowledge into new products and processes, the levels of technical and a locative efficiency that are achieved, this is not the same in labour economics. Labour which (otherwise known as human resources) has widely been recognized as being vital in every organization yet industry have a momentous task in forecasting and planning its manpower requirements which enables the full utilization of these resources. In view of its importance to productivity, there is the need to improve it. However, careful adaptation would be required to implement the knowledge and experience gained in the manufacturing industry to the building construction industry (Alarcon and Borcharding, 1991).

The aspects to be reviewed here include the following sections; section one of the reviewed literatures is about the concept and definition of labour productivity, and section two talks about measurement of productivity. In similar order follows subsequent sections; section three as methods used in productivity measurement, section four is misconceptions about construction productivity, followed by productivity in the construction industry. Then, continued with the impact of motivation, age, technology and unionism on labour productivity. Then, factors affecting construction labour productivity as the seventh section and the eighth section being the constraints to construction labour productivity. And finally ended with a conceptual framework deduced from reviewed literature on construction labour production. Also, the relevant literature reviewed would serve as a framework for the study. It would further be used to support or refute findings made in this research at the analysis stage of this write-up.

2.2 The Concept and Definition of Labour Productivity

The construction industry is seen as one of the most challenging and demanding industry in Ghana and still holds many opportunities for productivity improvement. The term

“productivity” expresses the relationship between outputs and inputs (Borcherding & Liou, 1986). An increased productivity can at a large have impact on the overall construction process and will result in insignificant cost and time saving (Ghana Trade Union Congress, 2011). Productivity improvement is the main concern for any profit oriented firm, as it represents the effective and efficient translating of resources into marketable product and also determining profitability. Therefore, considerable effort has been directed to understand the productivity concept with different approaches taken by researchers resulting in far reaching variety of definitions of productivity (Ghana Trade Union Congress, 2011).

Profitability describes the financial result of business operation. Productivity and price recovery are the major factors affecting profitability. Devis (2007) said at the broadest level, productivity refers to the ability of an industry to convert inputs into outputs. Productivity is a relative concept and when it measures that relates output to only one class of inputs, it is known as partial productivity. For example, labour productivity is measured dividing total output by the amount of labour used in production. It was observed by researchers like Tague and Jergeas (2002) that industry output has grown in line with the broader economy.

Productivity is a relevant concept with comparison either being made across time or between different production units. Productivity is a clear-cut or straightforward concept of a ratio of volume measure of output to a volume measure of inputs used in generating the output. That is to say the amount of output a person is able to generate within a specific time or period. Productivity simply means output per man hour (quantity of bricks laid by a bricklayer within a certain period of time). Prokopenko (1987), said “Productivity is the only important world-wide source for economic growth, social progress and improved standard of living”. Productivity can be defined in many ways, but as far back as 1883, Littre gave a definition to productivity as the “faculty to produce,” that is, the desire to produce (Jarkas, 2005). According to Jorgenson, Gollop and Fraumeni (1987), there are many definitions to productivity. Here, we restrict our interest to labour productivity as a direct measure of industrialization. The Organization for European Economic Cooperation (OEEC) in 1950, introduced the definition of productivity as a quotient obtained by dividing the output by one of the production factors (Sumanth, 1984). Drexler (1982) said in his studies the definition of labour productivity is the amount of goods and services produced by a productive factor (manpower) in the unit of time. The most used definition is that of Borcherding and Liou (1986), as a ratio between an output value and an input value used to produce the output. This output consists of products or services, and the input consists of materials, labour, energy, etc. Productivity is defined in many ways. Yet in construction, productivity is taken to mean labour productivity. Meaning units of work placed or produced per man-hour. The inverse of labour productivity, man-hours per unit (unit rate), is also usually used. Productivity is the ratio of output to all or some of the resources used to construct the object (output). Resources consist of labour, capital, energy, raw materials, etc.

Productivity is the “relationship between output generated by a production process or service system and the input provided to create this output”. It is a measure of output from a production process or a service system per unit of input. Productivity is the ratio of output to all or some of the resources used to produce that output. Output can be homogenous or heterogeneous. Productivity can be looked at as a ratio that tells us how well a company (individual or a country) is doing in terms of converting resources (labour, materials, machines etc.) into goods and services. In plain words, or in a clearer way, productivity refers to an economy’s ability to turn inputs into outputs. Mathematically, productivity is defined as the ratio of output to input or an output-input ratio. Generally, an operational definition of productivity that fit well with the various approaches to define the concept (which draws upon the output-input paradigm) as the amount or quantity of output of the process to unit of resources put-in”. This is in line with similar definitions given by a several number of researches (Ghana Trade Union Congress, 2011; Tran and Tookey, 2011; Page 2010; Enshassi *et al.*, 2007). Each measure of productivity is a ratio of output and input. However, the summary of the first Equation have all the key features embodied in this definitions;

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} \quad (\text{Eq.1a})$$

Where Input refers to production factors such as labour, capital, raw materials, and information used in the process of production and Output refers to the product or service

created. The output may be in the form of goods or services and it may be either for immediate use or an intermediate input for another production or service system.

$$\text{Productivity} = \frac{\text{Output}}{\text{Labourcost}} \quad (\text{Eq.1b})$$

In the above formula, labour cost means all inputs. This is quality added to the quantity of work done. That is to say that a high output-input ratio implies higher productivity. The reverse is also true, that is a low ratio implies lower or dwindling productivity. Higher productivity therefore means the ability of a labour force to achieve more in terms of quantity or quality of work done (output) with fewer or same labour cost or amount of resources (inputs). The productivity ratio, however, does not on its own measure how efficient and effective the conversion of resources (inputs) into output takes place. The basic notion of productivity is that it is the relationship between the quantity and quality of what is done (output) and the amount of resources, human or material, used in doing so. A productive system is one that produced more output, in terms of quantity and quality with the same or smaller amount of inputs.

Horner and Talhouni (1998) stated, "A popular concept in the USA, and increasingly in the UK, is the concept of earned hours. It relies on the establishment of a set of standard outputs or "norms" for each unit of operation. Thus, a number of earned hours are associated with each unit of work completed. Productivity may then be defined as the ratio of earned to actual hours. The problem with this concept is in establishing reliable "norms", for setting standards. It also depends on the method used to measure productivity, and on the extent to which account is taken of all the factors which affect it. On a construction site, contractors usually pay a lot of attention to labour productivity, and it can be defined in one of the following was;

$$\text{Labour Productivity} = \frac{\text{Output}}{\text{Labourcost}} \quad (\text{Eq. 2a})$$

OR

$$\text{Labour Productivity} = \frac{\text{Output}}{\text{Workhour}} \quad (\text{Eq. 2b})$$

There is no standard definition of productivity, and some contractors use the inverse of the above;

$$\text{Labour Productivity} = \frac{\text{Labourcost/Workhour}}{\text{output}} \quad (\text{Eq. 3})$$

Productivity is a relative concept which makes for comparisons either across time or between different production units and sectors. For example, producing more output this year with the same amount of resources or inputs that were used last year means that productivity has improved or there have been productivity gains amid the two periods. And that is to say, productivity is higher in this year compared to last year. Also that signifies how well an individual entity uses its capital or resources to produce outputs from inputs.

Going a little further of this general notion or norm, a critical observation of productivity literature revealed various applications which mean there is neither a consensus as to the meaning nor a universally accepted measure of productivity. To make a venture at measuring productivity would be based on the individual, the firm, selected industrial sectors, and even entire economies. Debatably, it appears as the choice of appropriate measurement method increase with complexity.

This study of determinants of labour productivity of site operatives is a contextual one, pertaining to Ghana and maybe might be suitable for Sub-Sahara African countries like Senegal, Gambia, Mali Niger, Benin, Cameroun, etc. Due to the contextual nature of the study, the researcher is considering Ghana as a developing country and for that matter, has adopted the simplest definition of labour productivity by previous research (Borcherding and Liou, 1986) and modernized it for the study. Construction labour productivity according to the current researcher is defined as, "the quantity of activity carried out by operatives per unit time" or "the ratio of the quantity of work carried out to the time taken." To further explain or give more flesh to the definition, if a metre square (m^2) area of blockwork is laid by a mason that is the output, within a specific time (the input).

2.3 Measurement of Productivity

Productivity is equals to value divided by time (Pavlina, 2005).

Productivity = Value/Time

According to this formula there are two possible ways to maximize the productivity. To either maximize the Value or/and Minimize the time. In order to complicate the situation one can add other factors like energy and resources but making simplicity of time in most cases factors like energy and resources are considered as reducible to time factor approximately. Optimization of time factor that incurred for any venture will bring the least time counter (Pavlina, 2005).

Accordingly, time consumed for realization of activity concerned is less and it is definite to give high productivity yield. Pavlina (2005) also argues that "value" fraction of the productivity equation can be appropriated to the "quality". Productivity concept in business ventures is not a new theory. It goes as far back as more than five decades. As per the definition made by European Productivity Agency (1959) "Productivity is a state of mind, an attitude that seeks the continuous improvement of what exists. It is a conviction that once one can do better today than yesterday and that tomorrow will be better than today". It also outlined that applying the simplest mathematical concepts, productivity can be improved by a larger increase of output against a smaller increase in input or it can be improved by increasing output and reducing input which is a real challenge for any industry.

Productivity is a ratio of volume measure of output to a volume measure of inputs used in generating the output. However, productivity literature shows that while there are virtually no disagreements over the concept there is no such agreement over how it is measured. This has given rise to multiplicity of measurements and measurement indicators (Ghana Trade Union Congress, 2011a). The varied measurement indicators also show that there is no consensus on the purpose of productivity. Therefore, depending on the objectives one has in mind in measuring productivity one might agree to one measurement indicator or the other (Ghana Trade Union Congress, 2011b). There are different reasons why firms, industries and countries go to great lengths to develop productivity indicators and proceed to measure the level of those indicators. Policymakers (governmental agencies, commerce and congress) are interested in productivity measurement for several reasons. These include but not limited to technological change, efficiency, benchmarking production units, cost saving, and they provide indicators for assessing the overall living standards of the people (Ghana Trade Union Congress, 2011c).

As said earlier, different measures of productivity serve different purposes. As suggested by Thomas, Maloney, Malcolm, Horner, Smith, Handa and Sanders (1990), it is important to choose a measure that is appropriate to the purpose. Thomas *et al.*, (1990), defined different aspects of measures as follows:

Total factor productivity (TFP)

$$= \frac{\text{Totaloutput}}{\text{Labour+Materials+Equipment+Energy+Capital}} \quad (\text{Eq.4a})$$

$$= \frac{\text{Dollars/Cedisofoutput}}{\text{Dollars/Cedisofinput}}, \text{ better still} \quad (\text{Eq.4b})$$

2.3.1 The Total Factor Productivity

The complete height of total factor productivity is obtained by dividing total output by total inputs (Busari, D. T., A. A. Amin & T. Ntilivamunda, 2005). Total inputs are regularly the total sum of physical amounts of labour and capital; land as a production factor is frequently overlooked. Once all production inputs are accounted for, total factor productivity growth is identified as, the amount or portion of actual output growth and this remains unexplained by growth in inputs. In other words, total factor productivity is a measurement of what we do not know but which is thought to have genuine output growth. According to Ghana Trade Union Congress, (2011), TFP is actually an economic model measured in terms of dollars, since dollars are the only measure common to both inputs and outputs (in Ghana most tendering quotations are done dollars). Many agencies may modify TFP equation 4 put above by adding maintenance costs or deleting energy or capital costs. Outputs are expressed in terms of functional units. For example, the Ghana Highway Authority (GHA) may be interested in:

$$\text{Productivity} = \frac{\text{Output}}{\text{Design+Construction+Inspection+Miscellaneous}} \quad (\text{Eq. 5a})$$

$$\text{Productivity} = \frac{\text{Roadmile}}{\text{GhCedis/Dollars}} \quad (\text{Eq. 5b}).$$

As mentioned earlier, the definition of TFP is useful in policy-making and for broad program planning for government agencies (Ghana Trade Union Congress, 2011). The second equation (Eq.5b) is also subject to significant inaccuracies when applied to individual projects of different kinds. Notably in Ghana, the Ghana Highway Authority, City and Urban roads, apply this to road engineering and civil works (Ghana Trade Union Congress, 2011).

On a specific project or schedule, a more perfect definition that can be used by governmental agencies for specific program planning and by the informal sector for conceptual estimates on individual projects is;

$$\text{Productivity} = \frac{\text{Output}}{\text{Labour+Equipment+Materials}} \quad (\text{Eq. 6a})$$

$$\text{Productivity} = \frac{\text{Squarefeet}}{\text{GhCedis/Dollars}} \quad (\text{Eq. 6b}).$$

Activity-oriented individuals like contractors might be likely to use and also define productivity this way, thus using a narrowly defined version of (Eq. 6a), where the units of output are specific for generic kinds of work. Distinctive units are cubic yards, tons, and square feet. Most related activities like fabrication of reinforcement, casting of concrete, and brick/block laying can be combined using the earned-value concept (Thomas & Kramer, 1987). Productivity is expressed as units of output per cedi/dollar or work-hour. During the execution of the project, the contractor borders only on labour productivity and follow time schedule, so that they can meet target. On the site, they are interested in labour productivity and it really means a lot to project managers. And therefore can be defined in one of the following ways (Thomas & Mathews, 1985 cited in Thomas et al., 1990, p. 707);

$$\text{Labour productivity} = \frac{\text{Output}}{\text{Labourcost}} \quad (\text{Ref. to Eq. 2a})$$

or

$$\text{Labour productivity} = \frac{\text{Output}}{\text{Workhour}} \quad (\text{Ref. to Eq. 2})$$

Most contractors work with the unit rate and the unit rate is when the labour cost or work hour is divided by the total output as stated in equation 3;

$$\text{Labour Productivity} = \frac{\text{LabourcostorWorkhour}}{\text{Output}} \quad (\text{Ref. to Eq. 3})$$

The majority of contractors also rely on the performance factor as their way of measuring productivity;

$$\text{Performance factor} = \frac{\text{Estimatedunitrate}}{\text{Actualunitrate}} \quad (\text{Eq. 7}).$$

Performance and efficiency are terms contractors use interchangeable, and efficiency is also used synonymously with labour productivity. It is so because measuring productivity indicates how efficient a firm or an industry is becoming in converting resources into usable products and tangible objects. An efficient firm or country is one that achieves maximum output likely with the judicious use of existing level of technology. Efficiency gains are therefore a movement towards 'best practices'. It also entails eliminating technical or organizational inefficiencies. A growing level of productivity either at the firm level or national level is an indication of a growing efficiency, in transforming resources into outputs. According to Horner and Talhouni (1998), Dundee University measured labour productivity in three different ways. These measurements were done by the Construction Management Research Unit of the Dundee University (CMRUDU).

$\frac{\text{Output}}{\text{Total time}}$; where total time is total paid hours

$\frac{\text{Output}}{\text{Available time}}$; where available time is total hours' minus, avoidable delays principally meal breaks and weather.

$\frac{\text{Output}}{\text{Productivity time}}$; where productivity time is available time minus avoidable delays.

The least but not the last of all the methods used in productivity measurement is Thomas' baseline productivity, (Thomas, 2000). All that this method says is to work with zero effect disruption. This is calculated by applying the following steps to the daily site activities;

- Calculate or find out the number of working days that comprise 10% of the total working days.
- Round this number to the next highest odd number; this number should not be less than 5. This number, n, defines the size of (number of days in) the baseline subset.
- The contents of the baseline subset are the 'n' working days that have the highest daily production or output.
- For these days, take note of the daily productivity.
- The baseline productivity is the median of the daily productivity value in the baseline subset."

Thomas (2000) baseline method was criticized by Ibbs and Liu (2005), and stated that "It is highly subjective. There is no evidence that 10% of the whole daily productivity is a reasonable or well-accepted percentage to represent the best performance a contractor could achieve. Every project is different. Moreover, this 10% sample is presumably 10% of the time that similar work is being performed, not 10% of the total project, which may consist of a series of quite dissimilar work categories. However, Thomas is unclear on this. This procedure selects the contents of the baseline subset "as the n workdays that have the highest daily production or output." Daily output might be maximized by crew size. Therefore, certain days could be selected as the baseline, which are not truly indicative of the achieved productivity." Ibbs and Liu (2005), introduced a new method called "K-means clustering" in place of the baseline productivity calculation that overcome the Thomas' weaknesses.

2.4 Methods used in Productivity Measurement

This sub-heading is meant to explain in simple language the concept of productivity and methods used in measuring it, arithmetically. It also brings to fore some popular misconceptions about productivity, by distinguishing between labour productivity and total factor productivity, efficiency and effectiveness. There are many different measures of productivity and productivity growth (Horner & Talhouni, 1998). The choice of a particular measure is dependent on the purpose of the productivity measurement. But in many instances, choice of one measure over another depends on the availability of data. In broad terms, productivity measures can be categorized into two. The first classification covers the number of production factors that are considered in the measurement of productivity and it is based on the notion that different input measures result in different productivity measures.

Single Factor Productivity Measures; Single-factor productivity refers to the measurement of productivity that is a ratio of output to one input factor. It is also referred to as partial measures of productivity. A most well-known measure of single-factor productivity is the measure of output per work input, describing work productivity. These measures relate a measure of output to a single input or factor of production. An example of single-factor productivity measure is labour productivity which relates output to labour hours used in generating the output or capital productivity which also relates output to volume of capital consumed in the production of the output. These measures of productivity are also referred to as partial productivity measures.

Multi-Factor Productivity Measures; these measures relate a measure of output to a basket of inputs or production factors. Multi-factor productivity is sometimes referred to as total factor productivity even though there may be important methodological differences. In multi-factor productivity, several production factors are included as inputs, though not necessarily all factors. In total factor productivity all possible production factors are considered as inputs, though this is seldom the case. In practice, multi-factor indices of

productivity relate output to the combined inputs of labour and capital. Thus MFP reflects the efficiency with which capital and labour inputs are combined to generate outputs.

The second distinction is between productivity measures that relate gross output to one or several inputs or production factors and those which use the concept of value added to ascertain changes in outputs. Of the most frequently used MFP measures, capital-labour MFP relies on a value-added concept of output while capital-labour-energy-materials MFP relies on a particular measure of gross output. The five most widely used productivity concepts stated by Attar, A. A., Gupta, A. K., and Desai D. B., (2011) in their findings about improving productivity are;

- Labour productivity, based on gross output: This productivity measurement traces the labour requirement per unit of output. It reflects the change in the input coefficient of labour by industry and is useful for the analysis of specific industry labour requirements. Its main advantage as a productivity measure is its ease of measurement and readability; particularly, the gross output measure requires only price indices on gross output. However, since labour productivity is a partial productivity measure, output typically reflects the joint influence of many different factors (Attar et al., 2011).
- Labour productivity, based on value-added: Value-added based labour productivity is useful for the analysis of micro-macro links, such as an individual industry's contribution to economy-wide labour productivity and economic growth. From a policy perspective, it is important as a reference statistic in wage bargaining. Its main advantage as a productivity measure is its ease of measurement and readability, though it does require price indices on intermediate inputs, as well as to gross output data. In addition to its limitations as a partial productivity measure, value-added labour productivity has several theoretical and practical drawbacks including the potential for double counting production of benefits and double deflation.
- Capital-labour MFP, based on value-added: This productivity measurement is useful for the analysis of micro-macro links, such as the industry contribution to economy-wide MFP growth and living standards, as well as, for analysis of structural change. Its main advantage as a productivity measure is the ease of aggregation across industries. The data for this measurement is also directly available from national accounts. The main drawback to the value-added based capital-labour MFP is that it is not a good measure of technology shifts at the industry or firm level. It also suffers the disadvantage of other value-added measures that have been double deflated with a fixed weight as quantity index (Attar et al., 2011).
- Capital productivity, based on value-added: Changes in capital productivity denote the degree to which output growth can be achieved with lower welfare costs in the form of foregone consumption. Its main advantage as a productivity measure is its ease of readability but capital productivity suffers the same limitations as other partial productivity measurements (Attar et al., 2011).
- KLEMS Multi-factor productivity: KLEMS-MFP is used in the analysis of industry-level and sectoral technical change. It is the most appropriate tool to measure technical change by industry because it fully acknowledges the role of intermediate inputs in production. Domar's aggregation of KLEMS -MFP across industries renders an accurate assessment of the contributions of industries to aggregate MFP change. The major drawback to KLEMS MFP is its significant data requirements, in particular timely availability of input-output tables that are consistent with national accounts. It is also more difficult to communicate inter industry links and aggregation across industries using KLEMS-MFP than in the case of value-added based MFP measures (Attar et al., 2011).

There are varied methods used in the measure of labour productivity and these include the project level information systems, direct observation methods, and survey/interview

based methods (Thomas, 2000). Each method is geared towards measuring certain aspects of construction production and complementing each other. Project level information systems, such as electronic cost reports and unit rate reports, are used to measure the input and output in construction productions, thus leading to generating productivity measures such as worker hour per output quantities. Such systems from this standpoint can only reveal issues pertaining to the global outcome in production, even right from the industrial economics, not to talk of labour economics.

According to Oglesby *et al.*, (1989), the information gathered through the above three methods are then used to support productivity improvement decision making, which completes a typical framework of productivity measurement for improvement in the construction industry. The issue is that this productivity measurement framework does offer possible solution to improve onsite productivity, one of the major limitations is that most of these techniques or methods are manually intensive, resulting in relatively outmoded information and expensive data collection systems (McCullouch 1997; Cheok *et al.*, 2000). For example, because of the manual efforts required in input and output quantity gathering, the productivity information in the project level information systems is often slowly updated (every one to two weeks), leaving such systems only as unsuitable for the purpose of small scale project but macro project control, such as cost tracking, and unrealistic for supporting rapid response to problems that result in low productivity in on-going projects. The same limitations apply to other methods in this productivity measurement framework.

2.5 Misconceptions about Construction Productivity

Time and again the concept of productivity is confused with several related but distinct concepts. To uphold a clear view of the productivity concept requires that these misconceptions be dealt with decisively.

A study done by Adrian (1990) states the following general misconceptions about labour productivity:

- i. Key factor for low productivity in construction industry is labour.
- ii. Because the construction industry is controlled by the weather, productivity cannot be improved.
- iii. The construction industry always has an unfavourable relationship process.

Yet there are several of such misconceptions in the construction industry. One of such is the probability for people to equate productivity to labour efficiency or labour productivity. While labour continues to be key production factor, it is just one of the numerous production factors that go into the production of goods and services (Adrian, 1990).

The second source of confusion arises out of the notion of factor intensity. Many people have tended to construe productivity to mean a more intensive use of capital or resources such as labour and machines. Productivity refers to a more intelligent or prudent use of resources which will result in effectiveness and efficiency. For that matter, more output can be produced either with the same or fewer resources. Factor intensity; on the other hand, mean getting more resources into production. For this instance, the resulting increase in production or output is accredited to the increase in resources used and not the efficient use of resources. In relating to labour, it can be said that improved labour productivity is achieved by working intelligently and not by working harder (Adrian, 1990).

A third major misconception about productivity is the use of rising or declining output to measure improvements or declines in productivity. A rising output might not automatically mean productivity is enhanced, just as declining output might not necessarily be due to drop in productivity. If the rising output is as a result of putting more inputs into production (i.e., if costs of inputs have risen disproportionately) the productivity ratio will also remain unchanged or it might even decline.

There is also the chronic confusion between productivity and profitability. It is often assumed that increase in profit signify improvement in productivity, in like manner a decrease in profits imply that productivity has gone down. Higher productivity might not always lead to higher profit. Surely, profits will actually go down if what is efficiently produced is not in demand or its price falls totally due to isolated factors such as changes in weather pattern. It is also true that rising profit does not mean that there are improvements in productivity.

A fifth misconception relate to the difference stuck between productivity and efficiency. Efficiency refers to the production of quality output at a bare minimum cost. It is

the value of output relative to the cost of inputs used in the production process. But while productivity refers to the quantity of output (regardless of value) that is produced from a given quantity of resources. In this sense, productivity is said to have increased or improved when the quantity of output increases relative to the quantity of inputs. Efficiency, however, is said to improve when the cost of inputs used is reduced relative to the value of output. It is therefore possible to improve efficiency without improving productivity. A change in the relative price of input might induce a firm to change its inputs mix as a way to reduce its input cost. A reduced input cost relative to value of output helps the firm to improve its efficiency without actually increasing the quantity of output relative to the quantity of inputs (productivity).

A sixth misconception has to do with the notion that productivity is applicable only to production of tangible goods. Behind this confusion is the apparent difficulty of measuring productivity in areas such as services. However, despite this apparent difficulty of measuring productivity in certain spheres of human activity, productivity is relevant for all organizations. It is also measurable in all organizations and activities including services and even the military. For this reason, some have defined productivity as a state of mind and attitude that seek the continuous improvement of what exists. It is a conviction that one can do better today than yesterday and that tomorrow will be better than today.

Last but not least of the misconceptions is the very important mistake that organizations can achieve productivity gains or improvements in productivity simply through costs-cutting measures. Combined with the notion that productivity is equivalent to labour productivity, managers and policymakers have frequently focused on cutting labour costs as a way to improve their productivity. While it is true that productivity can be improved by reducing input cost, indiscriminate cost-cutting can in the long term be counter-productive.

2.6 Productivity in the Construction Industry

It is now obvious that productivity improvement is the quickest and most sustainable way out of poverty and underdevelopment. Productivity growth is also recognized as the sustainable way to transform lives caught up in deprivation and improve living conditions particularly in the context of prevalent depletion of global resources. The socio-economic situation in Sub-Saharan Africa is characterized by widespread poverty and deprivation. Majority of the people receive low incomes, and have limited access to quality healthcare and education as well as decent housing. Majority of Sub-Saharan African countries in warm climates are faced with a challenge of meeting their food needs with many going hungry at night. In spite of the fact that the sub region is home to considerable amounts of natural resources in the world, poverty level is still high. World Food Organization gives a lot of food-aid to most of these countries (World Food Organization, 2011). In the age of globalization where other regions of the world are growing their economies and lifting millions of its citizens out of poverty, many countries still wallowing in intractable poverty due to climatic conditions, and many more at risk of becoming poor. There are deficits of decent jobs but blue-collar jobs (construction work), and the low productivity from workers who got the jobs inversely determine the wages they are paid, not even a 'take home wage', then ask of living wage. Yet, construction activities have the potential to generate incomes even in isolated communities, hence its ability to alleviate poverty. Construction is one of the largest industries and contributes to about 10% of the gross national product (GNP) in industrialized countries (Navon, 2005).

The desire to improve labour productivity in the construction industry has been increased over the last two decades. Increase of productivity was calculated prior to mid-1906's, in the construction industry (Stall, 1983). Literature shows a lot of research has been done in the developed economies, sadly the same cannot be said of developing countries in the Sub-Saharan Africa, even Ghana. According to Prokopenko (1987), "Productivity is the only important world-wide source for economic growth, social progress and improved standard of living". Productivity is then defined by Borcharding and Liou (1986) as a ratio between an output value and an input value used to produce the output. This output consists of products or services, and the input consists of materials, labour, energy, etc. Despite much study has been conducted on identifying the factors that influence productivity, the problem of low productivity levels still persists even in UK construction, not to mention countries in Sub-Saharan Africa (see Latham, 1994 and Egan, 1998). The decline in productivity has remained a

nerve-racking issue in the construction industry all over the world. A study by Thomas and Kramer (1988) said in 1968, the Construction Roundtable was established due to concern about the increased cost of construction ensuing from an increase in the inflation rate and a significant decline in construction productivity. A review of previous productivity research found a significant lack of studies that investigated contextual influences that could truncate productivity loss. Instead, past research relied on quantitative survey, mainly from a managerial point of view, which was inadequate to tackle a complex phenomenon like labour productivity.

2.7 Determinants of Labour Productivity

Undeniably, it was known that careful adaptation would be required to implement the knowledge and experience gained in the manufacturing industry to the building construction industry (Alarcon and Borcharding, 1991). Research has shown a number of factors that affects productivity are still anonymous which need to be further studied even in developed countries (Makulsawatudom and Emsley, 2002).

In Senegal, Mbaye (2002) found a deep fall in productivity over the period studied relative to other countries, whilst in Zimbabwe there was no growth in total factor productivity throughout the period of economic adjustment (Bjurek and Dureval, 2000). Ameh and Odusami (2002) recognized low wages, lack of materials and unfriendly working environment as having key impact on productivity of craftsmen engaged in in-situ concrete operation in a single storey building project in Nigeria. Laufer and Moore (1983) opined that, financial incentive programmes could be used to increase construction labour productivity. Whilst Enshassi *et al.*, (2007) also identified in their study in the Gaza Strip, five most important factors that impact negatively on labour productivity as material shortages, lack of experience of labour, lack of labour surveillance, and alteration of drawings/specification during execution. Similarly, Makulsawatudom *et al.*, (2004) also established 10 most significant factors affecting construction productivity in Thailand and they include lack of materials, incomplete drawings, incompetent supervisors, lack of tools and equipment, absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework. Groák, (1994) argued that 'the notion of the dominance of the project changes the ideas or redirects the thought on what we focus for productivity improvements' (p. 290).

In the construction industry, one of the greatest challenges faced by project managers is how to identify and evaluate factors affecting construction labour productivity. Factors such as low morale, poor supervision, poor training, and unsafe working conditions are generally related to worker motivation, which are intrinsic. A great deal of research has been carried out on the factors that motivate construction workers (Borcharding and Oglesby 1974; Borcharding *et al.* 1980; Borcharding and Garner 1981; Maloney 1983; Maloney and McFillen 1985, 1986). Summaries of these factors are also available (Warren 1989). Other studies have shown the effect that management (starting with the foreman) can have on crew performance. For example, a survey of 703 construction workers showed that foremen have "a strong impact on worker motivation, performance, and satisfaction" (Maloney and McFillen 1987). The relationship between productivity and foremen's management style has also been recognized (Hinze and Kuechenmeister 1981; Emna *et al.* 1986). Another study found "poor supervision poor planning, and generally poor management" to be major causes of absenteeism and turnover ("Absenteeism" 1982).

Furthermore, to understand and being conscious of critical factors affecting productivity is important, whether it affects productivity positively or negatively, because it can be used to prepare a plan or strategy to reduce inefficiencies and to improve the effectiveness of project performance. Enshassi *et al.* (2007) observe that despite the rigorous investigations made into the factors affecting labour productivity, researchers have not globally settled on a collective set of factors with significant influence on productivity; or any agreement reached on the classification of these factors. The authors however, group factors affecting construction labour productivity under ten headings, namely: manpower, leadership, motivation, time, materials/tools, supervision, project, safety, quality and external. Kazaz *et al.* (2008) consider productivity factors under four groups namely; organizational factors, economic factors, physical factors and socio-psychological factors based on the theory of motivation. Durdyev & Mbachu (2011) consider key constraints and improvement measures for on-site labour productivity using 56 sub-factors. The factors were identified under eight broad

categories of internal and external constraints namely: project management/project team characteristics, project finance, workforce, project-related factors, unforeseen events, technology/process, statutory compliance and other external factors. Odesola (2012) identified 75 factors affecting construction labour productivity from literature and focus group discussions with masonry artisans and project supervisors/engineers. The declining rate of productivity and lack of productivity standards are the main problems of the construction industry. However, determinants of labour productivity in construction have been identified and classified by the author under 5 headings;

- Managerial related factors
- Technical / Technological related factors
- Labour union related factors
- Biographical variables related factors and
- External related factors.

2.8.1 Managerial Related Factors

The presence and supervision of management at a construction site is very essential for improving productivity (Thomas, 1991). The foundation of all job improvement efforts is management recognition of employee's desire to do good job, to take responsibility, to achieve and to succeed. Edwards and Love (2007); Love et al. (2005) conducted a research related to factors affecting productivity and came out with problems of rework and worker's performance and motivation affecting productivity in Australia. The United Nations Committee on Housing, Building, and Planning in 1965 conducted a research concerning the effects of repetition on building operations and processes. It discovered the necessity for a rise in productivity was perhaps more severe in the construction sector compared to any other sector. It was necessary to implement, as far as possible, industry-wide principles of production throughout the construction process (UNC, 1965).

The greatest boost or threat to productivity improvement comes from how management perceive workers who are often considered the most vital asset of every organization and the kind of communication that develops from such observation. Thomas et al., (2002) identified the main performance criteria of construction projects as financial stability, progress of work, standard of quality, health and safety, resources, relationship with clients, relationship with consultants, management capabilities, claim and contractual disputes, relationship with subcontractors, reputation and amount of subcontracting. Chan and Kumaraswamy (2002), also propene that interpersonal relation is one of bottle neck of productivity. Chan et al., (2002) goes on to say that construction time is increasingly important because it often serves as a crucial benchmarking for assessing the performance of a project and the efficiency of the project organization. Some conservative estimates put management directly in charge of about two-thirds of productivity gains (Prokopenko, 1960). If management subscribe to Theory X, it implies that managers need to direct and control workers, and then a fertile ground is laid for declining productivity. According to Theory X, workers are 'economic animals' who are only interested in money, they are lazy passive, have little or no ambition, they prefer to be led and they will always resist change. Theory X (of which Taylorism or Scientific Management theory forms part) stresses the use of coercion, tight controls, threats, and punishments.

McGregor (1960) warned that such management styles always result in low productivity, antagonism, militant unions, subtle sabotage and disloyalty. Moreover, such management styles cause individuals to pullout or withdraw from the organization (psychologically) and through chronic absenteeism and or high labour turnover. The result is low productivity. McGregor went ahead criticising the popular management view and style and recommended what he called Theory Y. This theory accepts the basic suggestion that management is responsible for the organization of work in the company but it stresses that workers are not economic animals as Theory X suggests. According to Theory Y, the task of management is to organize work and make conditions at the workplace in such a way that workers' efforts can be directed towards organizational goals. In other words, management should organize work in such a way that goals of organization and individual goals will coincide (Bolman & Deal, 1991). Impliedly (Fugar & Agyarkwa-Baah, 2010) found out that equipment, materials, finance related, environmental related, changes, government action,

contractual relationship, scheduling and controlling techniques as the factors influencing performance in the Ghanaian construction industry.

A number of studies have been carried out to look at factors impacting on project performance in developing countries. Faridi and El-Sayegh (2006) discovered that shortage of skills of manpower, poor supervision and poor site management, unsuitable leadership, shortage and breakdown of equipment among others contribute to construction delays in the United Arab Emirates. Hanson, Mbachu and Nkando (2003) examined causes that leads to low productivity and client dissatisfaction in the South African building industry and established that conflict, poor workmanship and incompetence of contractors to be among the factors which negatively impact on project performance. Mbachu and Nkando (2007) again found that quality and attitude to service is one of the key factors constraining successful project delivery in South Africa. Furthermore, Herbsman and Ellis (1990) explicitly recognized two strains of what they called 'construction productivity influence factors' and broadly grouped them into technical and administrative, the former defined as design related and deterministic and the latter as management related and stochastic. These goes to affirm that management role is vital in influencing work content element of construction labour productivity.

Construction projects are unique in every aspect, from the nature and layers of the starter, design, environment, and demography of the workforce, and all these have impact on the project, and labour productivity also brings challenges with its complexities to the managers of the project. It is therefore essential for the project managers to have a controlling hand over the job to avoid rework and double handling. Logcher and Collins (1978), gave basic understanding about major factors of managerial approach and stated "What is needed is a basic knowledge of how major factors of a management strategy, divorced from means, methods, materials, and job conditions, independently affect labour." A study by Makulsawatudom and Sinthawanarong (2004) confirmed that rework is one of the major factors in the construction industry that affect labour productivity in construction industry. The study also listed rework as one of the critical factors effecting productivity and said that rework is due to incompetent craftsmen and supervisors.

Given that there is an association between productivity and skills, it is important that construction project managers and contractors have a fair knowledge of the methods leading to the evaluation of productivity of equipment and labour, in the various crafts (Shehata et al., 2011) also, Iyer and Jha (2005) inferred that skills and quality of leadership affects strongly and directly on productivity or performance of construction project. As they bemoaned, "If project managers have strong leadership skills, the project performance can be monitored, controlled and managed with high quality".

2.8.2 Technical/Technological Related Factors

Working harder is not the key to improving productivity, but working smarter by using technical and technological innovation, and proper organization of work. Technology has a potential of improving productivity in two major ways: (1) reducing labour by input by automating many manual operations and (2) reorganizing or enabling improvements in work processes. Technology is one of the most important factors in construction industry. According to Sundaraj (2006), a construction process demands heavy exchange of data and information between project participants on a daily basis. Research has shown that theories of technological innovation have room for improving the construction process (Widén, 2002). Based on the research done by Ofori (1991), training for construction industry in developing countries is generally contributed to the performance and effectiveness of both employer and employees. In a relatively recent research attempt, Triplett and Bosworth (2004) identified that much of the nation's productivity growth could be attributed to improved production of technology, increased competition due to globalization, and changes in workplace practices and firm organizations. Training is vital to the developing countries because efficient manpower planning and development plays a crucial role in support of a flexible and dynamic labour force, coping with the fast technology transfer and industrial growth.

Sexton and Barrett (2003) acknowledge that although construction firms have always demonstrated an ability to innovate, construction practitioners are now very much getting grasp with the need for and management of technological innovation as a clear-cut venture. The United Kingdom construction industry by way of example is increasingly being challenged to productively innovate in technology in order to satisfy better aspirations and needs of

society and clients, and improve competitiveness (Latham, 1994; Egan, 1998). The Ghanaian construction industry and the construction industries in other developing countries should likewise aim at being more innovative in technology in order to put up good job to satisfy the client's needs. It follows that labour productivity can be improved, especially in the situation of third world countries, with an increase in activities that support technological innovation. Technological innovation plays a pivotal role in improving labour productivity and developing new products and services, and in providing relative and complete advantages (Dodgson, 2000). In this era of power driven tools and equipment, operative's productivity has changed. Intangible investment in new knowledge and its dissemination are vital elements to productivity improvement than physical investments in bricks and machines (Freeman & Soete, 1997). According to Porter, 1987; Freeman and Soete (1997), it is generally accepted that technological innovation in manufacturing firms is one of the main reasons for industrial competitiveness and national development.

Productivity of operatives can be affected if required technological approach is not applied, also when tools and construction equipment for specific jobs are not available at the correct location and time. Inefficiency of equipment and technological gap are factors which cause low productivity. The productivity rate of inefficient equipment is generally low. The machines like bulldozers must be strong enough to save cost of repairs and frequent breakdowns. Therefore, it is essential for site supervisors to be familiar with the characteristics of the major types of equipment most commonly used in construction for efficiency. Usually old equipment is subject to a vast count of breakdowns, and it takes a long time for the labourers to complete the work, thus reducing productivity. Technology is such an important factor, hence the new way of working through the robotic technology helps workers to finish task in short period of time. For new and efficient ways of doing things technically, it is essential to select the appropriate tools and methods. Other technical problems like inadequate designs or incomplete engineering work can also lead to backlog in productivity of the operatives. Similarly, restrictive and redundant procedures also affect the effectiveness of projects (Dozzi & Abourizk, 1993).

In order to increase job-site productivity, it is beneficial to select equipment with the proper characteristics and a size most suitable for the work conditions at the construction site. Labourers require a minimum number of tools and equipment to work effectively to complete the assigned task. If the improper tools or equipment is provided, productivity may be affected (Alum & Lim, 1995; Guhathakurta & Yates, 1993). The size of the construction site and the material storage location has a significant impact on productivity because labourers require extra time to move required materials from inappropriate storage locations, thus resulting in productivity loss (Sanders & Thomas, 1991). According to Tucker *et al.*, (1999), lack of technical and managerial skills is often identified as one of the major problems of contractors in developing countries resulting in poor competitiveness with their well-developed and industrialized counterparts.

2.8.3 Trade/Labour Union Related Factors Labour to Productivity.

A trade union or labour union is a group of workers who have united together to achieve common goals such as protecting the integrity of its trade, achieving higher pay, increasing the number of employees an employer hires, and better working conditions. The trade union, through its leadership, bargains with the employer on behalf of union members and negotiates labour contracts (collective bargaining) with employers. The main purpose of these associations or unions is "maintaining or improving the conditions of their employment". According to a study by (Webb, Sidney; Webb & Beatrice, 1920) this may include the negotiation of wages, benefits, work rules, complaint procedures, rules governing hiring, firing and promotion of workers, workplace safety and policies.

Workers in Ghana came together under a united trade union movement, to secure social, political and economic justice and to support the efforts of affiliated unions to improve wages, shorten hours of work and create better conditions of service at work places. And also assist affiliated unions to undertake collective bargaining on behalf of workers and, finally to support the promotion of work efficiency and improve productivity at work places.

The construction industry in Ghana is dominated by the members of Construction and Building Material Workers' Union (CBMWU). Construction and Building Material Workers' Union (CBMWU) is an affiliate to the Trade Union Congress in Ghana with other 17 affiliated

unions. The CBMWU was formed in 1954. It organizes workers mainly from the building, stone weaning, and road construction (including the chipping and gravel production). The union has suffered membership decline since the 1980s due to the privatization of state-owned enterprises which was a condition of Structural Adjustment of the International Monetary Fund (IMF). The privatization of state-owned enterprises resulted in massive retrenchment exercise which wiped out a large section of the formal segment of the construction sector, especially in the State Housing Co-operation (SHTC). Since then the membership of the union has continued to decline mainly because of the excessively large share of redundant formal sector workers in the construction industry.

Construction Labour productivity in the context of Trade union, yields of productivity should evenly disbursed even to the least operative, no wonder its growing demand for living wages, employee involvement in the job to gain respect and make profit, which at the end of the day would lead to higher yields and workers may enjoy bonuses, incentives and higher wages. The union brings employers and employees on an equal footing, pedestal or platform for an agreement and bylaws that collectively bind both parties. The union initiate support with the notion of embracing differences of perspectives to bridge the wide gap between (white-collar) managers and (blue-collar) operatives' involvement in the job which could lead to the attainment of higher productivity levels on-site.

This concept of employee involvement in decision taking in manufacturing and construction industries is not new; it started in the mid-19th century in response to the social and economic impact of the industrial revolution. It started when coal mine workers united for a common goal; to fight for the reduction of man hours and to improve the working conditions. It has been around in the UK in various instances over the last century. According to Marchington and Wilkinson (2002), the concept evolved from the days of collective bargaining at the end of the First World War to the growing interest in industrial democracy in the 1970s to management-driven employee involvement schemes that stressed direct communication with individual employees. Talking about employee involvement goes with union laws and regulations with employers and these varies from country to country, as does the function of unions. For example, German and Dutch unions have played a greater role in management decisions through participation in corporate boards and co-determination than have unions in the United States. Moreover, in Ghana, and the United States, collective bargaining is most commonly undertaken by unions directly with employers, whereas in Austria, Denmark, Germany, or Sweden, unions most often negotiate with employers' associations (Bamberg & Ulrich, 2004).

Generally speaking, there are five major substantive issues which are in mind of the workers' quest in coming together. These are wages and other material remuneration, job security, working conditions, working time and, respect and dignity. In other words, 'Trade Unionism' is a drive, that quest for improvements in these substantive issues mentioned. This drive led to the formation of trades unions. According to Baba Aye (2010), the spectrum of this systemic conception of trade unions extends from the unitary, to the "limited intervention" of "guided democracy". Examples of the former would be clearly corporatist states/social systems such as those of fascist Germany and Italy, Stalinist USSR and the East bloc, the Estado Novo in Brazil, and the post-colonial one-party states in Ghana, Zambia and Tanzania.

Looking at the unionized workers and their involvement accrued much benefit and expected to extend beyond productivity gains to include improved employee attitudes and commitment (Wagner, 1994). This improvement is manifested as a result of their involvement, and in a sense of pride either through raising the status of operatives in problem-solving in the site or working cooperatively towards achieving a common goal. Thus, this study echoes similar studies into the effects of embracing employee voice (Marchington *et al.*, 2001).

There is not anything more dangerous to any economy than a dwindling of its labour productivity, it creates inflationary pressure, social conflict and mutual suspicion (Drucker, 1980). Trade unions are interested in productivity improvement in the construction industry because it is one effective way by which they can achieve their ultimate goal of enhancing the living standards of not only their members but the living standards of all workers and families. But studies have shown that productivity improvement and the net wealth creation associated with it do not automatically lead to improved living standards for workers and their families. This is because productivity gains have often coincided with rising inequality, meaning that the gains from improved productivity are often not equally shared among those who generated

the gains. For improvement in productivity to benefit all, including operatives and their families, the gains from productivity have to be fairly distributed. In a situation where few people at the top are awarded with a disproportionately large share of the net wealth while operatives are allocated small fraction of the gains, improved productivity will not translate into improved living standard for operatives and their families. For this and many other reasons, unions should not only be interested in measures to improve productivity but more importantly must also be interested in how the benefits of improved productivity are shared so that operatives will also benefit from their labour.

There is strong macro-economic and statistical evidence that say, the more effective or productive a nations' economy, the higher the personal income of its workers. At the company level when productivity is high the employer will have the ability to pay higher income. It is eminent that operatives will earn higher incomes from the productivity growth only when unions negotiate effectively. The unions will attain improved wages and salaries for their members and subsequently the dues the members pay will also be increased. The more productive an economy is, the more competitive that economy will be in the international markets and that will reduce the unemployment rate in that country. The more productive a company is, at the micro level, the more competitive it is in the economy and the more profits it can generate. If the favourable conditions are created for investments and the company ploughs back part of its profits in new investments, new jobs will be created through expansion of the company and unemployment will reduce. The social benefits of full employment of improved labour productivity are obvious.

Improving construction labour productivity, especially those that are pertinent to on-site labour, in the context of the growing importance of employee involvement, like the trade unions. This part of the research looks at trade unions involvement initiatives supporting the notion that embracing differences of perspectives between management and operatives in terms of dignity and respect, health and safety, job security, living wages, that lead to the achievement of high productivity levels on-site. Most countries around the world are still battling for these social benefits for economic and social interests, but the story is not the same in Ghana. Trade union rights, efforts and achievements in Ghana are enormous and stand high in Africa and the International Labour Organization. Trade union rights in Ghana are recognized by national legislation. Ghana rectified 50 ILO Conventions including the eight (8) core Conventions (Kalusopa, Otoo, & Shindondola-Mote, 2012).

Article 21 (e) of the 1992 Constitution of Ghana guarantees its citizens "freedom of association, which include forming or joining trade unions or other associations, national and international, for the protection of their interest" (Kalusopa *et al.*, 2012). Moreover, both Article 24 (3) of the constitution and Article 79 (1) of the Labour Act (Act 651, 2003) states that every worker has the right to form or join a trade union of his or her choice for the promotion and protection of their economic and social interests. Article 80 of the Labour Act further adds that "two or more people in the same undertaking may form or join a trade union". (Kalusopa *et al.*, 2012). However, clause 29 of the Act disallows managerial and supervisory staff from joining or forming a trade union. The Security and Intelligence Act of 1966 also exempts military and paramilitary personnel from joining or forming trade unions (Kalusopa *et al.*, 2012).

In Ghana, the Labour Act confers on trade unions the right to enter into collective bargaining with employers. Qualified trade unions must obtain a collective bargaining certificate from the Labour Department, to be able to bargain with employers on behalf of its members. This Labour Act established the National Tripartite Committee (NTC) which is made up of government, employers and organized labour. The NTC determines the National Minimum Wage (NMW) and advises government on employment and labour laws, international standards as well as industrial relations and occupational health and safety (Kalusopa *et al.*, 2012). Act 651 also established a National Labour Commission (NLC) made up of two representatives each from government, organized labour and employers. The Chairman of the Commission is jointly nominated by employers and labour. The NLC settles labour disputes through negotiation, mediation and arbitration without an option to court action. In the settlement of cases, the NLC has the powers of a High Court to put into effect the attendance of witnesses; and its decisions are binding on the parties (Kalusopa *et al.*, 2012).

Nonetheless, implementing these conventions and its associate legislations are sometimes confronted with a numeral challenge. Most of the times some employers (largely private employers) try to frustrate worker's effort to exercise their rights to unionisation and

collective bargaining (Kalusopa *et al.*, 2012). One more significant challenge to collective bargaining is the inability to expand the benefits to the majority of Ghanaians clustered in the informal sector. Even though the National Minimum Wage (NMW) applies to all sectors of the economy, its compliance in the informal sector has been low. Non-compliance with labour standards particularly in the informal sector occurs due to lack of enforcement and monitoring. Numerous workers in the informal sector have little or no knowledge about the labour legislative framework in place (Kalusopa *et al.*, 2012).

2.8.4 The Impact of Motivation on Productivity

Motivation is one of the important drivers pushed by labour unions at negotiation tables, when the issue of productivity come to fore. Motivation is essential to labour, as it gives site workers satisfaction such as achievement, sense of responsibility and pleasure of the work itself (Enshassi *et al.*, 2007). In a similar view, Mohajed (2005) is of the view that a combination of training, orientation for new employees, provision of a safe and clean environment, encouragement of two-way communication, employee participation in planning or decision making, and individual / team recognition may be utilised to achieve labour productivity. Motivation can best be achieved when labour personals ambitions and goals are same to those of the company. Factors such as payment delays, a lack of a financial motivation system, non-provision of proper transportation, and a lack of training sessions are grouped in this topic, motivation (DeCenzo & Holoviak, 1990). About a decade ago Roznowski and Hulin (1992) observed that once an individual has joined an organisation, a valid measure of his or her overall job contentment should be the single most important information a human resource manager must have about that person. This assertion has so far gone unchallenged because researchers and practitioners turn to associate job satisfaction with motivation and productivity (Montana & Charnov, 2000; Agyenim-Boateng *et al.*; 2000; Laurie, 2005). Indeed, because of the perception that job satisfaction affects the bottom line of organisations it is one of the most studied concepts in organisational sciences (Judge *et al.*, 1995). The association between job satisfaction and job performance has been studied extensively all the way through the history of industrial/organizational psychology (Judge, Thoresen, Bono, & Patton, 2001). It has been referred to as the "Holy Grail" of industrial/organizational psychology (Landy, 1989). The link between workplace attitudes and behavioural outcomes continues to be a common research topic (Harrison, Newman, & Roth, 2006; Schleicher, Watt, & Greguras, 2004), and stems from typical industrial/organizational and social psychological theory (e.g., Lawler & Porter, 1967; Wicker, 1969).

A study by Simons and Enz (1995), however, shows that there are significant differences in terms of what employees want from their work in different industries. Laurie (2005), have opined that the nature of work environment and workplace facilities affect job satisfaction and growth. Handy (1997), supports this assertion, he posits that, an inspired workplace will result in inspired workers. He finds the association between the atmosphere quality and style of building offices to work performance. Lambert *et al.*, (2001), also states that work environment is more essential in shaping worker job satisfaction. Impliedly, Fried and Ferris (1987) found in their study that there is a relationship between job complexity and job performance (productivity). Improved satisfaction can be realized as a result of job complexity. When the job characteristics that make up job complexity are increased, employees feel a sense of meaningfulness and responsibility regarding their jobs (also see Judge, Bono, & Locke, 2000). These feelings in turn lead to higher levels of job satisfaction. The performance of workers can also be increased with higher levels of job complexity, because these job characteristics were specifically recognized to show that productivity would increase if jobs were designed in a way that would make them more meaningful and challenging to the employees (Hackman & Lawler, 1971). In complex jobs, employees feel that their job is worthwhile and not a waste of time, as a result increasing job performance or productivity.

Nonetheless, the individual difference of growth need strength can affect this relationship with job performance (Hackman & Oldham, 1975). There is little difference that influences how employees will respond to jobs that have high job complexity, such that employees with high growth need strength will respond more favourably to high complexity jobs, with regards to the relationships of job complexity with satisfaction and performance. Humphrey, Nahrgang, and Morgeson (2007) stated in their empirical findings that "34% of the

variance in performance and more than 55% of the variance in satisfaction" was a 27 function of job characteristics. Hackman and Oldham (1976) also found that the job characteristics outcomes relationships are mediated by critical psychological state. Schmidt and Hunter (2004) argued that cognitive ability predicts performance better than all other measures of ability, traits, or dispositions that have been tested. Cognitive ability is an excellent predictor of job performance because people with higher levels of cognitive ability attain a greater amount of knowledge and thus able to perform better a diversity of behaviours on the job (Schmidt, Hunter & Outerbridge, 1986)

A study by Ackerman (1996), on a model code named, 'PPIK model' show how individuals differ, one from the other in their levels of cognitive ability. He found out that knowledge is not based on individual's ability alone, but also to some extent on processes, individual personality and interests. This model, (PPIK model) suggests that knowledge is based on both ability and non-ability traits. And one of the non-ability traits that have been researched into is an individual's level of investment. An individual's investment into any activity or a particular job or profession can partly determine the knowledge they attained in the said field (Chamorro-Premuzic, Furnham, & Ackerman, 2006). If one is satisfied with one's job, it seems that person would likely also invest more in the job than someone with lower level of morale, satisfaction and fulfilment in his work.

According to the gravitational hypothesis, employees will drift toward jobs that have ability and requirements that match their cognitive abilities (Wilk, Desmarais, & Sackett, 1995). In other words, individuals who, in terms of cognitive ability, are under and over-qualified for their jobs will likely seek other job opportunities that are a better match for their abilities. Because of this observable fact, people with high cognitive ability will be in better jobs, such as jobs that have higher ability requirements hence higher pay or jobs that are higher on dimensions are related to increased satisfaction, just as the job characteristics Hackman and Oldham (1975) has defined. These types of work are likely to be more satisfying and fulfilling. In other words, cognitively ability should be positively linked to job satisfaction, due to the tendency for high-ability individuals to take up jobs with more desirable characteristics. Similarly, (Hunter & Hunter 1984; Schmidt & Hunter, 1998) in their study reaffirms that people with higher cognitive ability have the upper hand in gaining employment in higher paid jobs than the lower cognitive ability, they said "Cognitive ability is one of the best predictors of job performance, accounting for over 25% of the variance in performance".

However, a lot of research depended on Herzberg's two-factor theory of motivation (Smithers & Walker, 2000) and this appears inadequate for understanding the Labourer's perspective. For example, Mullins (2005), spoke against the use of Herzberg's sample and suggested that the results might not apply to manual labourers. Apart from Herzberg's theory of motivation, previous productivity research also employed the expectancy motivational model (see Laufer & Jenkins, 1982) to study the motivation of construction workers. Unlike the Herzberg model, where the link to productivity is only inferred, the expectancy model explicitly links productivity to motivation quantitatively. Motivation, according to this theory, is 'a multiplicative function of the expectancies that individuals have concerning future outcomes and the value (as perceived by the workers) placed on those outcomes' (Laufer & Jenkins, 1982: 535). Maloney and McFillen (1985), for example, used the model to study the motivational impact of work crews on labour productivity. The expectancy model was also regarded highly by Thomas and Yiakoumis (1987) who tried to incorporate it within their factor model of labour productivity. However, it appears that the desire to combine expectancy and factor models came to nothing, perhaps because the latter requires factors to be quantified (Thomas *et al.*, 1990). Apart from invoking the points made earlier in the discussion of the quantitative nature of the work surrounding work-content factors, such incorporation does not take heed of warnings by Laufer and Jenkins (1982). In their conclusions, they argued that the use of quantification in the expectancy model should be mainly for illustrative purposes as they explained that the complexities of human behaviour transcend than which a model can predict. A further limitation is the reliability of statistics. Radosavljevic and Horner (2002) revisited formwork and masonry data sets compiled by Professors Thomas and Horner across 11 sites in the USA and the UK, only to confirm their suspicion that productivity is not normally distributed. This consistent finding bears significant implications in that 'some basic statistical diagnostics may give misleading results'. The authors therefore concluded that 'test statistics that rely on normality usually have been taken for granted, and as a result, not much could

have been done to achieve a better understanding of the ubiquitous complexity' of construction labour productivity.

2.8.5 Biographical Variables Related Factors to Labour Productivity.

All said and done, the researcher, in this study posits that labour demand and employability depends to a large extent on age/gender composition of the workforce, and this has great effect on the company's profit, the nation's workforce and economic gains at large. There is also that older women are clearly less present in employment than older men (European Labour Force Survey -EU-LFS, 2010). Literature reveals that a graying workforce will also become more female. Impliedly, there is held up effect of the rising overall female participation in the labour force (Peracchi & Welch, 1994). For women still leave the labour market earlier than men (Fitzenberger et al., 2004). But this should change in the cause of time. The question is, are employers willing to employ older individuals, in particular older women? Study show evidence in lifting the overall senior employment rate in the EU requires significantly raising that of women older than 50. Numerous empirical studies based on cross-sectional data show that a larger share of old workers has a detrimental effect on firm productivity (e.g. Haltiwanger et al., 1999; Lallemand & Rycx, 2009; Mahlberg et al., 2009; Prskawetz et al., 2007). Recent studies (e.g. Malmberg et al., 2008; Göbel & Zwick, 2009) are often based on longitudinal matched employer-employee datasets and found that a larger share of older workers does not necessarily affect firm productivity. The studies referred to so far concentrated exclusively on the link between ages structure and firm-level productivity, without assessing its relation to the wage profile.

Mahlberg et al. (2013) examined age profiles of productivity and wages in Austria between 2002 and 2005, using a matched employer-employee dataset covering a wide range of economic sectors. Contrary to a common belief, and acknowledging that determining causal connections is difficult, they found out that having a larger share of younger employees (defined as less than age 30) is associated with lower productivity and wages, while having a larger share of older employees (defined as age 50 and above) is not. They found no evidence that older workers are overpaid relative to their productivity. These results conform closely to similar research on the relationship of age, pay and productivity across Israeli and US firms (Hellerstein & Neumark, 1995) and (Hellerstein et al., 1999). Yet, Bartel and Sicherman (1993); Ahituv and Zeira (2000); Daveri and Maliranta (2006), in their studies have argued that rapid technological shifts have lowered the comparative advantage of seniority.

The most significant feature today in the construction industry in Ghana, and global demography is the aging of the labour force. Talking about age, then physique and nutrition cannot be left out cause; improvement in the contribution of labour to productivity is the result of a healthier, better education, better nourished labour force and at times shorter work week (Heizer & Render, 1990). Every country is anticipated to experience an increase of people aged 60 and over in the coming decades. The UN projects that by 2050 there would be 2 billion people aged 60 or over, compared with 680 million today. The number of those aged 80 and over projected to increase at even faster rate (United Nations Population Division, 2011). This is not an issue only in the construction industry, but both popular and academic discourse, the rising number of older people has set off a series of alarms. Recently, there are books written with titles such as *Age Quake*, *Gray dawn*, and *Workforce Crisis* have sought to draw the attention of readers to the potential problems that aging might bring. *The Economist* weighed in with a cover story, "*The End of Retirement*". Peter G. Peterson, a past US Secretary of commerce and former CEO of the now-defunct Lehman Brothers, went so far as to describe global aging as, "a threat graver and certain than those posed by chemical weapons, nuclear proliferation, or ethnic strife" (Peterson, 1999).

The concerns being raised stem from a careful study of trends and observations; working-age people are the prime savers of an economy. Older people usually draw on savings to support themselves. If large numbers of older people are liquidating their assets at the same time, assets value will decrease, undermining stock of wealth throughout the population. The elderly workforce tends to put great demand of health care systems, with health expenditure already accounting for substantial portions of GDP. In many high-income countries and in some middle-income countries as well, these greater demands will all the more stressful.

Fertility is falling in most countries, and the share of the population that is below age 14 is shrinking. When the youth population share is stagnant and the elderly population share rises, the relative size of the working-age population segment of the population necessarily declines. Population aging and fast technological changes in the labour market have led to widespread concerns as to how well the older workforce will be able to cope with new work processes (Ahituv&Zeira 2000; Van Dalen et al., 2010; UN 2011). The fact is cognitive functions declines over the life cycle, indicating perhaps older workers would not be able to adapt to technological changes.

Skirbekk (2008) finds that the development of cognitive abilities leads to a lump-shaped age-productivity profile at the individual level, whereby built up experience mitigates the decline in the productivity likely at higher ages. Bringing to fore a cross-section data on Austrian firms in 2001, the findings in Prskawetz et al., (2007) and Mahlberg et al., (2009) confirm such a lump-shaped productivity profile over age. In contrast, however, current panel data studies using firm-level data provide facts against this age-productivity pattern. Aubert and Crépon (2006) and Göbel and Zwick (2009) show that the age-productivity relation is quite sensitive to the estimation method and indicate that controlling for unobserved time-invariant firm heterogeneity and indigeneity leads to a flattening of the age-productivity profile at higher ages.

Undeniable, previous studies have been clear on the relationship between age and productivity. Heizer and Render (1990) said lack of compensation and advanced in age of labourer negatively affect labour productivity because labour speed, agility, and strength decline over time and reduce productivity.

2.8.6 External Related Factors

A study by Zou *et al.*, (2007), found out that project-funding problems have been recognized as cost-related risks, time-related risks, and quality-related risks which can considerably affect the delivery of a construction project. The risk of delayed payment from the client impacts the duration and cost of the project. These risks cause the project's cost to increase abnormally and, consequently, delay the project's progress. Thomas *et al.*, (1999) stated that "there is a 30% loss of efficiency when work changes are being performed. This outcome can be interpreted as changes to specifications and drawings that require added time for adjustments of resources and manpower so that the change can be effected. Also research by (Guhathakurta & Yates., 1993; Olomolaiye *et al.*, 1996) shows that inspection delays are vital process; for example, because contractors cannot cast concrete before inspection of formwork and steel work, the inspection delay contributes to delays in work activities. This drastically stops any task that requires inspection, like as backfilling and casting of concrete. Additionally, it delays the inspection of completed work which, in turn, leads to a delay in the commencement of new work.

Adverse weather conditions are significant factor to consider for completion of any construction project. Unfavourable weather can delay production since it increases the number of stops or causes interruption to work activities. Adverse weather, such as winds and rains, reduces productivity, particularly for external work such as timbering to trenches, formwork, concrete casting, external plastering, external painting, and external tiling. Adverse climatic condition sometimes stops the work totally (Sanders & Thomas, 1991).

2.9 Constraints to Labour Productivity

Increasingly labour economy is becoming more sophisticated, complex and dynamic, day in and day out. For that matter, economic measurement and analysis, pertaining to productivity, has become difficult and complicated. The main issue involves defining units of measurement, evaluating qualitative changes and obtaining reliable data for both inputs and outputs. This method is further complicated by the need to price or deflate this data in order to assess changes in productivity in real terms. Measurement of inputs is very challenging.

Variations in the rate of input utilization are at best to some extent picked up in data series. Especially, the rate of capital equipment utilization, i.e. the measurement of machine hours, is hardly ever accomplished. Labour input, if measured by hours really worked, is appropriate to reflect the changing rate of manpower deployment, but remains a defective measure. The main constraint to operative labour productivity is management of the resources, including labour resources. In Ghana, management of scanty resources to

accomplish much is not constrained to the average contractor, because they have qualified personnel with control-hands over the resources, but government influence in the construction processes is a barrier and challenge to labour productivity. This is so because construction business is booming in Ghana, hence political interference and manipulation of the tendering or bidding processes, which render the so-called processes questionable.

Furthermore, the increasing importance of productivity within the national economy has generated heightened mis-measurement of labour hours. Technology might worsen this measurement error by allowing increased work flexibility and longer effectual workdays that are not accurately captured by authorized statistics. This is a contextual study pertaining to Ghana but in other countries, the constraints vary. In the New Zealand context, Page (2010) identifies level of trade skills, project organisation and design detailing. The BCSPT Report (DBH, 2009) have shown sector wide skill shortage, procurement processes of construction projects, lack of innovation in the construction practices, and the impact of regulations as causes of low productivity of the New Zealand construction sector between 1997 and 2008. The report also identified design related problems, poor supervision and workmanship, and faulty materials as prime causes of defects and low productivity. It is upon the review of related literature, a conceptual framework was drawn, to guide the study (see Figure 2.1).

2.10 Conceptual Framework

Literature thoroughly reviewed and a conceptual framework deduced from it to guide the study. The conceptual framework outlines the connectivity and flow of the variables pertaining to the construction labour productivity. Variables appeared under constraints or "Barriers" have been identified as "Productivity Hindering Factors".

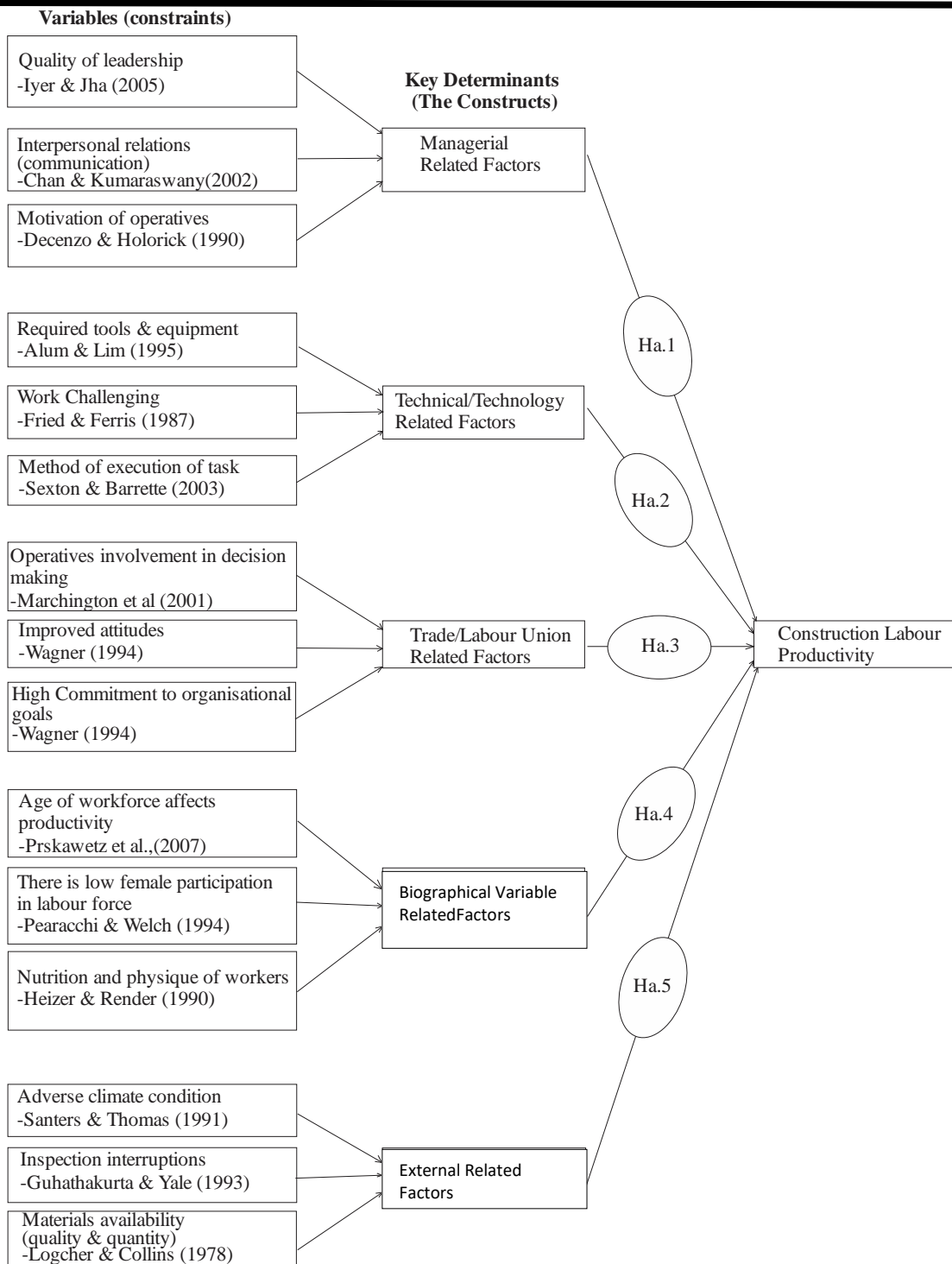


Figure 2.1 – Conceptual Framework of the Research Study.

3.0 RESEARCH METHODOLOGY

This study employed a quantitative approach. This was seen as appropriate in view of one of the study's research questions which seeks to find out the current practices use by contractors to improve productivity and to find out the factors that correlate labour productivity of operatives in the Ghanaian construction industry. The strength of the quantitative approach is that the research findings come from quantifiable data that are usually generalize-able to a larger population (Neuman, 2006).

3.1 Population

The population for the study is made up of a targeted group within construction companies namely; site Supervisors or site managers. General site foremen and headmen in construction firms of all categories belonging to the Association of Building and Civil Engineering Contractors of Ghana (ABCECG). According to Association of Building and Civil Engineering Contractors of Ghana, they hold a total membership of 1500 contractors in the country (ABCECG, 2013). The following figures were given by ABCECG for the regions; Greater Accra region- 127 contractors, Ashanti region - 48 contractors and Northern region-62 contractors. These three regions host many of the reputable construction companies operating in the country. The major cities in these regions are their administrative capital cities, and for that matter, Tamale has been chosen for Northern region, Kumasi for Ashanti region and Accra for the Greater Accra region.

Even though there are other mainstream associations of construction firms in Ghana, the firms in this association (ABCECG) is selected for the study because of its outstanding track record proven over the years and the international recognition it has attained. Secondly, it comprises of both building and civil engineering contractors. Thirdly, it covers both large and small scale contractors (D1, D2, D3 and D4 for general building contractors, K1, K2, K3 and K4 for civil engineering contractors).

Classification of construction firms in Ghana is done by the Ministry of Water Resources, Works and Housing (MWRWH). The D1, D2 and K1, K2 categories are classified as large scale firms and D3, D4 and K3, K4 are classified as the small scale contractors. According to the ministry's classification, the large scale contractors both civil and general building contractors are in the highest financial class. Though the small scale firms employ a large number of workers because small firm are spread throughout the length and breadth of the country, the large firms have relatively more organized managed labour force, and undertake large volumes of works.

The selection of data source is relevant for an academic research of this kind, instead of taking the list of up-to-date firms from the Ministry of Water Resources, Works and Housing, the researcher sort to use the list of firms from an association (ABCECG). In fact, Ministry of Water Resources, Works and Housing annual contract registration is not the most reliable data source available at present in Ghana. Simply because most construction companies are defaulting and not up-to-date in business because of competition, political affiliation, scarcity of contract and liquidity problems or for one reason or the other, they are not being able to renew their registration at the ministry. Secondly, a construction firm needs to register with the ministry to be qualified to bid for public works. When one is not registered, one can only bid for private jobs. These and many more make records of construction companies by the Ministry of Water Resources, Works and Housing incomplete.

3.2 Sampling Technique

The stratified random sampling and snow ball sampling was employed. Snow ball was used in the northern region because the researcher was not familiar with the terrain and have to fall on others for direction to construction sites. In fact, sample should represent all the properties of the population without any doubt. The main intention of stratified random sampling techniques was to collect representative samples from contractors in the two regions randomly. A suitable sampling technique is required to limit the study to a relatively small portion of the population.

3.3 Determination of Sample Size

The more accurately we expect the data to reflect the total population, the larger will be the sample size and more reliable and valid the results based on it will become (Bouma and Atkinson, 1995. Pp. 152-153). The total number of construction firms to be included in the study would be determined by the Kish equation; Kish (1965). Assaf *et al.*, (1999, 2001), Abdul-Hadi (1999) and Enshassi (2010), among others used this equation:

$$n = \frac{n'}{\left\{1 + \left(\frac{n'}{N}\right)\right\}} \text{Where}$$

n = Sample Size from finite population

N = Total Population

$$n' = \text{Sample Size from infinite population calculated from;} n' = \frac{S^2}{V^2},$$

Where V = Standard error of sample population equal to 0.05 for the confidence level 95%, t = 1.96

S^2 = Standard error variance of population elements,
 $S^2 = P (1 - P)$; Maximum at P = 0.5.

The sample size of the contractors can be calculated from the afore mentioned equations as follows;

$$n' = \frac{S^2}{V^2} =$$

$$S^2 = P (1 - P)$$

$$S^2 = 0.5 (1 - 0.5)$$

$$S^2 = 0.5 \times 0.5$$

$$S^2 = P (1 - P)$$

Where P = 0.5

$$S^2 = 0.5 (1 - 0.5)$$

$$S^2 = 0.75$$

To find V^2 , let $V = 0.05$ level of confidence.

$$V^2 = (0.05)^2$$

$$V^2 = 0.0025$$

$$\therefore n' = \frac{S^2}{V^2} = \frac{0.75}{0.0025}$$

$$n' = 300 \text{ answer}$$

$$n \text{ contractors in Accra} = \frac{300}{\left\{1 + \left(\frac{300}{127}\right)\right\}} = 90 \text{ contractors}$$

$$n \text{ contractors in Kumasi} = \frac{300}{\left\{1 + \left(\frac{300}{48}\right)\right\}} = 42 \text{ contractors}$$

$$n \text{ contractors in Tamale} = \frac{300}{\left\{1 + \left(\frac{300}{62}\right)\right\}} = 52 \text{ contractors}$$

Assuming a non-response rate of 40%, a total of 1.4 x 184 will be required to be distributed. That is a total of 257 questionnaires will be required to be distributed. Presumably 40% non-response rate will do for unreturned or unanswered questionnaire, and all wasted questionnaires. The total questionnaires to be distributed in each of the three selected regions is summarized in Table 3.1.

Table 3.1 Number of questionnaires to be administered in the selected region

REGION	Greater Accra	Ashanti	Northern	Total
Number of questionnaires to be administered.	115	66	76	257

3.4 Data Collection and Procedure: The following instrument was used to collect data for the research:

Questionnaire: Structured questionnaires would be used to gather data for analysis. The questionnaires would be devised through the literature review having in mind the nature and character of the population. It would also be essential to provide straightforward questions to respondents to ensure a clear understanding of all the applicable definitions, procedures, strategies and guiding principles that would be used to collect the data. In order to enhance the study, after the literature review, a plan would be formulated for collecting field information and creating an evaluation process and numerical values.

3.4.1 Questionnaire

Questionnaires are used for the gathering of data. The questionnaires are prepared for the site supervisors of the Contractors who are members of Association Building and Civil

Engineering Contractors of Ghana. As earlier mentioned, the questions are such that they contain elements to ravel labour related issues that impede productivity and profit.

3.4.2 Pilot-Test of Questionnaires

A pilot-test of survey questionnaire of an industry-wide research of this calibre is deemed important. The pilot-test is conducted to obtain feedback from practitioners in the industry. The pilot-test served largely to; 1) test the relevance of the constructs in Ghanaian construction context, 2) identify further constructs not captured from the secondary source (literature review), 3) to test the clarity and relevance of the questions, 4) modify the look and feel of the questionnaires and 5) to explore ways of improving the questionnaires appeal and response rate. The questionnaires were pre-tested by ten Mphil. Construction students. Response revealed the need to improve the clarity of a few questions. Part of the feedback received from the pre-test was the need to add "Uncertain" or "No idea" to the four-point rating system to five-point rating scale. This was to avoid any guesses from the participants who might not be clear about the question or not having the background knowledge of some particular constraints.

3.4.3 Validity and Reliability

This part presents tests of reliability of questionnaire according to the pilot study. One of the most commonly used indicators of internal consistency is Cronbach's alpha coefficient. According to Hair et al. (2010) and Straubs et al. (2004), the Cronbach alpha coefficient of a scale should be 0.7 or above. In the current study, the Cronbach alpha coefficient was 0.978, indicating that the research instrument has high reliability, graded excellent. The reliability of an instrument is the level of consistency which measures the attribute it is supposed to be measuring (Polit & Hunger, 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring instrument. The test is repeated to the same sample of people on two times and then compares the scores obtained by computing a reliability coefficient (Polit & Hunger, 1985). Chronbach's coefficient alpha (George and Mallery, 2003) is designed as a measure of internal consistency, and asked, do all items within the instrument measure the same thing? The normal range of Chronbach's coefficient alpha value between 0.0 and + 1.0. The closer the Alpha to 1, the greater the internal consistency of items in the instrument being assumed. As the number of items (variables) in the scale increases, the value α becomes large. Also, if the inter correlation between items is large, the corresponding α will also be large. Since the alpha value is inflated by a large number of variables then there is no set interpretation as to what is an acceptable alpha value.

The Chronbach's coefficient alpha was calculated for each field of the questionnaire. The most identical values of alpha indicate that the mean and variances in the original scales do not differ much, and thus standardization does not make a great difference in alpha. Table 3.2 shows the values of Chronbach's Alpha for each filed of the questionnaire and the entire questionnaire. For the fields, values of Chronbach's Alpha were in the range from 0.707 and 0.879. This range is considered high; the result ensures the reliability of each field of the questionnaire. Cronbach's Coefficient Alpha reliability estimate for the 93 labour productivity items was 0.978. Chronbach's Alpha value shows an excellent reliability of the entire questionnaire. In so doing, it can be said that the questionnaire is valid, reliable, and ready for distribution for the population sample.

Table 3.2 Chronbach's Alpha for each filed of the questionnaire

S/N	Field	No. of items	Cronbach's Alpha
1.	Managerial related factors	24	0.943
2.	Technical/ Technological factors	12	0.861
3.	Labour Union related factors	12	0.831
4.	Biographical variables factors	15	0.895
5.	External related factors	12	0.905

6.	Productivity	4	0.859
7.	Constraints	6	0.859
8.	Practices/Measures	8	0.871
	Total	93	0.978

3.4.4 Scale and Rating of Responses

The results were determined using mean value data based on the following rating scale: (1=Strongly Disagree, 2=Disagree 3=Uncertain/ No idea, 4=Agree, 5=Strongly Agree). Mean is a technique to compute the strength of index familiarity, frequencies and agreements of specific question. The data collected were analyzed using mean index which is used specifically for the ordinal scale measurement. The mean index can be computed by using the SPSS.

All the key Determinants/factors related to operatives' productivity in construction were calculated and arranged based on the indication of mean response in the descending order and whichever values indicating near to one (1) will be considered as the highest entry modes decision of mean response. The mean response for mean value was allocated with the rating of 1.00 to 1.50 for strongly disagree, 1.50 to 2.50 for disagree, 2.50 to 3.50 for uncertain or no idea, 3.50 to 4.50 for agree and 4.50 to 5.00 as strongly agree.

3.4.5 Principal Component Analysis

The researcher intended use of the PCA is for the purpose of reducing the data to a bearable few for clearer presentation of results. This method is mostly used as a tool in exploratory data analysis and for making predictive models. Principal component analysis is closely related to factor analysis, and the factor analysis is a technique used to condense the information in a large number of variables into a smaller set of new, composite dimensions known as factors (Hair et al., 2011). Factor analysis typically incorporates more domain specific assumptions about the underlying structure and solves eigenvectors of a slightly different matrix. Principal component analysis can be done by eigenvalue decomposition of a data correlation matrix usually after mean centring the data matrix for each attribute. The results of a PCA are usually discussed in terms of component scores, sometimes called factor scores (the transformed variable values corresponding to a particular data point), and loadings (the weight by which each standardized original variable should be multiplied to get the component score).

In order to test for the appropriateness of using the PCA for the data, two tests were conducted, Kaiser- Meyer- Olkin (KMO) and Bartlett's test of sphericity. The KMO measure of sampling adequacy compares magnitudes of correlation coefficients to the magnitude of partial correlation coefficients (Malhotra and Dash, 2011). The value of KMO ranges from 0 to 1 and a minimum value of 0.5 is specified as an acceptable threshold for proceeding with factor analysis (Hair et al., 2011; Malhotra and Dash, 2011). The rotated component matrix is presented in Table 3.3. In the preliminary analysis, the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy achieved a high of 0.938. The communalities achieved were also 0.80 or higher, indicating that the sampling size was reasonable enough for the factor analysis to proceed. In order to test for the appropriateness of using the PCA for the data, two tests were conducted, Kaiser- Meyer- Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity

In the present research, the KMO measure of sampling adequacy is 0.886 which is well above the acceptable value of 0.5 and is interpreted as 'meritorious'(Hair et al.,2011). The Bartlett's test of sphericity tests the factors that the correlation matrix is an identity matrix, which implies that the variables are uncorrelated (Chan et al., 2012; Field, 2005; Malhotra and Dash, 2011). The value associated with Bartlett's test of sphericity was large (approximate chi-square statistic=5.192E3) and the Bartlett's test is significant (p=.000), therefore factor analysis is appropriate (see Table 3.3).

Table 3.3: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		
	.886	
Bartlett's Test of Sphericity Approx. Chi-Square		5.192E3
	Df 378	
	Sig.	.000

3.4.6 Correlation matrix

There was perfect positive correlative between the factors. The matrix shows perfect relationship, with $r = +1$ or a perfect negative relationship, with an $r = -1$ between any two aspects of the factors. Hence many of the factors have relationships such that motivation and skills are highly correlated at 0.797, with the exception of the 'job security' (see Table 4.18), which had low correlation of 0.184 with other factors especially 'nutrition and physique,' hence it was not included in the analysis.

The SPSS tool used advises that, any factor that correlates highly (for example $r > 0.8$) should be eliminated from the investigation. A careful study reveals that there is none of the factors gone beyond 0.8, making a greater number of the factors moderately and highly correlated. Both tests used indicated factor analysis to be an appropriate technique for the present research. The variable 'job security' had very low correlation (.184) with the other variables especially 'nutrition' and hence was not included in the analysis

4.0 DATA ANALYSIS

4.1 Introduction

The chapter presents the results and analysis of data. The chapter is organized into seven sections. Section one is an introductory section followed by section two on the response rate. Section three presents results relating to the demographic characteristic of the respondents. Section four reports on the practices and measures put in place by companies to enhance labour productivity, and section five is also about constraints to labour productivity. Section six presents the factors that influence labour productivity. Then finally ended section seven with principal component analysis of the factors that influence labour productivity.

4.2 Response Rate

Table 4.1 presents a total of two hundred and fifty-seven questionnaires which were administered and one hundred and eighty four were returned. Four questionnaires were not usable leaving one hundred and eighty to be used for the analysis. The response rate was therefore seventy per cent (70%). The high response rate may be partly due to the fact the researcher was once a trade union executive for the association of Construction and Building Materials Workers Union (CBMWU) and have a cordial relationship with the Association of Building and Civil Engineering Contractors of Ghana (ABCECG). Also, the researcher personally administered the questions and made follow ups till the questionnaires were completed by willing respondents and handed over. Table 4.1 gives the summary of the responses received for the regions surveyed. The researcher spent considerable time of his working life with Desimone Ltd., a building construction firm located in Accra but sometimes trekked to other regions to carry out his duties as a union leader.

Table 4.1 Summary of Response

Table 4.2 Gender distribution of respondents

Item	Frequency	Percentage (%)
Male	174	96.7
Female	6	3.3
Total	180	100

In Table 4.3, in terms of age, 3.3% of the respondents were below 20 years and 53.3% were between 20 and 30 years, 16.7% between 31 and 40 years and 26.7% above 40 years, implying that a good percentage of them are young and old adults (30 and over 40 years).

Table 4.3 Age of respondents.

Age	Frequency	Percentage (%)
Below 20 yrs	6	3.3
20-30 yrs	96	53.3
31-40 yrs	30	16.7
41-50 yrs	48	26.7
Total	180	100

In Table 4.4, in terms of education, 18.3% have Technical/secondary school certificate (SSCE) certificate, 55% have higher national diploma, 25% have their first degrees and 1.7 % have masters in various fields.

Table 4.4. Academic Qualification of respondents.

Academic Qualification	Frequency	Percentage (%)
Technical/Sec sch.	33	18.3
HigherNational Diploma	99	55.
Degree	45	25.0
Master's Degree	3	1.7
Total	180	100

Table 4.5, present the professional qualification of respondents. A careful study of Table 4.5 indicates 31.7% of the respondents are quantity surveyors, 5.0% are structural engineers, 45% are project managers and 18.3% are trade foremen.

Table 4.5. Profession (occupation) of respondents

Profession (Occupation)	Frequency	Percentage (%)
Quantity Surveyor	57	31.7
Structural Engineer	9	5.0
Project Manager	81	45.0
Foreman	33	18.3
Total	180	100

In Table 4.6, in terms of experience or the duration of practice of profession of respondents. About 11.7% of the respondents have the highest experience of 21 years and above working experience, 5.0% have working experience of 11-15 years, another 5.0% have 16-20 years of working experience, and 26.7% have 5-10 years working experience and 51.7% have been practicing their profession for 5 years and below, and this imply that a good percentage of them are young and old adults from the tertiary institutions.

Table 4.6. The Experience of Respondents.

Duration of Practice	Frequency	Percentage (%)
Below 5 yrs	93	51.7
5-10 yrs	48	26.7
11-15 yrs	9	5.0
16-20 yrs	9	5.0
21 yrs& above	21	11.7
Total	180	100

In Table 4.7, presents the number of projects won, 58.3% of the companies won contracts between 1-2 and 41.7% of companies won 3 to 5 projects. The respondents of the survey represented construction companies where they worked, their responses indicate the number projects the firm won in a year.

Table 4.7. Projects won in a year by respondent's firm.

Projects won in one year	Frequency	Percentage (%)
1-2 Projects	105	58.3
3-5 Projects	75	41.7
Total	180	100

In Table 4.8, 51.7% of the companies won projects at the value of 0-5 million dollars in a year, 45% of companies won projects with a value of 5-10 million dollars and 3.3% of companies won projects with the highest value, between 10-100 million dollars.

Table 4.8 Value of Projects Won in a Year by Respondent's Firm.

Value of Projects	Frequency	Percentage (%)
0-5 Million (\$)	93	51.7
5-10 Million (\$)	81	45.0
10-100 Million (\$)	6	3.3
Total	180	100

4.4 Practices and Measures Companies put in to enhance Labour Productivity.

Table 4.9 shows level of agreement in a descending order for the measures and practices put in place by respondents' companies to enhance labour productivity in construction. Analysis shows that all respondents agreed with the measures listed. Provisions of sick leave with pay, health insurance and retirement benefit for employees at the mean value of 4.5000. It is the most important measure that would influence labour productivity of operatives in the construction industry. Provision of these will make the labour work less stressful, relieving one of thinking about one's own welfare and retirement. Similarly, majority of respondents strongly agreed that management bearing full cost of treatment of injuries sustained at workplace at the mean value of 4.4667.

Another measure that scored much was height allowance for working on higher structures at certain heights, they strongly agreed at mean value of 4.4500, and followed by respondents strongly agreeing to schedule overtime in order to finish work by planned schedule at the mean value of 4.4000. The fifth variable respondents strongly agree to was 'information provided to both employees and management on the achievement and progress', at mean value of 4.2833. Which was followed by inappropriate human relations could lead to withdrawal of goodwill by employees at the mean value of 4.2500. Long service award for the recognition of employees' long-term commitment to organization would enhance the operative's productivity was seventh in ranking at the mean value of 4.1500. The last but not the least of the measures was tools allowance to be paid to employees. See Table 4.9.

Table 4.9 Descriptive Statistics of Practices and Measures Adopt to Enhance Productivity.

Variable	N	Min	Max	Mean	Std. Dv.
Provision of sick leave with pay, health insurance, retirement benefits for employees.	180	2.00	5.00	4.5000	.74369
Management bearing full cost of treatment of injuries sustained at work place.	180	2.00	5.00	4.4667	.72002

Height allowance (for working on higher structures at certain heights).	180	1.00	5.00	4.4500	.86699
Schedule overtime (in order to finish work by planed schedule).	180	2.00	5.00	4.4000	.73690
Information is provided to both employees and management on the achievement and progress.	180	2.00	5.00	4.2833	.73443
Inappropriate human relations could lead to withdrawal of goodwill by employees.	180	1.00	5.00	4.2500	.97954
Long service award (recognition of employees' long-term commitment to organization).	180	1.00	5.00	4.1500	.99986
Tools allowance is paid to employees.	180	1.00	5.00	3.9833	1.15054
Valid N (listwise)	180				

4.5 Constraints to Labour Productivity

Table 4.10, presents the analysis of the subcomponents of on-site productivity constraints and majority of respondents strongly agreed that Governments influence on the construction process as a constraint to operatives' productivity at mean value of 4.5167. This subcomponent constraints, has a variable which is related to a statutory compliance in Building Regulation Act (BRA) 1992. This statutory compliance makes a government's agency (MWHWR) the sole registrar of construction companies in Ghana. It compels the construction firms to be in bed with the government, or it would be difficult to win a bid to government project. When work goes down, workers are slapped off with redundancy. It implies that, contractors pay much to acquire projects and tend to under pay the operatives to make profit. In other words, they employ fewer hands for big projects. Perhaps, this could be the reason the operatives highly rated governments influence as a constraint to productivity.

The results show that out of the significant 6 variables measuring for constraint of productivity, respondent's response was high, as they agreed to all variables as barriers to productivity. The other constraints agreed by respondents at mean value of 4.4833 which affect the productivity was the level of empowerment of operatives, giving training and, resource operatives with the necessary equipment, would influence productivity positively. The next constraint to labour productivity agreed by respondents at mean value of 4.2667 was material related, acquiring materials from unreliable material source or supply. Respondents again strongly agreed at mean value of 4.1500 that inspection delays by authorities negatively affect productivity, for that matter a constraint. These were followed by 'restrictive union contract has bad effects on labour productivity of site operatives', at mean value of 4.1500 as indicated on Table 4.10. The variable EPA (Environmental Protection Agency) approval does delays progress of work and affects labour productivity being the key legislation affecting construction contracts and operations - was rated very low by majority of the respondents at mean value of 3.7500.

Table 4.10 Descriptive Statistics of Constraint to Labour Productivity

Variable	N	Min	Max	Mean	Std. Dv.
Government's influence on the construction process; political influence and Frequent changes in government policies/ legislations impact on construction productivity.	180	1.00	5.00	4.5167	.82878

Level of empowerment (training and resourcing) of labour force has a positive influence on productivity.	180	2.00	5.00	4.4833	.64708
Materials related (unreliable materials supply).	180	1.00	5.00	4.2667	.93115
Inspection delays by authorities negatively affect productivity.	180	1.00	5.00	4.1500	1.08043
Restrictive union contract has bad effects on labour productivity of site operatives.	180	2.00	5.00	4.0500	.97611
EPA (Environmental Protection Agency) approval does delays progress of work and affects labour productivity.	180	1.00	5.00	3.7500	1.10800
Valid N (listwise)	180				

4.6 Productivity Related Factors.

In Table 4.11, pertaining to productivity related factors there are 4 variables, which were all highly scored by respondents. The respondents strongly agreed at the mean value of 4.5667 that an efficient worker would produce more units of work in less time. Secondly respondents strongly agreed again at the mean value of 4.5333 that an efficient worker carries out his work with high degree of workmanship. Respondents continued to agree on the third item that, a more committed worker would be productive. Then finally ended on this by strongly agreeing that an efficient worker will achieve set target at the mean value of 4.4667, which was positive.

Table 4.11 Descriptive Statistics of Productivity Related Factors

Variation	N	Min	Max	Mean	Std. Dv.
An efficient worker would produce more units of work in less time.	180	1.00	5.00	4.5667	.66936
An efficient worker carries out his work with high degree of workmanship.	180	1.00	5.00	4.5333	.74294
More committed worker is productive.	180	1.00	5.00	4.500	.80847
An efficient worker achieve set target.	180	1.00	5.00	4.4667	.86780
Valid N (listwise)	180				

4.6.1 Managerial Related Factors

The results of this part of the study provide an indication of the mean value and ranking of managerial related factors in descending order according to respondent's response. In Table 4.12, in relating to managerial factors, there are 24 variables measuring managerial factors. Surprisingly, the respondents strongly agreed to 21 variables and agreed to the 3 remaining variable. This is an indication that managerial related factors are crucial to site operative's productivity.

The responding rate of the variables on the table 4.12 was very high. The majority of 180 respondents strongly agreed that, a worker that is strongly motivated will certainly put in more effort on the job, at the mean value of 4.8000. They agreed also at the mean value of 4.7500 that availability of qualified staff, and training proprietors and technicians would enhance productivity on the site. Respondents again gone further to agree that supervision based on leadership by example will influence productivity at the mean value of 4.6667. On safety and health variable, respondents strongly agreed that danger or caution signals and posters gets operatives informed of danger than verbal warning at the mean value of 4.4000. The last but not the least factor respondents agreed at mean value of 3.8167 to was training and orientation of new operatives affects productivity, thus to say new recruits of operatives should either have orientation or training on their work. This can be explained as shown by Table 4.12.

Table 4.12 Descriptive Statistics of Managerial Related Factors that Influence Labour Productivity.

Variation	N	Min	Max	Mean	Std. Dv.
A strongly motivated worker will certainly put in more effort on the job.	180	1.00	5.00	4.8000	.62891
Availability of qualified staff, training proprietors and technicians would enhance productivity.	180	1.00	5.00	4.7500	.62423
Supervision based on leadership by example influence productivity	180	2.00	5.00	4.6667	.59795
Experience supervisors Plan their work ahead of time and this affects productivity.	180	1.00	5.00	4.5667	.69395
Friendly environment enhances site operatives' productivity.	180	1.00	5.00	4.5667	.66936
Task is well executed when divided to small units for effective monitoring and supervision.	180	3.00	5.00	4.5333	.61997
A strongly motivated worker will certainly perform his/her work at a higher quality.	180	1.00	5.00	4.5167	.74350
A strongly motivated worker will certainly work more productively.	180	2.00	5.00	4.5167	.69696
Experience supervisor knows his team (equitably share work and match skills).	180	1.00	5.00	4.5000	.72080
Interpersonal relations (management/operatives relationship) affect productivity.	180	1.00	5.00	4.4833	.76571
Communicating what the Forms of expectations are to operatives enhances productivity.	180	1.00	5.00	4.4833	.74350

Planning of task (be such that it follow sequential manner to avoid other operatives waiting for uncompleted task, before the next task is executed).	180	3.00	5.00	4.4500	.61884
The level of skill of Labour Force enhances productivity	180	1.00	5.00	4.4500	.74200
Project management style (e.g. engineer gives instruction to foreman not labourer), enhances productivity	180	1.00	5.00	4.4500	.88611
Tasks carried out in gangs enhance new learning skills, an opportunity for individual development of skills	180	1.00	5.00	4.4333	.86586
Danger or caution signals and posters gets operatives informed of danger than verbal warning.	180	1.00	5.00	4.4000	.75930
First aid kit provided would speed up recovery of minor injuries and would add up to productivity of operatives.	180	3.00	5.00	4.3500	.65566
Organization saves money On medicals by providing Protective clothing to operatives.	180	2.00	5.00	4.3500	.77297
Orientation for (fork-lift and dumper Operators) reduces accident rate on site.	180	2.00	5.00	4.3000	.78320
On-the-job training Enhances the performance of operatives.	180	1.00	5.00	4.2833	.91709
Employees who have knowledge, skills and abilities acquired through training increase productivity at the site.	180	2.00	5.00	4.2833	.71124
Quick interpretation of Drawings by experience Supervisor enhances operative's productivity.	180	1.00	5.00	4.2500	.88989
On-the-job training program Demonstrate a true interest of management drive to raise employee productivity.	180	1.00	5.00	4.2000	1.08004
Training and orientation of new operatives affects productivity.	180	1.00	5.00	3.8167	1.12103
Valid N (listwise)	180		5.00		

4.6.2 Technical/Technological Related Factors

Analysis of the sub-factors under the Technical/ Technological related factors are broad category of determinants of operatives on site presented in Table 4.13. There are 12 variables under this heading. The majority (8) of the respondents rated and strongly agreed

that 'required tools and equipment adequately provided for work would affect productivity' at a mean value of 4.5333.

The response rate was very high indicating that each variable measured well, certain situations on site that hinders operative's productivity. Results of respondents again shown at mean value of 4.5000 that, inappropriate methods retard operatives' productivity is one of the most influential factors that affects labour productivity on site. They again strongly agreed that storage location should be close to avoid double handling by operatives (stockpiles should be close to mixing plant), ranking third and at a mean value of 4.4333. Results of respondents show that, quick replacement and repairs of broken down and old equipment is one of the most influential factor that affects labour productivity on site, they strongly agreed this at a mean value of 4.3000. This is followed by poor material storage facilities at the mean value of 4.2833, and then followed by conjunction and poor access in project site ranking seventh at the mean value of 4.2667. The responses are set in the descending order to determine the ranking. The last response on the table is productivity would increase if jobs were designed in a way that would make them meaningful and challenging to operatives, at a mean value of 3.6500 (see Table 4.13).

Table 4.13 Descriptive Statistics of Technical/Technological Related Factors that Influence Labour Productivity.

Variable	N	Min.	Max	Mean	Std. Dv.
Required tools and equipment adequately provided for work would affects productivity.	180	1.00	5.00	4.5333	.72002
Inappropriate methods retard operatives' productivity.	180	3.00	5.00	4.5000	.64730
Storage location should be close to avoid double handling by operatives (stockpiles should be close to mixing plant).	180	1.00	5.00	4.4333	.74068
Insufficient transportation facilities for workers retard productivity.	180	1.00	5.00	4.3500	.98296
Quick replacement and repairs of broken down and old equipment positively influence productivity.	180	1.00	5.00	4.3000	1.00779
Poor material storage facilities negatively affect productivity.	180	1.00	5.00	4.2833	1.02087
Conjunction and poor access in project site retards productivity of workforce.	180	1.00	5.00	4.2667	1.12662
Constant disruption of work (Frequent changes in design and specifications) badly influence productivity.	180	1.00	5.00	4.2500	1.15248
Resistance to accept new technologies or new way of doing things has negative effects on productivity.	180	1.00	5.00	4.2333	1.11916

When job complexity is increased, operatives feel a sense of meaningfulness and responsibility regarding their jobs.	180	1.00	5.00	4.3333	1.01882
Operative are challenged when assigned to operate small machines.	180	1.00	5.00	4.0167	.99426
Productivity would increase if jobs were designed in a way that would make them meaningful and challenging to operatives.	180	1.00	5.00	3.6500	.6500
Valid N (listwise)	180				

4.6.3 Labour Union Related Factors

In Table 4.14, highly motivated operatives are highly committed to organizational goals, was the variable that had the highest response and ranked 1st at the mean value of 4.7333. The respondents strongly agreed to 4 variables and agreed to 8 of them, indicating all 12 variables was highly considered by respondents as Labour Union related factors that influence operatives' labour productivity. The last item in terms of ranking was 12 and at mean value of 3.6667, that is permanent workers are committed to their organization than casual workers. (see Table 4.14).

Table 4.14 Descriptive Statistics of Labour Union Related Factors that Influence Labour Productivity.

Variable	N	Min.	Max	Mean	Std. Dv.
Highly motivated operatives are highly committed to organizational goals.	180	2.00	5.00	4.7333	.63069
Attending an employee's relative funeral (Personal family problems) in Ghana affect productivity.	180	1.00	5.00	4.4667	.94189
Workers involvement in decision-making on site positively affects productivity.	180	1.00	5.00	4.3833	.79997
Level of commitment of workers positively affects productivity.	180	1.00	5.00	4.3333	.99720
Workers working in gangs improve productivity.	180	2.00	5.00	4.2500	.72370
Management assisting operatives to solve their personal problem leads to high commitment.	180	1.00	5.00	4.2000	.91175
Job security creates competition among operatives.	180	1.00	5.00	4.1667	.93653
Operatives who are sure of The security of their job Work with high enthusiasm.	180	1.00	5.00	4.0333	.91481
Unionized operatives Accrued much gain including improved attitudes and commitment.	180	1.00	5.00	4.0000	.98593

Trade Union rules have positive influences on productivity.	180	1.00	5.00	3.9667	.98537
Existence of labour or trade union unites labour force to work as a team.	180	1.00	5.00	3.8167	1.19344
Permanent workers are committed to their organization than casual workers.	180	1.00	5.00	3.6667	1.40231
Valid N (listwise)	180				

4.6.4 Biographical Variables Related Factors

Table 4.15, Reports on Biographical Variables Related Factors. There was high response on biographical factors except on the variable ethnic background of a worker will impact on his/her productivity respondents shown no idea at a mean value of 2.6833. There are 15 variables and respondents strongly agreed to 8 with Nutrition and physique of workers leads to higher productivity becoming the highest, and they agreed to 6 of the variables, and then were uncertain/no idea for 1 variable.

Table 4.15 Descriptive Statistics of Biographical Variables Related Factors

Variable	N	Min.	Max	Mean	Std. Dv.
Nutrition and physique of Workers leads to higher productivity.	180	2.00	5.00	4.4833	.88737
Food at canteen for workers at subsidized price will reduce time for breaks leading to productivity improvement.	180	1.00	5.00	4.4667	.82827
Better nourished labour force would increase productivity.	180	2.00	5.00	4.4333	.76297
Employers are not willing to employ older individuals, in particular older women.	180	1.00	5.00	4.3833	.91709
There is low female participation in the labour force.	180	1.00	5.00	4.3333	.85221
Female workers turn to retire from their jobs earlier than their male counterparts.	180	1.00	5.00	4.2833	.97037
Younger workers prefer work based on contract (Finish and go) which enhances productivity of the workforce.	180	1.00	5.00	4.2833	1.11503
Slow adaptability of new technology of older folks affects productivity negatively.	180	1.00	5.00	4.2333	1.16322
Level of familiarity with current job and condition improves productivity.	180	1.00	5.00	4.2167	.84082
Experience of operatives mitigates the decline in productivity in older operatives.	180	1.00	5.00	4.1500	1.11102

Age of the workforce influence productivity.	180	1.00	5.00	4.1333	.88690
Expatriate operatives are expensive to hire by management than the indigenes.	180	1.00	5.00	4.1000	1.10913
Language barrier Could affect progress of work (time used interpreting the language)	180	1.00	5.00	4.1000	1.12414
Operatives with higher Cognitive ability will be in better jobs that have higher ability requirements for good wages.	180	1.00	5.00	4.0167	1.19344
Ethnic background of a worker will impact on his/her productivity.	180	1.00	5.00	2.6833	1.42396
Valid N (listwise)	180				

4.6.5 External Related Factors

Table 4.16, illustrates the ranking of factors for the external group. Muddy site due to continue rains render access roads inaccessible were ranked first in the external group, with a mean value of 4.5833 and second among all 12 external related factors negatively affect labour productivity was adverse weather condition was the next with a mean value of 4.4500 and ground conditions necessitating revisions (e.g. water gushing out of the ground), this ranked third at a mean value of 4.4500. Repetition of work and work changes affect productivity ranked fourth on the Table 4.16 with a mean value of 4.4167. The respondents strongly agreed to eight variables and agreed to the four remaining variables. The last but not the least sub factor respondents agreed to at a mean value of 3.6167 was Project Engineer's inspection interrupt work assigned to operatives (see Table 4.16).

Table 4.16 Descriptive Statistics of External Related Factors that Influence Labour Productivity

Variable	N	Min.	Max	Mean	Std. Dv.
Muddy site due to continue rains can render access roads inaccessible and would affects productivity negatively	180	1.00	5.00	4.5833	.73898
Adverse weather condition (Harsh weather).	180	1.00	5.00	4.4833	.92438
Ground conditions necessitating revisions (e.g. water gushing out from ground).	180	2.00	5.00	4.4500	.80692
Repetition of work and work changes affect productivity.	180	1.00	5.00	4.4167	.88359
Energy/fuel crises, insufficient energy to power the plants have negative impact on productivity.	180	1.00	5.00	4.3833	.97037
Land litigation has a very high negative influence on productivity.	180	1.00	5.00	4.3833	.87979

Material availability (in quantity & quality) affects productivity.	180	1.00	5.00	4.3833	.97037
Inflation in material prices negatively affects work output.	180	2.00	5.00	4.3333	.87165
Inspection of activities that lead to fire at areas where flammable and combustible substances are stored.	180	1.00	5.00	4.2333	.86586
Late instruction from owner to carry out a task negatively affects productivity.	180	1.00	5.00	4.1167	.89863
Waiting for Project manager's instructions negatively affects productivity.	180	1.00	5.00	3.9333	1.17040
Project Engineer's inspection interrupt work assigned to operatives.	180	1.00	5.00	3.6167	1.32140
Valid N (listwise)	180				

Table 4.17: Correlation matrix

	Quality_ leadership	Communication	Motivation	Experience_ supervisors	Skills	Planning_ task	Training_ Orientation	Safety	Equipment	Challenging_ task	Inappropriate_ method	Storage_ location	Workers_ involvement	Unionized_ operatives	
Correlation	Quality leadership	1.000													
	Communication	.630	1.000												
	Motivation	.722	.739	1.000											
	Experience supervisors	.617	.746	.673	1.000										
	Skills	.628	.649	.797	.725	1.000									
	Planning_ task	.603	.622	.659	.663	.702	1.000								
	Training Orientation	.410	.636	.444	.633	.495	.570	1.000							
	Safety	.612	.661	.547	.686	.548	.683	.761	1.000						
	Equipment	.264	.487	.400	.556	.452	.463	.692	.482	1.000					
	Challenging_ task	.334	.379	.313	.427	.326	.451	.368	.377	.354	1.000				
	Inappropriate_ method	.364	.484	.429	.590	.428	.469	.612	.538	.513	.386	1.000			
	Storage_location	.386	.510	.475	.552	.503	.589	.585	.644	.529	.542	.677	1.000		
	Workers_involvement	.609	.500	.556	.515	.513	.536	.530	.503	.394	.419	.389	.464	1.000	
	Unionized_operatives	.614	.573	.543	.551	.475	.676	.530	.644	.456	.561	.506	.566	.589	1.000
	Commitment	.552	.751	.701	.671	.658	.695	.525	.611	.606	.416	.588	.597	.491	.679
	Job_security	.351	.297	.268	.393	.345	.392	.392	.377	.362	.228	.342	.330	.325	.263
	Age	.654	.575	.519	.653	.579	.645	.479	.605	.386	.546	.360	.433	.653	.719
	Gender	.476	.670	.720	.629	.588	.692	.510	.529	.476	.333	.523	.550	.377	.548
	Cultural_background	.423	.441	.420	.411	.459	.338	.417	.396	.448	.305	.202	.241	.264	.504
	Nutrition_physique	.547	.528	.609	.594	.555	.502	.358	.516	.214	.363	.272	.298	.419	.588
	Cognitive_ability	.573	.663	.593	.654	.622	.731	.523	.588	.492	.474	.417	.482	.613	.733
	Climate_condition	.621	.672	.672	.671	.636	.698	.716	.699	.461	.382	.522	.558	.560	.503
	Inspection	.652	.621	.583	.583	.504	.586	.547	.665	.359	.549	.458	.520	.565	.799
	Material_availability	.582	.667	.645	.717	.560	.628	.661	.700	.443	.392	.505	.566	.595	.515
	Instructions	.564	.585	.565	.675	.494	.574	.529	.577	.389	.346	.596	.527	.496	.563
	Productivity	.585	.628	.722	.613	.655	.532	.354	.405	.293	.494	.289	.323	.605	.452
	Constraints	.597	.596	.628	.543	.547	.703	.632	.616	.403	.433	.380	.447	.664	.620

Practices_measure s	.571	.591	.476	.570	.497	.624	.623	.718	.490	.384	.581	.610	.517	.626
------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

Commitment	Job_security	Age	Gender	Cultural_background	Nutrition_physique	Cognitive_ability	Climate_condition	Inspection	Material_availability	Instructors	Productivity	Constraints	Practices_measure s
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1.000													
.446	1.000												
.634	.337	1.000											
.706	.307	.478	1.000										
.527	.376	.571	.402	1.000									
.531	.184	.681	.586	.533	1.000								
.700	.411	.784	.549	.612	.601	1.000							
.598	.457	.628	.677	.459	.517	.644	1.000						
.659	.283	.652	.539	.531	.675	.676	.524	1.000					

.577	.369	.580	.560	.366	.451	.617	.827	.525	1.000					
.600	.314	.500	.626	.471	.501	.626	.650	.673	.694	1.000				
.599	.267	.585	.516	.400	.590	.624	.605	.557	.591	.542	1.000			
.646	.389	.646	.599	.492	.535	.695	.737	.742	.711	.623	.624	1.000		
.575	.351	.523	.621	.430	.522	.605	.635	.669	.550	.670	.458	.588	1.000	

a. Determinant= 3.05E-014

Principal component analysis was used for factor extraction and the criterion of an eigen value greater than 1 was used to determine the number of factors to be extracted. An eigen value represents the amount of variance associated with the factor (Field, 2005). Figure 4.1 represents a plot of eigen values against the number of factors in the order of extraction. The plot, known as the scree plot, shows a steep descent in the curve followed by gradual trailing off called the scree (Malhotra and Dash, (2011)

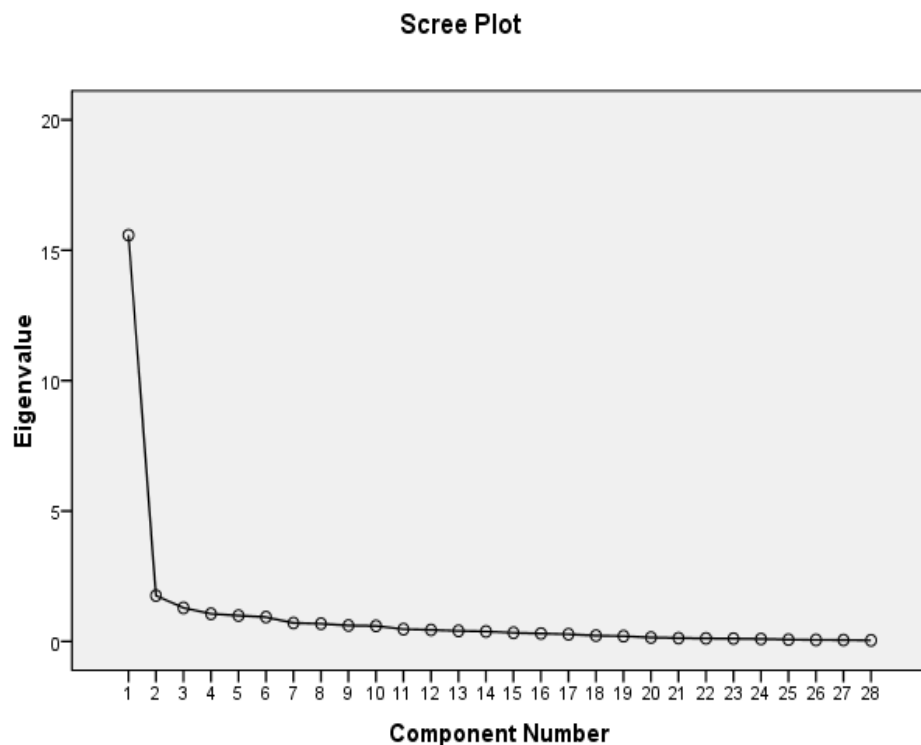


Figure 4.1 Scree Plot of The 28 Factors Affecting Operatives' Labour Productivity.

In Table 4.19, four factors were extracted based on the Eigen value criterion and the extracted factors account for 70.56 % of the total variance which is above the minimum limit of 60 % recommended by Hair et al. (2011) and Malhotra and Dash (2011).

Varimax orthogonal rotation was performed to advance or improve the interpretability of the factors. As a general guideline, a value ranging from 0.1 to 0.4 would be classed as weak correlation, and anything above 0.5 would be regarded as a strong correlation (Cohen 1988). A value approaching zero indicates the absence of any relationship between two variables, in other words no correlation. Table 4.19 represents the factor loadings of the variables on the 4 factors extracted. Hair et al. (2011) recommends factor loadings above 0.50 for practical significance and hence all factor loadings below 0.50 have been suppressed in the present study. The 28 factors/determiners or attributes used for factor analysis were thus grouped into four factors namely, (1) quality leadership; (2) communication; (3) motivation; (4) experience supervisors.

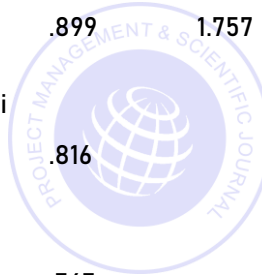
Table 4.19 Determination of Component that meet Criterion (An Eigenvalue of 1 or More); see Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.695	56.054	56.054	15.695	56.054	56.054	7.270	25.965	25.965
2	1.737	6.205	62.259	1.737	6.205	62.259	5.288	18.887	44.853
3	1.271	4.539	66.798	1.271	4.539	66.798	4.783	17.083	61.936
4	1.054	3.766	70.564	1.054	3.766	70.564	2.416	8.629	70.564
5	.980	3.500	74.064						
6	.893	3.188	77.252						
7	.707	2.525	79.777						
8	.664	2.372	82.150						
9	.597	2.132	84.281						
10	.578	2.064	86.345						
11	.472	1.685	88.031						
12	.440	1.570	89.601						
13	.406	1.450	91.050						
14	.370	1.321	92.371						
15	.327	1.168	93.539						
16	.307	1.097	94.636						
17	.281	1.003	95.639						
18	.222	.792	96.431						
19	.201	.719	97.150						
20	.148	.530	97.680						
21	.127	.452	98.132						
22	.114	.406	98.538						
23	.107	.383	98.921						
24	.091	.325	99.246						
25	.066	.235	99.481						
26	.057	.202	99.683						
27	.050	.180	99.863						
28	.038	.137	100.000						

Extraction Method: Principal Component Analysis.

Table 4.20 Results of Factor Analysis on the Factors Affecting Operatives' Labour Productivity

Factors	Variables measuring	Factor	Eigen	Percentage	
Cumulative	the factors	loading	value	of variance	Explained
percentage of					
variance					
Explained					
1.	Supervision based on leadership by example influence productivity.	.932	15.582	55.648%	55.648%
Quality leadership	Project management style (e.g. engineer gives instruction to foreman not labourer), enhances productivity.	.857			
	Availability of qualified staff, training proprietors and technicians would enhance productivity.	.633			
2.	Interpersonal relations (management/operatives relationship) affect productivity.	.899	1.757	6.273%	61.922%
Communication	Communicating what the forms of expectations are to operatives enhances productivity.	.816			
	Friendly environment enhances site operatives' productivity.	.767			
3.	A strongly motivated worker will certainly work more productively.	.837	1.285	4.588%	66.510%
Motivation	A strongly motivated worker will certainly	.831			
		.727			



4.	perform his/her work at a higher quality.	.910	1.059	3.781%	70.292%
Experience Supervisors	A strongly motivated worker will certainly put in more effort on the job	.861			
	Experience supervisors plan their work ahead of time and this affects productivity.	.846			
	Experience supervisor knows his team (equitably share work to match skills).				
	Quick interpretation of drawings by experience supervisor enhances operative's productivity.				

DISCUSSION OF RESULTS

5.1 Introduction

In the preceding chapters we have had a lengthy discussion over identifying the research problem, reviewing the literature through relevant labour productivity theories, making effort to the research problem through methodology, data collection and finally analysing data on meaningful ways to unravel and then highlight some futuristic events about labour productivity. In this chapter, discussion will be made on issues as data analysis had revealed.

The prime objective of the study is to make known the determinants to operatives' productivity in the construction industry in Ghana. As revealed in the preceding chapters through literature, there are many factors affecting operative's productivity on site but it will be the most crucial factor to know them per the perception of practitioners, as to which ones are considered more crucial, pertaining to Ghana as long as operative's productivity is concern. Therefore, conducting a comprehensive discussion over data analysis, it is important that the analysis is thoroughly viewed.

The chapter presents the discussion of the results of findings of the research. Results are discussed in relation to the research objectives. Subsections of the chapter comprised the practices that enhance productivity of operatives, constraints to operatives' productivity, determinants of productivity of operatives and the summary of the chapter.

5.2 Practices That Enhance Productivity of Operatives

The sustainability and success of a construction firm today, depends more and more on the diverse practices and measures adopted by management of the companies. The management of the 21st century firms should focus on innovative and skilled labour-force, employees' satisfaction, development and well-being of workers, workmen compensation, career progression and related work practices should enable employees and the organization to achieve high performance.

The first research objective of this study was to assess current practices by Ghanaian contractors to improve productivity. During the data gathering processes, research participants' responses provided valuable measures to mitigate identified determinants that influence labour productivity. And Table 4.9 shows level of agreement in a descending order for the measures put in place by respondents' companies to enhance labour productivity in construction industry. Analysis shows that respondents agreed with all the measures listed. Table 4.9, indicates that, provision of sick leave with pay, health insurance and retirement benefits for employees came at the mean value of 4.5000. These results are consistent with

Lazear (1979)'s theory of deferred compensation, which assumes that workers and firms want to be engaged in long term relationships and concludes that rising earnings do not necessarily fully reflect increased productivity. But this current finding contradicts with what (Prendergast 1993) said, he considered the role of promotions in inducing firm specific skills. Provision of sick leave with pay, health insurance and retirement benefits for employees is the most important measure that would influence labour productivity of operatives in the construction industry. Provision of these will make the labour work less stressful, relieving one of thinking about one's own welfare and retirement. Similarly, majority of respondents strongly agree at the mean value of 4.4667 in the second rank that management bearing the full cost of treatment of injuries sustained at workplace, would boost productivity. This result is in agreement with the findings of Fabling and Grimes (2008); the authors examine the relative importance of internal/ controllable and external/uncontrollable constraints to firm's performance and conclude that the differences in firm performance are explained in large measure by factors over which they have control rather than purely by exogenous factors.

Another measure that scored much at the third rank was height allowance for operatives working on higher structures at certain heights, they strongly agreed at mean value of 4.4500, because working at higher levels is a risk taking venture. Of the 1,121 workplace fatalities in 2002, approximately 20% of them occurred in construction-related accidents (BLS 2002). Construction labourers ranked ninth among the most dangerous occupations,

The respondents strongly agreeing at the fourth rank with a mean value of 4.4000 to schedule overtime in order to finish work by planned schedule. That is to say operatives agree that working time could be extended in order to finish work on schedule, but it should go with the due allowances. The fifth variable respondents strongly agree to be information provided to both employees and management on the achievements and progress, at mean value of 4.2833.

This result is consistent with the findings of the Building and Construction Sector Task Force (DBH, 2009) notes that better management of the boom-bust cycle will help improve skill development and retention, reduce waste and give greater confidence to industry participants. Which was followed by inappropriate human relations, could lead to withdrawal of goodwill by employees at the mean value of 4.2500. Operatives solely wanted management to recognize their existence and respect because without them work will come to stand still. Long service award for the recognition of employees' long-term commitment to organization would enhance the operative's productivity was seventh in ranking at the mean value of 4.1500. Social and welfare issues are one of operative's challenges, for higher productivity this issues should be given serious attention. The last but not the list of the measures was tools allowance to be paid to employees, see Table 4.9. The low response to this is an indication that workers sometimes do not know what they are entitled for.

5.3 Constraints to Operatives' Productivity

Table 4.10, presents the analysis of the subcomponents of onsite productivity constraints and respondents strongly agreed that Governments influence on the construction process as a constraint to operatives' productivity. In terms of constraints This subcomponent constraints, has a variable which is related to a statutory compliance in Building Regulation Act (BRA) 1992. This statutory compliance makes a government's agency (MWHWR) the sole registrar of construction companies in Ghana. It compels the construction firms to be in bed with the government, or it would be difficult to win a bid to government project. When work goes down, workers are slapped off with redundancy. It implies that, contractors pay much to acquire projects and tend to under pay the operatives to make profit. Perhaps, this could be the reason the operatives highly rated governments influence as a constraint to productivity.

McShane (1996) hints that the impact of Resource Management Act 1991 (RMA) on on-site labour productivity is profound, especially in relation to resource content issues. The Department of Building and Housing (DBH, 2009) also notes that a number of industry leaders see regulation in its broadest sense as a critical factor constraining the industry productivity through increased compliance costs, limitation on activity, stifling of innovation and reduction of efficiency on worksites.

The results show that out of the significant 6 variables measuring for constraint of productivity, respondent's response were high, as they agreed to all variables as barriers to productivity. The other constraints agreed by respondents which affect the productivity are the level of empowerment of

operatives, thus giving training and, resource operatives with the necessary equipment, would influence productivity positively. The next constraint to labour productivity agreed by respondents is material related, acquiring materials from unreliable material source or supply.

Respondents again strongly agreed that inspection delays by authorities negatively affect productivity, for that matter a constraint. These were followed by 'restrictive union contract have bad effects on labour productivity of site operatives', as indicated on Table 4.10. The variable EPA (Environmental Protection Agency) approval does delays progress of work and affects labour productivity being the key legislation affecting construction contracts and operations - was rated very low by majority of the respondents. It is surprising to note that the EPA - being the key legislation about health and safety in construction activities and operations - was rated very low by majority of the respondents. Perhaps, this could be due to the increased ignorance of, and proactive response to, the Act since all parties must now abide by its provisions.

For instance, Wilkinson and Scofield (2010) recognized the choice of procurement system as having a major impact on the achievement of time, cost and quality targets for a project. Mbachu and Nkado (2007) discovered factors involving the acts of omission of the role of key personnel including clients, consultants and contractors, as well as project characteristics and external factors. In New Zealand, Page (2010) identifies level of trade skills, project organisation and design detailing.

The BCSPT Report (DBH, 2009) points to sector extensive scarcity of skills, procedure to procurement of construction projects, lack of innovation in the construction practices, and the impact of regulations as causes of low productivity growth of the New Zealand building and construction sector between 1997 and 2008.

A report by Egan (1998), focused on providing shelter or building houses, it points to numerous constraints including processes and overuse of materials, poor management-worker relationships, undetermined targets and ineffective measurements of performance as some of the productivity constraints. As it relates to productivity, the main argument put up by the Egan Report is that devoid of best practices and measurable indicators to help monitor the progress of improvements, the task to produce better projects (including improvement of productivity) will not be feasible owing to faulty processes and lack of benchmarks.

The Report also identified design problems, poor supervision and workmanship, and faulty materials as main causes of defects and low productivity. On the other hand, the Report admits that the identified constraints are unlikely to explain fully the sector's poor productivity performance, and therefore calls for further research in this area.

5.4 Determinants of Productivity of Operatives

This subsection introduces the main determinants or 'drivers' of labour productivity growth. The main drivers of operatives' productivity are the determinants which have been extracted by the principal component analysis (PCA). Four items are extracted, thus quality leadership, communication, motivation and experience supervisors.

5.4.1 Quality leadership

Surprisingly, predicted four top most factors affecting the operatives' productivity on site, sited in the conceptual frame work and questionnaire coincidentally has been extracted by principal component analysis (PCA) tool used to analyse the factors. The first factor 'quality leadership' according the Table 4.20, accounts for 55.648% of the total variance and this stresses the importance of management and supervision in construction industry. This findings support what (Makulsawatudom & Sinuthawanarong, 2004) as they bemoaned that, rework is one of the major factors that affect labour productivity in the construction industry. This goes to also buttress what Lyer and Jha (2005) propose, 'that skills and quality of leadership affects strongly and directly on productivity or performance of construction project' (see Conceptual framework pg. 59).

One of the variables used to measure this factor is 'Supervision based on leadership by example'. Leadership by example has power to command followers to succumb and very motivational to compel the recalcitrant operative on site to do the job they have not intended doing. Leadership by example is a tool to silence any unruly behaviour and for that matter, any site supervisor who applies it would perform

credibly and definitely meet set targets. This strategy works, instead of yelling and picking argument with a tradesman, the supervisor can take a hammer and drive a nail, he can take a trowel and collect mortar, he can also use the spade in levelling the ground or use a club hammer to drive a peg into the ground, report to site early before workers can arrive, etc. These acts of the supervisor will silence and help the tradesman to have a positive attitude on the job site. This finding agrees with what (McTague & Jergeas, 2002) found that cost overruns and labour productivity losses on large oil and gas construction projects were the result of many factors such as the apparent "management" deficiency in managing scope, time, quality, cost, productivity, tools, scaffold, equipment, materials, and lack of leadership, among other things.

According to Shehata et al., (2011), it is important that construction project managers have a fair knowledge of the methods leading to evaluation of productivity or equipment and labour. Faridi and El-sayegh (2006) bemoaned the shortage of skills of man power, poor supervision, site management, unsustainable leadership, shortage of equipment to have contributed to delays of projects in U.A.E. Similarly Iyer and Jha (2005) re-echoed the same sentiment of skills acquisition. They said in their study, "If project managers have acquired skills in leadership, then project performance can be monitored, controlled and managed with high standard of quality". A careful study of Table 4.4, in the current study indicates that there are qualified project managers in the construction industry. About 55% of them being holders of higher national diploma are good signs for the industry.

5.4.2 Communication

In Table 4.20, the second factor explains 6.273% of the total variance and a cumulative percentage of 61.922%. Ineffective and inadequate communication among the supervisors and tradesmen can affect tradesmen motivation and increase mistakes in construction causing detrimental effects to operative productivity. Enshassi et al., (2007), said 'misunderstanding between labour and superintendents was a major factor impacting productivity in the Gaza strip'. Lack of communication was also a factor affecting operative labour productivity in Alberta, Canada (Hewage and Ruwanpura, 2006).

Construction involves a variety of tasks being carried out simultaneously engaging various specialists, consultants, contractors, subcontractors and trades. Poor communication among parties involved can spark off various other productivity problems, ranging from resource shortages to intractable disputes among the project participants. Effective interactions among all parties involved in the project on the site are a key to the successful completion of a construction project. These revelations reaffirm the study of Thomas et al., (2002); Chan and Kumaraswamy (2002), who propose that interpersonal relation is one of the bottlenecks of productivity.

5.4.3 Motivation

Motivation is the third factor, and it explains 4.588% of the total variance and reflects on the primary and secondary motivational needs of the operatives. Undeniably, previous studies have seen factors relating to pay and incentives as significantly affecting motivation of operatives. Monetary factors were found to be preeminent in influencing labour motivation in Turkey (Kazaz and Ulubeyli, 2007; Parkin et al., 2009). In Iran, Zakeri et al., (1997) also found monetary issues influencing operatives' motivation to be able to put up their best at work site. Similarly, same findings were discovered in Indonesia (Kaming et al., 1998b). In addition to satisfying the primary motivators related to pay and incentives, tradesmen also require their higher level motivational needs to be fulfilled.

Lack of recognition of good and efficient workers and disregard of tradesmen suggestions can create negative motivational forces in the tradesmen which get reflected in the productive capacity of the labour force. Poor site facilities/conditions are a profound problem at most of the construction sites in Kumasi and Tamale, if compared to construction sites in Accra (capital city of Ghana), and this can be a demotivator to the workforce. The project management should realize the importance of maintaining workforce motivation in improving operatives' productivity and take necessary actions to satisfy the primary and secondary motivational needs of the (operatives) workforce.

5.4.4 Experience Supervisors.

This factor 'Experience supervisors' accounts for 3.781% of the total variance and a cumulative percentage of 70.292% and these stress the importance of supervision in construction. Supervisor

absenteeism during working hours can result in the operatives taking on unproductive activities or idling about. Lack of experience of the supervisor can be a major concern and a problem at the job sites with the supervisor being unable to provide necessary guidance to the operatives, resulting in an increase of errors, faulty works, corrections, reworks and double handling. This result confirms the findings of (Thomas and Sakarcan 1994) who found that supervision and proper coordination of subcontractors have the most significant impact on on-site labour productivity. (Abdul Kadir et al. 2005) put emphasis on coordination with subcontractors, which was ranked as one of the influential factors in the study. Furthermore, Jergeas (2009) and KPMG (2009) argue that effective project integration management, comprising the activities that integrate, coordinate and bring together the various functions and multiple stakeholders, is the key to achieving onsite productivity and performance. As said before, lack of operative labour supervision was identified as a besetting problem affecting labour productivity studies carried out in the Gaza strip and Kuwait (Enshassi et al., 2007; Jarkas and Bitar, 2012) whereas incompetent supervisors were found to significantly impair productivity in Uganda and Thailand (Makulsawatudom et al., 2004; Alinaitwe et al., 2007). Also, the experience of the supervisory team reflects on the capability of the site supervisors, especially, when the work is not planned properly, as one of the variables used to measure this factor was 'experience supervisors plan their work ahead of time'.

The result or tail-end of inexperienced supervisory is poor site management. Most often these in experienced supervisors would accelerate the schedule by increasing the number of workers, and congestion and interference would be the result. Kaming et al., (1998a) reported that a labour density greater than one man per 30 m² results in loss of productivity, which intensifies with the degree of overcrowding and the number of men on site. Interference was an important problem influencing productivity in Indonesia and the United Kingdom (Kaming et al., 1997; Olomolaiye, 1988).

5.5 Summary: Mathematical Validity and Reliability of Factor Analysis

In summary of the above sections, a mathematical validity and reliability of factor analysis to see a healthy relationship or correlation among the factors extracted by principal component analysis. According to Doloi et al. (2012), if the attributes explain the factor identified by factor analysis, they should exhibit significant correlations with one another. Validity of factor analysis was hence established by calculating the Pearson correlation among the factors tabulated in Table 5.1, supported with statistical evidence. The correlation coefficients show that the attributes were correlated, with all correlations being significant at the 1% significant level. Thus it may be concluded that the factors contain attributes that are related.

Table 5.1: Summary of the Correlation Coefficient between the Factors Affecting Operatives Labour Productivity

Factor/Attribute		1	2	3	4
Quality leadership	Pearson	1	.633**	.724**	.620**
	Sig. (2-tailed)		.000	.000	.000
	N	180	180	180	180
Communication	Pearson	.633**	1	.740**	.749**
	Sig. (2-tailed)	.000		.000	.000
	N	180	180	180	180
Motivation	Pearson	.724**	.740**	1	.675**
	Sig. (2-tailed)	.000	.000		.000
	N	180	180	180	180
Experience supervisors	Pearson	.620**	.749**	.675**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	180	180	180	180

** . Correlation is significant at the 0.01 level (2-tailed).

The reliability of the factor analysis was established by calculating the Cronbach's alpha reliability coefficient (α) (Chan et al., 2012; Doloi et al., 2012; Choi et al., 2011). The Cronbach's alpha coefficient was calculated for the attributes in each grouped factor, as well as on all the attributes and the respective values are shown in Table 5.2a and b. The lower threshold limit of Cronbach's alpha coefficient is 0.7 which reduced to 0.6 in exploratory research (Hair et al., 2011). The value of α for all attributes was 0.897 which is excellent (Doloi et al., 2012). The α values calculated therefore indicate good reliability of the attributes under factor analysis.

Table 5.2a & b: Result Summary of Reliability Analysis for Grouped Factors Affecting Operatives Labor Productivity

Table 5.a: Case Processing Summary

	N	%
Cases Valid	180	98.9
Excluded a	2	1.1
Total	182	100.00

a. Listwise deletion based on all variables in the procedure.

Table 5.2b: Reliability Statistics

Cronbach's Alpha	No of Items
.897	4



6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusions drawn from the research findings and recommendations put forward for knowing the determinants of labour productivity of site operatives and to develop a framework for improving construction labour productivity in Ghana.

6.2 Summary of Research Findings

This research, predominantly confirmed findings of studies made elsewhere in the world. As part of its objectives has identified key constraints to construction labour productivity of site operatives in the construction industry in Ghana and has prioritized the determinants based on their severity of factors extracted by PCA. Then 93 variables (sub factors) have been identified and grouped under 28 factors, which also came under 5 broad categories of factors relating to operatives' productivity, deduced from a conceptual framework after extensively doing a review relating to productivity.

The drivers/determinants of productivity in the construction industry may have considerable effects on the economic development and stability. However, quality leadership skills were acceptable as the most important determinant that influenced the productivity of the operative, among other determinants such as communication, motivation and experience supervisors. Quality leadership skill is a major factor that influences the labour productivity. So, proper planning is really needed to make sure that the project is completed successfully. The project managers should train themselves to be more creative, more innovative, as well as equipped with leadership skills. As leaders on project sites, they should be good role models to command the respect of the employees. Bridging of the gap between blue-colour operatives and white-colour management is very important for industrial harmony that would be

free from agitation and also Project managers should establish friendly atmosphere, good employer-employee relationship.

The impacts on operative's productivity was identified where it is strongly agreeing that communication will increase the productivity as low labour productivity will cause delaying of project. Communication would be effective if friendly environment is created, and site supervisors communicate what the forms of expectations are to operatives as they are part of the project team. Again, supervisors should create interpersonal relations, thus management/operative relationship. Company can send their supervisors to other develop countries to learn more about technology for advancement of work. Since, the new technological knowledge and skills can be shared and fully practiced in other countries, and consequently our construction industry players would compete globally if they apply technology.

The motivation factor became very important, since it was one of the managerial factors the Principal Component Analysis (PCA) tool extracted. Motivation is a subject that is difficult to be divorced from productivity. A number of researchers have done extensive work in this area. Many authorities have propounded a lot of models in this field. On the other hand, models and theories developed outside the boundaries of the construction context might not be valid for creating knowledge about the motivators of construction workers. It is in this light that studies that has adopted new approaches and methods to critically look at the motivation of operatives in the construction context become relevant and necessary.

Other researchers have projected the use monetary motivation, as they argued that, "monetary factors were found to be preeminent in influencing labour motivation. In Iran, it was also found that monetary issues influenced the motivation of operatives to put up their best at work site.

The concept of employee involvement in decision taking in construction industries is also very important. It has been around in the UK in over the last century. The concept was developed from the days of collective bargaining at the end of the First World War. Which is still effective and relevant today provided site managers will apply it. In sharp contrast to its prominence, the understanding of motivation in the construction context has hardly gone beyond the initial stages and is deemed limited. Currently, there are management-driven employee involvement schemes that stressed direct communication with individual employees. This also allows tradesmen to individually bargain to their worth. Motivation of the operative can also come from within through the encouragement by leadership, just letting the operative know, tomorrow would better than today.

The factor, 'Experience Supervisors' is the last of the four factors extracted by PCA as the determinants of operative productivity in the construction industry in Ghana. Inexperienced supervisors have project management deficiencies. Unacceptable project coordination and poor project planning and scheduling can create a shortage of all resources needed for construction thereby significantly affecting productivity. Preceding researchers using analytical hierarchy process (AHP) identified pre-planning and programming to be the most critical factor in improving construction labour productivity. Unrealistic project goals setting and deadlines can negatively affect productivity. In addition to causing time overruns, unrealistic schedules can also lead to mistakes and rework in construction.

6.3 Conclusion

Construction industry in Ghana is at the infant stage and still crawling in terms of technological advancement. The researcher is not surprised that the Principal Component Analysis tool used for data analysis only extracted factors that fall under managerial related factors. The cause of low productivity in construction in Ghana is purely managerial related. However, per the findings of this current study, causes of low productivity in Ghanaian construction industry are all (managerial issues) leadership related factors. Similarly, most research across the globe has discovered managerial issues to be one major factor influencing operatives' productivity.

This current study on productivity drew its literature from two previously separate branches of economics; industrial economics and labour economics. Drawing upon these two distinct sources of economic analysis has had some implication on the structure, methodology, analysis and consequently the findings. Since labour productivity of the operative is having economic underpinning, and researcher drawing from labour economics, is making a statement basing on findings from the research that, any medium or small firm have one watch word, 'prudent management of scanty resources' if mismanaged, the result would be loss not profit.

The controlling factor here is management. The managers of any economy and not having a controlling hand of the economy, the result will be misappropriation, mismanagement, restrictive and redundant procedures leading to unprofitable ventures.

The groups of factors which are highly effective are managerial related factors; supervision, material, execution plan, and design. Moreover, for large companies, equipment factors are also highly effective, thus in the domain of Technical / Technological related factors. This were findings of other researchers who discovered that lack of technical and managerial skills is often identified as one of the major problems of contractors in developing countries resulting in poor competitiveness with their well-developed and industrialized counterparts. Practically it is a difficult task for all to improve labour productivity up to 100%. But if site managers have control on above factors, productivity can be improved up to a large extent.

6.4 Recommendations to stakeholders in the Construction Industry

This study surveyed common themes in the literature relating to determinants of site operatives' productivity. Quality leadership, communication, motivation and experience of supervisors will improve productivity at the firm level within the construction industry. The following recommendations are made based on the findings of the study:

- Training aimed at enhancing leadership skills needs to be carried out by construction companies regularly so as to enhance the leadership skills of site/project managers.
- Since experience is an important tool in enhancing labour productivity, construction companies need to take measures to lower their staff turnover this will ensure highly experienced staff does not leave their organisations for other firms.
- Communication has been found to a vital tool and in line with this site manager need to take part in continuing professional development, particularly if such training is aimed at developing verbal, written and graphic aspects of communication.
- Award schemes for site managers as well as project managers need to be instituted by construction companies to motivate them. Also, non-financial means of motivation such as certificates of award, promotion, letter of commendation, holidays abroad should be instituted when possible.

6.5 Recommendations for Future Research

The goal of this study was to find out the determinants of labour productivity of site operatives in Ghana from the Site managers point of view in the industry and to know the practices put in place by contractors to improve labour productivity in the Ghanaian construction industry. However, this study covered a particular scope hence the need for a further research into other areas in the industry concerning determinants of labour productivity of site operatives, the industry as a whole, looking at wider influencing factors. The following recommendations are suggested for future research:

The sample population for this study included only construction companies registered with the Association of Building and Civil Engineering Contractors in Ghana. Future studies may conduct a survey on construction companies not registered with this association but belonging to other mainstream bodies and compare the findings with this one. Since there are numerous small scale contractors dotted around every hamlet in Ghana.

Because this study was geared towards all class of construction firms, further research on this topic should take into consideration conducting a study on workers working with D1K1 construction companies being the highest financial classification in terms of general building and civil works by the Ministry of Water Resources, Works and Housing, since working conditions may differ from other classifications such as D2K2, D3K3 and D4K4 companies.

The scope of this research was limited to workers who could be classified as operatives or skilled labour only. Future research may utilize similar methods and procedures to conduct research on other workers in the industry such as unskilled labour and also on other construction professionals instead of general building and civil works.

Due to financial constraints, this study randomly selected only 3 regions out of 10 regions for the study. Future studies may be conducted on construction companies in all the 10 regions and compare the findings.

6.6 Contribution to the Block of Knowledge (Bok)

The key contributions of this study to existing stock of knowledge include the identification and prioritization of the key constraints to labour productivity of site operatives to the College of Labour Studies, Ghana and also add up to practices or measures for improving labour productivity and to support frameworks for evaluating labour productivity of site operatives.

References

Abdul Kadir, M.R., Lee W.P., Jaafar M.S., Sapuan S.M. & Ali A.A.A. (2005). *Factors affecting construction labour productivity for Malaysian residential projects Structural Survey, 23(1), 42-54*

Ackerman, P. L. (1996). *A theory of adult intellectual development: Process, personality, interests, and knowledge. Intelligence, 22, 227-257.*

Agyedu, G. O., Donkor F. & Obeng, S., (2011). *Teach Yourself Research Methods*. Kumasi: Paks Publications.

Agyenim Boateng, O. E, Atta, E.T., & Baafi-Frimpong (2000). *Educational management and administration*. Cape Coast: University Press.

Ahadzi D. K. (1995). Factors affecting labour productivity in the construction industry in Ghana: The perception of consultants and contractors, *Journal of the Building and Road Research Institute*, Vol. 3 (1/2), pp. 22-32.

Ahituv, A., Zeira, J., (2000). *Technical progress and early retirement*. CEPR Discussion Paper No. 2614. Centre for Economic and Policy Research, London.

Alarcon, L. F. & Borchard, J. D., (1991). Quantitative effects on construction productivity. *The Construction Lawyer, American Bar Association, 17(1), 35-48.*

Alinaitwe, M.H., Mwakail, J.A. and Hansson, B. (2007). Factors affecting the productivity of building craftsmen: Studies of Uganda, *Journal of Civil Engineering and Management, XIII (3), 169-176*

Anaman, K. A. & Amponsah, C. O. (2007). Analysis of the causality links between the growth of the construction industry and the growth of the macro-economy in Ghana. *Construction Management and Economics (September 2007) 25, 951-961.*

Attar, A.A., Gupta A. K. & Desai D. B. (2011). A study of Various Factors Affecting Labour Productivity and Methods to improve it. *Journal of Mechanical and Civil Engineering*. ISSN: 2278-1684, PP: 11-14.

Aubert, P. & Crépon, B., (2006). *Age, wage and productivity: firm-level evidence. Mimeo*, INSEE, Paris..

Baba Aye, (2010). Trade unionism and trades unions; an introductory: A presentation at the June 5, 2010, 1-day National Industrial Relations Workshop I organized for the Total E&P branch of Petroleum and Natural Gas Senior Staff Association of Nigeria (PENGASSAN), on the platform of J'Aiye Management Consultants (JMC) Awesome Inc. template. Power

Bamberg & Ulrich (June 2004). [*The role of German trade unions in the national and European standardisation process*](#). TUTB Newsletter. 24-25. Retrieved July 27, 2011.

Bartel, A.P., Sicherman, N., (1993). Technological change and retirement decisions of old workers. *Journal of Labor Economics, 11 (1), 162-183.*

Bennett, et. al. (2000). Job satisfaction of agricultural teachers in Georgia and selected variables indicating their risk of leaving the teaching profession. The GLOBE Program, Washington, DC.

Bjurek, H. & Durevall, D. (2000). Does Market Liberalization increase Total Factor Productivity? Evidence from the Manufacturing Sector in Zimbabwe. *Journal of Southern African Studies*, 26,3, 463-479.

Borcherding, J. D, & Liou, F.-S. (1986). Work sampling can predict unit rate productivity. *Journal of Construction Engineering and Management*, 112(1), 90-103.

Borcherding, J. D., & Oglesby Clarkson H. (1974). Construction productivity and job satisfaction. *Journal of Construction Division, ASCE*

Borcherding, J.D. & Oglesby C.H. (1975). Job dissatisfaction in construction work. *Journal of the Construction Division, ASCE*, 102(CO2), 415-434

Borcherding, J.D., Sebastian, S.J. & Samelson, N.M. (1979). Improving motivation and productivity on large projects. In: Proceedings of the ASCE, *Annual Convention and Exposition and Continuing Education Programme*, 22-26, October.

Bouma, G.D. & Atkinson, G.B.J. (1995). *A handbook of Social research*, (2nded). Oxford: Oxford University Press.

Bureau of Labour Statistics BLS. (2002). National Census of Fatal Occupational Injuries in 2001, U.S. Department of Labour, Washington, D.C.

Busari D. T., A. A. Amin & T. Ntilivamunda, (2005). Modelling Total Factor Productivity in African economies. *Tenth annual conference on econometric modelling in Africa*, 6-8 July 2005, Nairobi Kenya.

Carlos, C. & Paul, D. (2010). "Effortless productivity tracking", White Paper#21, Breakthrough Strategy Committee, London, UK, Accessed 08 February 2011 from: <https://www.construction-institute.org/scriptcontent/btsc-pubs/CII-BTSC-121.doc>

Chamorro-Premuzic, T., Furnham, A., & Ackerman, P. L. (2006). Ability and personality correlates of general knowledge. *Personality and Individual Differences*, 41, 419-429.

Chan, J. H. L., Chan, D. W. M., Chan, A. P. C. & Lam. P. T. I. (2012). "Risk mitigating strategies for guaranteed maximum price and target cost contracts in construction- A factor analysis approach." *Journal of Facilities Management*, 10(1), 6-25.

Chan Daniel w. m. & Kumaraswamy Mohan M., (2002). Compressing construction durations: lessons learned from Hong Kong building projects. *International Journal of Project Management*, Vol.20, PP. 23.35

Cheung, S. O., Suen, H. C. H., & Cheung, K. K. W. (2004). "PPMS: A web-based construction project performance monitoring system." *Automation in Construction*, 13(3), 361-376.

Choi, T.N.Y., Chan, D. W. M. & Chan, A. P. C. (2011). "Perceived benefits of applying pay for safety scheme (PFSS) in construction- A factor analysis approach. *Safety Science*, 49(6), 813-823.

CIDB (2008). Malaysian Construction Industry Master Plan, CIDB Malaysia.

Clayton, C.R.I. (2001). *Managing Geotechnical Risk: Improving Productivity in UK Building and Construction*, (1st ed.), Thomas Telford, London

Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Science*. Hillsdale, NJ: Erlbaum.
Construction Industry Institute (2000). *Quantifying the cumulative impact of change orders for electrical and mechanical contractors*. Research Summary 158-1, Cumulative Change Order Impact Research Team, Construction Industry Institute (CII), University of Texas at Austin.

Crotty, M., (1998). *The foundation of social research: Meaning and perspective in the research process*. London: Sage.

Dainty, A & Loosemore, M. (2013). *Human Resource Management in Construction Projects*, Routledge.

Davenport, T.H. (2005). *Thinking for a living*, Harvard Business School Publishing, Massachusetts.

Daveri, F., Maliranta, M., (2006). Age, seniority and labour costs: lessons from the Finnish IT revolution. *Economic Policy* 22 (49), 117-175.

DeCenzo, D., & Holvikiak, S. (1990). *Employee Benefits*. Prentice Hall, City, New Jersey, 55-56.

Department of Building and Housing (DBH) (2009). Report of the Building and Construction Sector Productivity Taskforce, Accessed 20 October 2010 from: <http://www.dbh.govt.nz/UserFiles/File/Building/sector-forum/Sector-Productivity-Taskforce-Report.pdf>

Devis, N. (2007). *Construction sector productivity*. Scoping report. Department of Building and Housing, New Zealand

Dodgson, M. (2000). *The Management of Technological Innovation*. Oxford: Oxford University Press.

Doloi, H. (2008). "Application of AHP in improving construction productivity from management perspective." *Construction Management and Economics*, 26(8), 841-854.

Doloi, H., Sawhney, A., Iyer, K. C. & Rentala, S. (2012). "Analysing factors affecting delays in Indian construction projects." *International Journal of Project Management*, 30(4), 479-489.

Drucker, P.F. (1999). *Management challenges for the 21st century*, Amsterdam: Elsevier.

D, Dozzi, S.P. & AbouRizk, S.M. (1993). "Productivity in Construction." Institute for Research in Construction, National Research Council, Ottawa, Ontario, Canada.

Durdyev, S. & Mbachu, J. (2011). 'On-site Labour Productivity of New Zealand Construction Industry: Key Constraints and Improvement Measures', *Australasian Journal of Construction Economics and Building*, 11(3), 18-33.

Dwivedula, R. & Bredillet, C. N. (2010). 'Profiling work motivation of project workers', *International Journal of Project Management*, 28(2), 158-165.

E. Edwards, D. J., Yang, J., Wright, B.C. & Love, P.E.D. (2007). "Establishing the link between plant operator performance and personal motivation." *Journal of Engineering, Design and Technology*, 5(2), 173 - 187.

Edwards, B. & Eckblad, J., (1984). Motivating the British construction industry. *Construction Management and Economics*, 2, 145-156.

Egan, J. (1998). *Rethinking Construction*. Report from the construction task force, London: HMSO Department of Trade and Industry.

Enshassi, A., Mohammed, S., Mustapha, Z.A. & Mayer, P.E. (2007). Factors affecting labour productivity in building projects in the Gaza Strip. *Journal of Civil Engineering and Management*, 13(4), 245–254. European Labour Force Survey (EU-LFS) 2010.

Fabling, R. & Grimes, A., (2008). *The suite smell of success: Complementary personnel practices and firm performance*, Discussion Paper DP2009/13, Reserve Bank of New Zealand, Wellington, (December), Accessed 10 March 2011 from http://www.rbnz.govt.nz/research/discusspapers/dp09_13.pdf

Faridi, A. & El-Sayegh, S. (2006). Significant factors causing delay in the UAE construction industry. *Construction Management and Economics* 24(11), 1167–1176

Field, A. (2005). *Discovering statistics using SPSS*, (2ndEd). London: Sage Publications.

Fitzenberger, B., Schnabel, R. & Wunderlich, G., (2004). The gender gap in labour market participation and employment: a cohort analysis for West Germany. *Journal of Population Economics* 17 (1), 83–116.

Fowler, E.J. (2002). *Survey research methods*, (3rded.). Thousand Oaks, CA; Sage.

Fried, Y. & Ferris, G. R. (1987). The validity of the job characteristics model: A review and meta-analysis. *Personnel Psychology*, 40, 287–322.

Fugar, F. D.K., & Agyarkwa, A.B. (2010). "Delays in Building Construction in Ghana", *Australian Journal of Construction Economics and Building*, 10 (1/2), pp. 103–116.

Ghana Trade Union Congress, (2011). *Productivity and ethics; A training Manual for Labour Studies*. Accra-Ghana: O'Mens Graphix,

Ghoddousi, P & Hosseini, M. R. (2012). 'A Survey of the Factors Affecting the Productivity of Construction Projects in Iran', *Technological and Economic Development of Economy*, 18 (1), 99–116.

Göbel, C. & Zwick, T., (2009). *Age and Productivity - Evidence from Linked Employer Employee Data*. Discussion Paper 09-020. Centre for European Economic Research.

Groák, S. (1994). Is construction an industry? Notes towards a greater analytic emphasis on external linkages. *Construction Management and Economics*, 12, 287–293.

Gudienė, N, Banaitis, A & Banaitienė, N. (2013). 'Evaluation of critical success factors for construction projects – an empirical study in Lithuania', *International Journal of Strategic Property Management*, 17(1), 21–31.

Guhathakurta, S. & Yates, J. (1993). "International labour productivity." *Journal of Construction Engineering*, 35(1), 15–25.

Hackman, J. R., & Lawler III, E. E. (1971). Employee reactions to job characteristics. *Journal of Applied Psychology*, 55, 259–286.

Hackman, J. R., & Oldham, G. R. (1975). Development of the Job Diagnostic Survey. *Journal of Applied Psychology*, 60, 159–170.

Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational Behaviour and Human Performance*, 16, 250–279.

Hair, J. F., Black, W.C., Babin, B. J., Anderson, R. E. & Tatham, R. L. (2011). *Multivariate data analysis*, (6th Ed). Dorling Kindersley (India) Pvt. Ltd, New Delhi.

Handy, C. (1997). *Boring workplace, boring worker*. Management Today, pp 29

Hanna, A. S., Taylor, C. S., & Sullivan, K. T. (2005). "Impact of extended overtime on construction labour productivity." *ASCE Journal of Construction Engineering Management*, 131(6), 734-740.

Hanson, D.; Mbachu, J. & Nkando, R. (2003). Causes of client dissatisfaction in the South African building industry and ways of improvement: the contractors' perspectives, in CIDB, South.

Haltiwanger, J.C., Lane, J.I. & Spletzer, J.R., (1999). Productivity differences across employers: the roles of employer size, age, human capital. *American Economic Review* 89, 94-98.

Harrison, D. A., Newman, D. A., & Roth, P. L. (2006). How important are job attitudes? Meta-analytic comparison of integrative behavioural outcomes and time sequences. *Academy of Management Journal*, 49, 305-325.

Hazeltine, CS. (1976) 'Motivation of construction workers', *Journal of the Construction Division*, 102 (C03), 497-510.

Heizer, J., & Render, B. (1990). *Production and Operations Management "Strategic and Tactical Decisions."* Prentice Hall, NJ.

Hellerstein, J.K. & Neumark, D., (1995). Are earnings profiles steeper than productivity profiles? Evidence from Israeli firm-level data. *Journal of Human Resources* 30, 89-112.

Hellerstein, J.K., Neumark, D., & Troske, K.R., (1999). Wages, productivity, and worker characteristics: evidence from plant-level production functions and wage equations. *Journal of Labor Economics* 17, 409-446.

Herbsman, Z. & Ellis, R. (1990). Research of factors influencing construction productivity. *Construction Management and Economics*, 8, 49-61.

Hesham Ahmed Ibrahim, (1997). "Construction Labor Productivity under Different Effects" thesis presented to Alexandria University, in partial fulfillment of the requirements for the degree of Master of Science.

Hewage, K. N. & Ruwanpura, J. Y. (2006). "Carpentry workers issues and efficiencies related to construction productivity in commercial construction projects in Alberta." *Canada Journal of Civil Engineering*, 33, 1075-1089.

Healy, M. & Perry, C., (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm, *Qualitative Market Research*, 3(3), 118-126.

Humphrey, S. E., Nahrgang, J. D., & Morgeson, F. P. (2007). Integrating motivational theoretical extension of the work design literature. *Journal of Applied Psychology*, 92, 1332-1356.

Iyer K.C. & Jha K.N., (2005), Factors affecting cost performance: evidence from Indian construction projects, *International Journal of Project Management*, Vol. 23, PP. 283.295.

Jorgenson, D. W., Gollop, F., & Fraumeni, B. (1987). *Productivity and U.S. economic growth*, Harvard Univ. Press, Cambridge, Mass.

Judge, T. A., Bono, J. E., & Locke, E. A. (2000). Personality and job satisfaction: The mediating role of job characteristics. *Journal of Applied Psychology*, 85, 237-249.

Judge, T.A. & Bono, J. E. (2001). Relationship of core self-evaluations traits – Self-esteem, generalized self-efficacy, locus of control, and emotional stability – With job satisfaction and job performance: A meta-analysis. *Journal of Applied Psychology*, 86, 80-92.

Judge, T.A., et. al. (2001). Job satisfaction: a cross cultural review, in Andersen, Net. al.(eds), *Handbook of Industrial, Work and Organizational Psychology*, pp.25-52, London: Sages.

Judge, T.A., Hanisch, K.A., & Drankoski, R.D. (1995). Human resource management and employee attitudes, in Ferris et. al. (eds), *Handbook on Human Resource Management*, pp. 574 -596, Oxford: Blackwell Publishers.

Kalusopa T., OtooK. N., & Shindondola-Mote H., (2012). *Trade Union services and benefits in Africa*, Unique Expressions, Ghana.

Kaming, P.F. Holt, G.D., Kometa, S.T. & Olomolaiye, P.O. (1998a). "Severity diagnosis of productivity problems- a reliability analysis." *International Journal of Project Management*, 16(2), 107-113.

Kaming, P.F., Olomolaiye, P.O. Holt, G.D., & Harris, F.C. (1998b). "What motivates construction crafts in developing countries? A case study of Indonesia." *Building and Environment*, 33(2-3), 131-141.

Kaming, P.F. Olomolaiye, P.O. Holt, G.D., & Harris, F.C. (1997). "Factors influencing craftsmen's productivity in Indonesia." *International Journal of Project Management*, 15(1), 21-30.

Kazaz, A. & Ulubeyli, S. (2007). Drivers of productivity among construction workers: A study in a developing country. *Building and Environment*, 42(5), 2132-2140.

Kazaz, A., Manisali E. & Serdar, U. (2008). Effect of Motivational Factors on Construction Workforce Productivity in Turkey. *Journal of Civil Engineering and Management*, 14(2), 95-106.

Khoshoie, T. (2005). Stikiness in virtual community, Master thesis.

Knutson, K., Schexnayder, C.J., Fiori, C. & Mayo, R.E. (2009). *Construction Management Fundamentals*, (2nd Ed). New York: McGraw-Hill,

KPMG (2009). Managing construction risk, A White Paper on Industry Perspectives and some Recommendations, *Audit Committee Institute, KPMG International*, (March), 1-8

Lallemand, T. & Rycx, F., (2009). Are older workers harmful for firm productivity? *De Economist* 157, 273-292.

Lambert, G. E, Hogan L.N. & Barton M.S. (2001). The impact of job satisfaction on turnover intent: a test of structural measurement model using a national sample of workers. *Social Science Journal*, 38(2), pp. 233-250.

Landy, F. J. (1989). *Psychology of work behaviour*. Pacific Grove, CA: Brooks/Cole.

Latham, M. (1994). *Constructing the Team: Joint Review of Procurement and Contractual Arrangements in the UK Construction Industry*. London: Department of the Environment, HMSO.

Laufer, A. & Moore, B.E. (1983). Attitudes toward productivity pay programmes. *Journal of Construction Engineering and Management*, 109(1), 89-101

- Laurie, J. Mullins (2005). *Management and organizational behaviour*, (7th ed), Prentice Hall.
- Lawler, E. E., & Porter, L. W. (1967). The effect of performance on job satisfaction. *Industrial Relations*, 7, 20-28.
- Lazear, E.P., 1979. Why is there mandatory retirement? *The Journal of Political Economy*, 87, 1261-1284.
- Lema, N., & Samson M. (2002). Development of construction contractors performance measurement framework, *1st International Conference of Creating a Sustainable*.
- Leonard, C. A. (1987). The Effect of Change Orders on Productivity. The Revay Report, On-line. *World Wide Web Revay Rep.*, 6(2), 1-4.
- Lincoln, Y.S., & Guba, E.G., (2000). *Paradigmatic controversies, contradictions, and emerging confluences*. In Y.S. Lincoln & e.g. Guba (Eds.). *Handbook of qualitative research* (pp. 163-188). Thousand Oaks, CA: Sage.
- Lim, E.C. & Alum J. (1995), Construction Productivity: Issues Encountered By Contractors In Singapore, *International Journal Of Project Managers*, Vol. 22 No.1, Pp 51-58
- Love, P.E.D., David J. Edwards, D.J. & SMITH, J. (2005). "A Forensic Examination of the Causal Mechanisms of Rework in a Structural Steel Supply Chain." *Managerial Auditing Journal*, 20(5), 187-197.
- Mojahed, S. (2005). *A Project improvement system for effective management of construction projects*. Unpublished thesis (Phd), Louisiana State University and Agricultural and Mechanical College.
- Marchington, M. & Wilkinson, A. (2002). *People Management and Development: Human Resource Management at Work*. (2nd ed), London: CIPD.
- Marchington, M., Wilkinson, A., Ackers, P. & Dundon, A. (2001). *Management Choice and Employee Voice*. London: CIPD
- Mahlberg, B., Freund, I. & Prskawetz, A., (2009). *Firm Productivity, Workforce Age and Vocational Training in Austria*. In: Kuhn, M., Ochs, C. (Eds.), *Labour Markets and Demographic Change*. VS Verlag, pp. 58-84.
- Mahlberg, B., Freund, I., Cuaresma, J.C. & Prskawetz, A., (2013). Ageing, productivity and wages in Austria. *Labour Economics* 22, 5-15 (this issue).
- Makulsawatudom, A. & Emsley, M. (2002). *Critical factors influencing construction productivity in Thailand*. Proceedings of CIB 10th International Symposium on Construction Innovation and Global Competitiveness, Cincinnati, OH
- Makulsawatudom, A. & Sinthawanarong, K. (2004). "Critical factors influencing construction productivity in Thailand." *The Journal of King Mongkut's Institute of Technology North Bangkok* 14(3), 1-6.
- Malhotra, N.K. & Dash, S. (2011). *Marketing Research: An applied orientation*, (6th Ed). Dorling Kindersley (India) Pvt. Ltd, New Delhi.
- Malmberg, B., Lindh, T. & Halvarsson, M., (2008). *Productivity Consequences of Workforce Ageing: Stagnation or Horndal Effect?* In: Prskawetz, A., Bloom, D., Lutz, W. (Eds.),
- Mbachu, J. & Nkando, R. (2007). Factors constraining successful building project implementation in South Africa, *Construction Management and Economics* 25(1): 39-54.

Mbaye, A.A. (2002). 'An Industry Level Analysis of Manufacturing Productivity in Senegal', Africa Region Working Paper Series No. 41

McCullough, B. (2007) "Automating field data collection in construction organizations".Proc., 5th Construction Congress: Managing Engineered Construction in Expanding Global Markets, Minneapolis, 957-963

McGregor, D., (1960). "[*The Human Side of Enterprise*](#)", McGraw-Hill; annotated edn, McGraw-Hill, 2006

McTague, B. &Jergeas, G. (2002).*Productivity improvements on Alberta major construction projects*. Alberta Economic Development, Alberta.

McShane, O. (1996) "*The impact of the resource management act on the "Housing and Construction" Components of the Consumer Price Index*, A Report Prepared for the Reserve Bank of New Zealand, Accessed 26 February 2011 from: <http://www.rmastudies.org.nz/documents/ResBankF.pdf>

Mechanical Contractors of America.(1976). "*Factors Affecting Productivity*." Mechanical Contractors of America, Bulletin No. 58, January.

Montana, P.J. &Charnoy, B.H. (2000).*Management*. New York: Barron's.

Motafa E. ShehataKhaled,& M. El-Gohary,(2011).“Towards improving construction labour productivity and project performance.”*Alexandria Engineering Journal* (2011) 50,321-330.

National Electrical Contractors Association.(1989).*Overtime and Productivity in Electrical Construction*.NECA, (2nd Ed), Washington, DC.

Navarro, E. (2009).A Review of Maslow, Herzberg and Vroom in the Construction Industry over the Last 25 Years',In Proceedings of 25th Annual Conference, ARCOM (Association of Researchers in Construction Management).

Navon,R. (2005).*Automated project performance control of construction projects, Automation in Construction*, Vol. 14, PP. 467. 476

Neuman, W.I.,(2000).*Social research methods; Qualitative and quantitative approaches*, (4th ed.), Boston; Allyn& Bacon.

Neuman, W.L. (2006). *Social research methods: Qualitative and quantitative approaches*(6th ed.). Boston: Pearson Education Inc.

Neil, J. M., & Knack, L. E. (1984).“*Predicting productivity*.”Transactions of American Association of Cost Engineers, H.3.1-H.3.8.

Odesola, I.A. (2012).*Construction Labour Productivity of Masonry Operations in South-South of Nigeria*.Unpublished Ph.D. Thesis, Department of Building, University of Uyo, Nigeria.

Oglesby, C., Parker, H., & Howell, G. (1989).*Productivity Improvement in Construction*, New York: McGraw-Hill Book Company

Okai, R., (2010). *Research Methodology*. Kumasi: Omens Printing Press.

Olomolaiye, P. O., Wahab, K., & Price, A. (1987).“Problems influencing craftsman productivity in Nigeria.”*Building Environment*, 22(4), 317-323

Olomolaiye, P. O. (1988). "An evaluation of bricklayers' motivation and productivity." Ph.D. discussion, Loughborough University of Technology, U.K.

Page, I.C. (2010). "Construction industry productivity", Study Report SR 219, Building Research Association of New Zealand (BRANZ), Wellington, New Zealand.

Parker, H.W. (1980). Communication: Key to productive construction. *Journal of Professional Activities, ASCE, 106*(E13), 173–180.

Parkin, A.B., Tutesigensi, A. & Buyukalp, A. I. (2009). "Motivation among construction workers in Turkey." Dainty A. R. J. (Ed.) Proceedings of 25th Annual ARCOM Conference, Nottingham, U. K., 7-9 September 2009, 105-114.

Peracchi, F. & Welch, F., (1994). Trends in labour force transitions of older men and women. *Journal of Labour Economics 12*(2), 210–242.

Peterson Peter, G., (1999). Gray Dawn: The Global Aging Crisis. Foreign Affairs (January–February 1999).

Philips, D.C., & Burbules, N.C. (2000). *Postpositivism and educational research*. Lanham, NY: Rowman & Littlefield.

Prendergast, C., (1993). The role of promotions in inducing specific human capital acquisition. *Quarterly Journal of Economics 108* (2), 523–534.

Prskawetz, A., Mahlberg, B. & Skirbekk, V., (2007). *Firm Productivity, Workforce Age and Educational Structure in Austrian industries in 2001*. In: Clark, R., Ogawa, H., Mason, A. (Eds.), Population Aging, Intergenerational Transfers and the Macroeconomy. Edward Elgar Publishing, pp. 38–66.

Prokopenko J. (1987). 'Productivity Management: A practical Handbook' International Labour Organization, Geneva.

Prskawetz, A. & Fent, T., (2007). Workforce ageing and the substitution of labour. *The role of supply and demand of labour in Austria*. *Metroeconomica 58*, 95–126.

Horner, R.M.W. & Talhouni B.T., (1998). Effects of Accelerated Working, Delays and Disruption on Labor Productivity, The Chartered Institute of Building, 1998, pp. 1–37.

Refaat, H. Abdel-Razek, M. AbdElshakour Hany & Mohamed Abdel-Hamid, (2007). Labour productivity: benchmarking and variability in Egyptian projects. *International Journal of Project Management 25*(2) (2007) 189–197.

Randolph, H. T., William F. Maloney, R. Malcolm, W. Horner, Gray R. S., Vir K. H. & Steve R. S., (1990). Modeling construction labor productivity, *Journal of Construction Engineering and Management, ASCE 116*(4) 705–726.

Randolph H. T., (2000). *Principles of Construction Labor Productivity Measurement and Processing*, Report Number PTI 2K14, Pennsylvania Transportation Institute, The Pennsylvania State University, Transportation Research Building, March, 2000, pp. 1–54. ok-

Robert D. L. & William W. C., (1978). Management impacts on labor productivity, *Journal of the Construction Division, ASCE 104* (C04) (1978) 447–461.

Roznowski, M., &Hulin, C. (1992). *The scientific merit of valid measures of general constructs with special reference to job satisfaction and jobwithdrawal*. In Cranny et. al. (eds), *Job satisfaction*, 123-163, New York: Lexington Books.

Ruthankoon, R.&Ogunlana, S. O. (2003). 'Testing Herzberg's two-factor theory in the Thai construction industry', *Engineering, Construction and Architectural Management*, 10 (5), 333-341.

Sanders, S. R. & Thomas, H. R. (1991). "Factors affecting masonry productivity". *Journal of Construction Engineering Management*, 117(4), 626-644.

Schleicher, D. J., Watt, J. D., &Greguras, G. J. (2004). Re-examining the job satisfaction-performance relationship: The complexity of attitudes. *Journal of Applied Psychology*, 89,165-177.

Schmidt, F. L., Hunter, J. E., &Outerbridge, A. N. (1986).The impact of job experience and ability on job knowledge, work sample performance, and supervisory ratings of job performance. *Journal of Applied Psychology*, 71, 432-439.

Schmidt, F. L., & Hunter, J. E. (2004).General mental ability in the world of work: Occupational attainment and job performance. *Journal of Personality and SocialPsychology*, 86, 162-173.

Sekaran, U. (2000). *Research methods for business- A skill building approach*. (31C1 ed.), Wiley, cop, New York; Chichester.

Sexton, M. & Barrett, P. (2003).Appropriate innovation in small construction firms. *ConstructionManagementand Economics*, 21: 623-633

Skirbekk, V., (2008). Age and productivity capacity: descriptions, causes and policy options. *Ageing Horizons* 8, 4-12.

Smithers, G.L. & Walkers, D.H.T. (2000).The effect of the workplace on motivation and demotivation of construction professions. *Construction Management and Economics*,18, 833-841.

Stall, M. D. (1983). "Analyzing and improving productivity with computerized questionnaires and delay surveys."Proceedings of the Project Management Institute Annual Seminar.

Sundaraj, G. (2006).The way forward: construction industry master plan 2006-2015. www.objectiveworld.com/profile/nst20071129.pdf

Tangué, M.B. & George, J. (2002). *Productivity improvements on Alberta major construction projects*.Google Search, Scholar [Accessed 20th May 2010].

The Business Roundtable (1989). *Construction Labour Motivation: A Construction Industry Cost Effectiveness Project Report*.

Thomas, H. R. (1991). "Labour productivity and work sampling: The bottom line." *Journal of Construction Engineering and Management*, 117(3), 423-444.

Thomas, H. R., &Oloufa A. A. (1995). "Labour productivity, disruptions, and the ripple effect." *Cost Engineering*, 37(12), 49-54.

Thomas, H. R., Riley, D. R., &Sanvido, V. E. (1999). "Loss of labor productivity due to delivery methods and weather." *Journal of Construction Engineering and Management*, 125(1), 39-46.

Thomas, H. R., & Kramer, D. F. (1988). "The manual of construction productivity measurement and performance evaluation."Source Document 35, Construction Industry Institute, The University of Texas at Austin.

- Thomas, S. Ng, P. E. & Kumaraswamy M. M., (2002). *A dynamic e-Reporting system for contractor's performance appraisal*. Advances.
- Thomas, H. R. & Sakarcan, A. S. (1994). "Forecasting labor productivity using factor model". *Journal of Construction Engineering and Management*, ASCE, 120 (1) 228-239 in *Engineering Software*, Vol. 33, PP. 339-349
- Tran, V. & Tookey, J. (2011). 'Labour productivity in the New Zealand construction industry: A thorough investigation', *Australasian Journal of Construction Economics and Building*, 11(1) 41-60.
- Tucker, R. L., Haas, C. T., Glover, R. W., Alemany, C., Carley, L. A., Rodriguez, A. M. & Shields, D. (1999). *Key workforce challenges facing the American construction industry: an interim assessment*, Centre for construction industry studies, Austin: University of Texas at Austin.
- UKCES (2012) UK Employer Skills Survey.
- United Nations Population Division, (2011). *World Population Prospects: The 2010 Revision*.
- United Nations Committee on Housing, Building and Planning. (1965). *Effect of Repetition on Building Operations and Processes on Site*. United Nations, New York, NY.
- UN, (2011). *World Population Prospects. United Nations Population Division*, New York.
- Van Dalen, H., Henkens, K., et al., (2010). Productivity of older workers: perceptions of employers and employees. *Population and Development Review* 36 (2), 309-330.
- W. Ibbs & Min Liu, (2005). Improved measured mile analysis technique. *Journal of Construction Engineering and Management*, ASCE 131(12) (2005) 1249-1256.
- Webb, Sidney, Webb & Beatrice (1920). *History of Trade Unionism*. Longmans and Co. London. ch. I
- Welman, J.C., & Kruger, S.J. (2001). *Research Methodology*, (2nd ed.). Cape Town: Oxford University Press.
- Widén, K. (2002). *Innovation in the Construction Process - A Theoretical Framework*. Lund: Lund University.
- Wicker, A. W. (1969). Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues*, 25, 41-78.
- Wilk, S. L., Desmarais, L. B., & Sackett, P. R. (1995). Gravitation to jobs commensurate with ability: Longitudinal and cross-sectional tests. *Journal of Applied Psychology*, 80, 79-85.
- Yin, R.K. (2003). *Case study research, designs and methods*. (3rd ed.). Thousand Oaks, Sage, cop, Calif.
- Zakeri, M. Olomolaiye, P., Holt, G.D., & Harris, F.C. (1997). "Factors affecting the motivation of Iranian construction operatives." *Building and Environment*, 32(2), 161-166.