

**MAJOR CONSIDERATIONS IN DEVELOPING CONSTRUCTION LABOUR
PRODUCTIVITY STANDARDS IN ZAMBIA: A QUANTITY SURVEYORS
PERSPECTIVE.**

By

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A dissertation submitted to the University of Zambia in partial Fulfilment for the
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Management

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DECLARATION

I, **Robby Malipilo** hereby declare that the work presented in this dissertation is the result of my research work and that it has never been previously presented at this University and any other institution. Any work of other people included has been dully acknowledged.

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CERTIFICATE OF APPROVAL

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ABSTRACT

Recent studies have revealed that projects performance in Zambian Construction Industry is below satisfactory. Since labour is one of the key construction inputs, construction labour productivity is among the major determinants of projects' success in ZCI. However, before making attempts to improve CLP, there is need to have CLP standards for consistent measurement, estimation and evaluation of CLP. Therefore, this study aimed at establishing the major considerations in developing CLP standards in Zambia. Literature was reviewed and questionnaires were administered to Contractors, Quantity Surveyor professional firms and statutory bodies. Probability and non-probability sampling techniques were used in selecting target groups and determine sample sizes. Information gathered was analysed using frequency tables, chai-square and regression test. The following were the study results: The reliability of CLP estimation and evaluation in ZCI was highly questionable as estimators rely on their individual experience and historical productivity data due to lack of CLP standards. Major considerations in developing CLP standards in Zambia include; major resources required for optimal CLP (labour, materials and tools/equipment) and factors related to work, workers and management that influence CLP. Further, the process of CLP standards development can be initiated by government bodies or other relevant stakeholders and would require the formulation of Standard Development Technical Committee to conduct the consultative process. As such, the following recommendations were made: The process of CLP standards development in Zambia should be facilitated by Zambia Bureau of Standards as the mandated statutory body. SDTC must conduct detailed studies on factors that influence CLP in ZCI and must employ the principle of averaging to ascertain ideal CLP rates as standards. Stakeholders or experts from various sectors must be adequately represented in SDTC for CLP standards development in Zambia. Government should consider financing the development and publication of CLP standards in Zambia. If successfully developed, CLP standards must be reviewed periodically so as to ascertain the need for revision at any particular time.

Key Words: Construction, Labour, Productivity, Estimation, Evaluation, Standards.

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ACRONYMS

ABCEC: Association of Building and Civil Engineering Contractors

BOQ: Bills of Quantities

CLP: Construction Labour Productivity

CEP: Construction Equipment Productivity

DIC: Documentation and Information Centre

EIZ: Engineering Institution of Zambia

ILO: International Labour Organisation

MLSS: Ministry of Labour and Social Security

MIHUD: Ministry of Infrastructure, Housing and Urban Development

NCC: National Council for Construction

NGO: Non-Governmental Organisation

NQI: National Quality Infrastructure

NRCS: National Regulator for Compulsory Specifications

QS: Quantity Surveying

RDA: Road Development Agency

SDTC: Standard Development Technical Committee

SMM: Standard Method of Measurement for Building Works in Zambia

SPSS: Statistical Package for Social Science

ZABS: Zambia Bureau of Standards

ZCI: Zambian Construction Industry

ZCSA: Zambia Compulsory Standards Agency

CHAPTER ONE: INTRODUCTION

1.1 Background

Labour is an important resource in the construction industry and has significant influence on the success of construction projects. Karim et al. (2013) argued that construction projects are mostly labour based with basic hand tools and equipment, as labour costs comprise 30 to 50 percent of the overall projects cost. This clearly indicates that apart from resources such as finances, construction materials and tools/equipment, labour is another resource that is crucial to the construction sector. Therefore, it is just prudent that labour is also well utilised to maximise productivity on construction projects, and ultimately improve projects' performance in the construction sector. Ulubeyli et al. (2014) acknowledged labour as a project success factor by stating that labour productivity is also a key concept of construction planning efforts and has a direct interrelationship with time, cost and quality. Therefore, construction labour productivity (CLP) is a subject of great interest to the construction industry.

Productivity has been defined differently by different scholars. Gidwani and Dangayach (2017) defined productivity as an economic output per unit of input. Ulubeyli et al. (2014) defined productivity as the ratio of input to unit output. However, all existing definitions of productivity attempts to describe it as the ratio of output to resources consumed. With regards to construction, Ulubeyli et al. (2014) defined construction labour productivity (CLP) as the duration needed to complete the unit quantity of an activity. From the general perspective, CLP has been described as the ratio of output per labour hours. CLP is an important factor and has attracted the attention of various stakeholders in the construction sector. Karim et al. (2013) argued that labour productivity is one of the most important factors that affect the physical progress of the construction project. Therefore, understanding CLP is essential as it provides a basis for estimation, budgeting, scheduling and performance evaluation.

Several studies have been undertaken to assess the performance of construction projects in the Zambian Construction Industry (ZCI) and many results have clearly indicated that

projects performance in ZCI is below satisfactory. Chilongo and Mbetwa (2017) argued that in Zambia, many construction projects fail in time, cost and quality performance. Mukuka et al. (2013) pointed out that the construction industry in Zambia has not escaped the challenges facing other countries worldwide in terms of late delivery of projects. A study conducted by Muya et al. (2013) confirmed the prevalence of cost escalation, schedule delays and quality shortfalls on construction projects in Zambia. Therefore, the aspect of projects performance in ZCI still need researchers' attention.

Since labour is one of the key inputs in the construction sector, CLP is obviously among the various determinants of projects' success in ZCI. As supported by Muhammad et al. (2018) that poor productivity of labour is one of the major reasons of time overruns and increasing cost of construction projects. Tam et al. (2021) added that poor CLP influences quality, duration and cost of construction projects. Alaghbari et al. (2019) pointed out that CLP should be given priority as poor labour productivity is one of the main causes of cost and time overruns on construction projects. Therefore, CLP is indeed a parameter that deserves particular attention in an effort to enhance projects' performance and ultimately improve the overall performance of ZCI. However, other than understanding that high or optimal CLP is needed to improve projects performance in ZCI, it is also important to have a criteria to consistently measure, estimate and evaluate CLP. A comprehensive understanding of the concept of labour productivity must be achieved to successfully analyse it (Hickson and Ellis, 2014). This means that there is need to accurately and consistently measure, estimate and evaluate CLP before making attempts to improve it. As stated by Nasir et al. (2012) that to improve CLP, it must be measured accurately.

Due to the sensitivity and importance of CLP estimates on construction projects, their accuracy and reliability are very crucial. As supported by Ulubeyli et al. (2014) that correct values of CLP are essential in evaluation, planning and controlling of labour performance. Ulubeyli et al. (2014) added that labour-based productivity rates are useful in estimating time and cost of construction activities. The need for having correct and reliable values of CLP has necessitated various advancements in the construction industry such as development of CLP standards and metrics in developed and developing countries.

CLP standards can be described as established values of optimal labour output per labour hours for defined construction operations. Ulubeyli et al. (2014) defined a CLP standard as the duration needed to complete the unit quantity of construction activity. CLP standards are ideally developed for a specific country or region based on factors that influence labour productivity in that particular country or region. Factors that form a basis for developing CLP standards would include; labour, construction materials, tools and equipment, construction methods, site conditions, supervision, management and prevailing labour laws among others. Alaghbari et al. (2019) argued that labour productivity might be affected by many unexpected variables including factors related to labour, materials, tools and equipment, construction methods, political, financing and environment.

From the general perspective, standards are repeatable, agreed and documented criteria. Standards make life simple and increase the reliability and effectiveness in the use and evaluation of products and services (ZABS, 2022). With regards to construction, CLP standards are useful in many ways such as accurate and consistent estimation, measurement and evaluation of CLP. Like many other standards, CLP standards benefit the construction industry in many other ways including serving as benchmarks for measuring labour performance and promoting fair competition in the construction sector among others.

The question that came up was whether there were published CLP standards in Zambia to be used for accurate and consistent estimation, measurement and evaluation of CLP in the ZCI. Although several studies had been conducted on the subject of CLP in Zambia, preliminary findings did not indicate the existence of published CLP standards in Zambian gazette. As many scholars have put it, CLP standards are developed for a specific country or region, taking into account various factors such as type of materials, equipment and tools, weather conditions, regulations and other factors relating to that particular country or region. Therefore, the use of CLP standards adopted from other countries is likely to create gaps in CLP estimation and evaluation. Tam et al. (2021) argued that CLP is affected by various factors related to workforce, management,

equipment, tools, types of materials, technology and environment. Owing to the fact that these factors may vary significantly from one country or region to another, overreliance on foreign CLP may create gaps in CLP estimation and evaluation. Whiteside (2006) supported this by stating that, it is incorrect to assume that all published productivity values have the same basis. Apart from using CLP standards, estimators and planning engineers in the construction sector can also make use of their individual experience and historical productivity data in estimation, measurement and evaluation of CLP. However, many scholars have argued that the use of individual experience and historical productivity data may not result in generating reliable and accurate CLP estimates.

Therefore, it was concluded that due to lack of published CLP standards in Zambia, estimators and planning engineers are left with few options such as the use of their individual experience and historical productivity data to estimate, measure and evaluate CLP. However, the use of historical productivity data, individual experience or foreign productivity standards gives less confidence regarding the accuracy and reliability of CLP estimates. Kisi et al. (2018) stated that although quantifying labour productivity is an important step in managing labour productivity, without a metric for assessing such productivity, managers are left to rely upon historical averages to determine efficiency, which may be biased by inefficient historical averages or dissimilar technological capabilities. Therefore, it was prudent to commence or intensify studies towards CLP standards development in Zambia. Hence, this study endeavoured to establish the major considerations in developing CLP standards in Zambia.

1.2 Problem Statement

Lack of published construction labour productivity (CLP) standards in Zambia causes inconsistency in measurement, estimation, evaluation and management of labour productivity in ZCI. Therefore, there was need to establish the major considerations in developing CLP standards so as to provide a basis for the actual process of developing CLP standards suitable for Zambian Construction Industry.

1.3 Problem Justification

Preliminary findings did not indicate the existence of published CLP standards in Zambia, and hence, it was presumed that estimators and planning engineers in ZCI could have been relying on their individual experience and historical productivity data for CLP estimation and evaluation. However, many scholars have argued that estimates calculated from individual experience or by comparing actual productivity to historical productivity can be highly subjective. As supported by Malisiovas (2010) that the limitation of relying on estimator's experience is that the accuracy and reliability of estimate is influenced by personal prejudice and can be highly subjective. Additionally, inconsistency in CLP estimation and evaluation is inevitable if estimators rely on their individual experience and historical productivity data, especially that productivity can vary significantly from project to project or time to time. Kisi (2015) also stated that the approach of examining labour productivity by comparing actual to historical data only provides a relative benchmark for efficiency and may lead to the characterisation of operations as objectively efficient when in reality such operations might simply be comparably efficient.

Another indication of inconsistency in CLP estimation in ZCI was observed during tender openings where contractors' bid prices were quite different for the same projects. While it is correct that factors such as difference in profit margins and overhead costs can cause variance in contractors' bid prices, it is also true that huge difference in contractors' CLP estimation can cause significant difference in contractors' bid prices (Whiteside, 2006). Therefore, not using published CLP standards can lead to inconsistency and incorrect estimation and evaluation of CLP, which may in return have negative economic effects. As supported by (Bamfo-Agyei et al., 2022) that low productivity is a major issue in the construction industry of developing countries because of the absence of documented data for project estimation, planning, and management. While it is correct that developing CLP standards would not be an easy undertaking, having them would greatly benefit the ZCI.

1.4 Aim of the Research

The aim of this study was to establish the major considerations in developing construction labour productivity standards in Zambia from the Quantity Surveyors perspective.

1.5 Research Objectives

The following were the objectives of this research:

- i. To review existing building construction activities and construction labour productivity standards.
- ii. To assess the practices of estimation of construction labour productivity.
- iii. To assess the practices of evaluation of construction labour productivity.
- iv. To determine the major factors that influence construction labour productivity.
- v. To map construction stakeholders.
- vi. To establish the process of developing construction labour productivity standards in ZCI.

1.6 Research Questions

The following were the research questions:

- i. What are the existing building construction activities and construction labour productivity standards?
- ii. What are the practices of estimating construction labour productivity?
- iii. What are the practices of evaluating construction labour productivity?
- iv. What are the major factors that influence construction labour productivity?
- v. Who are the construction stakeholders?
- vi. How can construction labour productivity standards be developed?

1.7 Scope of the Research

In order to achieve the research aim, this study covered building construction activities, CLP standards, factors that influence CLP and the practices of CLP estimation and evaluation. The study also mapped construction stakeholders and established the process of CLP standards development. This study was limited to labour-intensive construction activities on medium and large capital building projects. These construction activities included concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation. Although, other construction projects are implemented without professional Quantity Surveyor Consultants, this study was limited to projects on which professional QS firms are employed. The study was conducted in Lusaka Province of

Zambia and targeted Building Contractors, QS professional firms, Ministry of Labour and Social Security (MLSS), National Council for Construction (NCC), Engineering Institution of Zambia (EIZ), Zambia Bureau of Standards (ZABS) and Zambia Compulsory Statutory Agency (ZCSA). As a matter of emphasis, this study did not attempt to develop CLP standards, but endeavoured to merely establish the major considerations in developing CLP standards with a view to provide a guide or a basis for the actual development of CLP standards in Zambia.

1.8 Significance of the Research

Firstly, this study was expected to contribute to the body of knowledge in the academics and provide a basis for further studies on the subject of CLP. Secondly, the study would provide a basis for developing suitable CLP standards which would serve as CLP benchmarks thereby improving accuracy and consistency in CLP estimation, measurement and evaluation in ZCI. Thirdly, having CLP standards would provide a basis for assessing the performance of construction projects and that of the overall ZCI. For instance, the Construction Sector Council (CSC), an Ottawa based national organisation started an initiative programme in the Canadian construction industry in 2008 with the goal to develop a method of measuring and benchmarking labour productivity and project performance so as to provide data for use by industry, academia and governments to support a process of continuous improvement in the industry (Nasir et al., 2012). Improved projects performance in ZCI would further economically benefit various stakeholders such as contractors, construction workers, consultants, suppliers, clients and government at large.

The study was also expected to give an insightful appreciation of various factors that influence CLP in the ZCI and ultimately enable the development of strategies for improving CLP. As argued by Attar et al. (2012) that understanding critical factors affecting labour productivity can be used to prepare a strategy to reduce inefficiencies and improve the effectiveness of projects performance. Having CLP standards in place (especially compulsory standards) would also promote a fair play among contractors in ZCI with regards to management of construction labour. Further, having CLP standards in

place would compel contractors to improve working conditions for their workers in pursuit for optimal CLP. Additionally, having CLP standards in place would minimise the exploitation of construction workers by their employers especially in terms of demand for unrealistic productivity or working with very tight schedules.

1.9 Research Methodology

Literature relevant to the study was reviewed and questionnaires were administered to Contractors, Quantity Surveyor professional firms and statutory bodies so as to obtain data. In order to select target groups and determine suitable sample sizes, probability and non-probability sampling techniques were used. Information gathered was analysed using frequency tables, chi-square and regression test to draw conclusions and make recommendations.

1.10 Chapter Synthesis

This study was divided into six chapters. Chapter one introduced the study on the “major considerations in developing CLP standards in Zambia: A Quantity Surveyor perspective”. The second chapter reviewed literature relevant to the study and the third chapter focused on the research methodology. Chapter four presented the findings of the study while chapter five presented the discussion of the results. Lastly, chapter six drew the conclusions and presented recommendations.

1.11 Chapter Summary

This chapter was an introduction to the entire study. The chapter gave the background to the problem, outlined research problem, justified the problem and stated the research aim and objectives. The chapter further highlighted on the scope of the study, research significance and research methodology. Lastly, the chapter showed the synthesis of all chapters of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature relevant to the study. Areas of interest were; building construction activities, construction labour productivity standards, factors that influence construction labour productivity (CLP) and the practice of CLP estimation and evaluation. The chapter also mapped construction stakeholders, and further reviewed literature on the process of CLP standards development. Lastly, the research hypotheses and conceptual framework were formulated.

2.2 Building Construction Activities and Construction Labour Productivity Standards

This section reviewed literature on building construction activities and construction labour productivity standards.

2.2.1 Building Construction Activities

Construction activities are specific activities that are performed or carried out during the execution of construction projects. Pymbolic staff (2021) described construction activities as all activities involved in construction works together to create great projects, big buildings and impressive structures. Construction activities in a case of building projects include; Site clearance, trench excavations, backfilling and compaction, steel fixing, concreting, blockwork, plastering, structural steel work, roofing, carpentry, ceiling, painting, tiling, electrical installation, plumbing works and many more. Construction activities also include those works which are performed to support the major activities. Loading and offloading of construction materials are examples of supportive activities. Construction activities are basically all activities that are carried out in the execution of construction projects. Therefore, understanding construction projects entails understanding specific construction activities involved at every stage of project execution.

i. Unit Measurement of Construction Activities

According to Foster (2013), quantities and units are concepts central to our measurement and manipulation of the physical world. Unlike supportive activities such as loading or

offloading of construction materials which usually have no standard unit of measurement, actual construction activities such as blockwork, concrete works and many other activities have units of measurement. According to Hiyassat et al. (2016), in construction, the output is usually expressed in weight, area, length or volume. These units of measurement are used for consistent measurement, understanding, description and analysis of construction works. In Zambia for instance, Standard Method of Measurement for Building Works in Zambia (SMM) 5 or 6 are used for measurement of building construction works. For instance, according to SMM 6 in Zambia, concrete works are measured in cubicmeters, squaremetres or number. In principle, all construction works must have specific standard unit of measurement which must be followed depending on the country. Standard method of measuring construction works makes it easy to understand and consistently measure construction works. Therefore, SMM 5 or 6 are used for preparation of Bill of Quantities (BOQ) for building works in Zambia.

ii. Labour-Intensive Construction Activities

Labour-intensive is a term in economics that describes an operation in which proportionately more labour is used than other factors of production (McCutcheon, 2008). Labour-intensive construction activities are works which largely depend on labourforce. McCutcheon (2008) described labour-intensive construction as the economically efficient employment of as great a proportion of labour as is technically feasible, ideally throughout the construction process. Construction activities under building projects such as blockwork, plaster, painting and roofing are examples of labour-intensive works because they require a large proportion of labour resource than equipment. As supported by Emuze and Sorensen (2014), that labour-intensive construction methods can be identified in projects where the majority of works are done through the use of manual labour rather than plant and equipment. Labour intensive projects thus involve the use of minimal equipment to achieve optimum performance in terms of client satisfaction, cost, quality and other considerations. Therefore, the concept of construction labour productivity (CLP) is applied to labour intensive construction activities and projects. For purposes of this study, the labour-intensive building construction activities that were

considered include; concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation.

iii. Equipment - Intensive Construction Activities

Equipment-intensive construction works are the opposite of labour-intensive construction works. While labour intensive construction activities require the employment of a big proportion of labour throughout the construction process as described by McCutcheon (2008), equipment intensive construction activities require a small proportion of labour and big proportion of equipment. David and Neal (1998) argued that equipment is a vital factor in construction particularly for heavy, highway and utility jobs that have relatively large quantities of excavations, grading, concrete, embankment and aggregate production. Equipment-intensive construction activities are therefore works which require more equipment than labour. Productivity of such works is largely dependent on productivity of the equipment. With the advances in construction equipment technology, there are some construction activities for which equipment, rather than labour, is the driver of productivity (Seresht and Fayek, 2019). these activities are called equipment-intensive construction activities and they include construction projects such as; earthmoving, pavement construction, pile construction and tunneling (Seresht and Fayek (2019). Hence, the concept of construction equipment productivity (CEP) is applied to equipment-intensive construction works or projects.

iv. Construction Resources

There are several resources that are required in the execution of construction projects. These include; land (space where building structures are built), finances, materials, labour and equipment. However, with regards to the execution of construction works on the project site, the three categories of direct resources that are given particular attention include; construction materials, construction labour and construction tools/equipment. Parthasarathy et al. (2017) argued that the construction of buildings involves three types of major resources; manpower, materials and equipment. Odesola (2015), stated that good project management in construction must vigorously pursue the efficient utilisation of labour, material and equipment, and that improvement of labour productivity should be a major and continuous concern of those who are responsible for cost control of constructed

facilities. Therefore, construction materials, labour and tools/equipment are the major resources crucial to the execution of construction works.

a) Construction Materials

Construction materials can be naturally occurring or manufactured products. Naturally occurring materials include; coarse and fine aggregates, timber and backfilling materials among others. Manufactured Construction materials include components, fittings, blocks, asphalt, cement, steel, roofing materials, tiles, paint and many others. Construction materials are among the key resources that are required in the execution of construction works and have an impact on productivity. Hickson and Ellis (2014) studied factors influencing labour productivity in Trinidad and Tobago, and materials shortage was found to be significant. Hence, there is need for proper materials management to ensure that right type, quality and quantity of construction materials are made available when needed so as to enhance productivity. Materials management system attempts to ensure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost (Vyas, 2011). Therefore, construction materials are crucial to the execution of construction works.

b) Construction Labour

Construction labour refers to construction workers who provide labourforce required in carrying out construction activities. Labour productivity is one of the most important factors that affect the physical progress of any construction project (Karim et al., 2013). Construction labour is therefore a resource that is crucial to the construction sector and has an influence on productivity. Labour is known as the most crucial and flexible resource used in the construction projects, and construction productivity is directly related to labour (Hamza et al., 2022). Despite the significant developments in construction technologies, operatives remain the key drivers in the industry, as in most countries, construction labour cost comprises 30 to 50 percent of the overall project's cost, and thus it is regarded as a true reflection of the efficiency and success of the operation (Jarkas et al., 2012).

Construction labour include workers such as; work men (general workers), bricklayers, steel fixers, painters, carpenters, welders, fitters, plumbers, tile fixers and electricians among others. The unit measurement for labour in construction sector of most countries is usually hours. One of the most commonly used measures in construction is labour productivity, which is defined as the ratio of output to labour input; the output is measured in terms of the quantities installed or executed, and labour input is measured as work-hours (Thomas and Sudhakumar, 2014). According to Joint Industrial Collective Agreement (2022) in Zambia, labour is measured in hours. Gurm and Aibinu (2017) also stated that labour productivity is measured as output per unit of labor input in terms of hours worked. Therefore, whether one is considering a single worker or a gang of workers, labour resource is usually measured in hours.

c) Construction Tools/Equipment

Tools/equipment are also resources that are required in the execution of construction works. With the growing industrialisation of construction work, the role of onsite tools/equipment and machineries is vital in achieving productivity and efficiency (Waris et al., 2014). Waris et al., (2014) added that during the construction phase, selection of right equipment has always been a key factor in the success of any construction project. All construction projects require different types of equipment and machineries having their own level of application. For example, residential projects have a low level of equipment usage; they require simple and traditional machines like fork-lifters, backhoes, hauling and hoisting equipment, material handling along with pneumatic tools (Waris et al., 2014). Commercial, industrial and heavy construction projects require intense and high utilisation of machinery for carrying out mass excavation, stabilising, compacting, asphalt paving and finishing, pipelines, railroads and many other special activities (Waris et al., 2014). Therefore, different tools/equipment are required on different projects and the selection criteria must focus on productivity, efficiency and cost.

2.2.2 Construction Labour Productivity Standards

Before tackling construction labour productivity standards, it is prudent to understand what Construction Labour Productivity (CLP) is. CLP is the measure of unit quantities of

construction activity completed by a worker or a gang of workers in a unit time under specific conditions (Shehata and Khaled, 2012). For example, if a bricklayer builds three squaremetres of blockwork in an hour, CLP for that blockwork would be three squaremetres per hour. Equally if a gang of workers pour two cubicmetres of concrete in an hour, CLP for that particular concrete work would be two cubicmetres per hour. Therefore, CLP is the measure of units of quantities of specific construction activity completed by a worker or gang of workers in a specific time. Note that labour is usually measured in hours as per standard practice in the construction sector of many countries. On the other hand, construction activity has a unit (such as cubicmetre, squaremetre, metre or number) of measurement as per the method of measurement being used. In simple terms, CLP can be described as the measure of unit quantities of work done per man hour under specific conditions. According to Thomas and Sudhakumar (2014), one of the most commonly used measures in construction is labour productivity, which is defined as the ratio of output to labour input; the output is measured in terms of the quantities installed, and labour input is measured as work-hours. Thus, construction labour productivity is expressed as follows:

$$\text{Construction Labour Productivity (CLP)} = \frac{\text{Output quantity}}{\text{Labour (hours)}}$$

i. Construction Labour Productivity Standards

A standard as an ideal or a set of criteria, rules or norms set by an authority or by general consent as an acceptable way of doing something. A technical standard on the other hand is an established norm or requirement for a repeatable technical task which is applied to a common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices. ZABS (2022) describes a standard as a technical document detailing the requirements necessary to ensure that a material, product, service, or procedure is fit for the purpose it was intended. Since standards contain specifications or precise criteria designed to be used consistently as a rule or guideline, they make life simple and increase the reliability and effectiveness of many goods and services.

A construction labour productivity (CLP) standard is a value that is established and published as the reference or benchmark for the number of labour hours required to complete a certain quantity of construction work activity under specific conditions. CLP standards are useful in many ways such as measurement, evaluation and estimation of labour performance. International Labour Organisation (1998) argued that the first action of any planning engineer on a labour-intensive project is to determine the type of work to be carried out, divide this work into quantities of activities that can be carried out by individuals or gang of workers, and lastly apply labour productivity standard to determine the required labourforce and project duration. This clearly shows that it is important to have correct CLP as they form a basis for consistent and accurate estimation and evaluation of performance. CLP standards can also be used in recording productivity improvement by comparing actual CLP achieved in the field against CLP standards which are benchmarks. As pointed out by Alinaitwe (2006) that before productivity can be increased, there is need to measure and quantify the existing situation. Alinaitwe (2006) further advised that a construction company should have a measurement procedure in place such that it can determine how it is doing relative to the benchmark.

Countries may have CLP standards for their respective construction sectors adopted or established by considering various factors. Due to varying factors such as weather conditions, types of materials, tools, economic and other factors, CLP standards may differ from one country or region to another. Researchers maintain that the major productivity factors vary from country to country, place to place and project to project (Jarkas and Bitar, 2012). For instance, a study conducted by Odesola and Oladokum (2015) on selected public building projects in Akwa Ibon State Nigeria, revealed that the average and baseline construction labour productivities of blockwork for a gang of 1 bricklayer and 1 helper are 0.83 squaremetre per hour and 1.07 squaremetre per hour for a 225 x 225 x 450mm sandcrete blocks. Odesola and Oladokum (2015) observed that variability in CLP of blockwork activity was due to weather condition and delay in supply of materials. The scholars therefore recommended that consideration should be given to the effect of adverse weather condition during labour estimation and that adequate

planning of construction resources would help in enhancing labour productivity on public building projects.

Another research was done by Shen, et al. (2011) to compare construction labour productivity (CLP) of the United States of America and that of China at activity level to evaluate productivity differences between the two countries from an operational perspective. Table 2.1 shows some of the construction activities that were considered in the study.

Table 2.1: Sampled construction activities and CLP (Shen et al., 2011)

Item No.	Activity ID	Activity Description	CLP Units	CLP USA	CLP China
1	CP2	Concrete placement continuous footing	m ³ /h	1.5	0.3
2	CP5	Concrete placement column	m ³ /h	0.8	0.2
3	CP6	Concrete placement beam	m ³ /h	0.7	0.2
4	ST1	Structural steel column installation	kg/h	613.7	208.3
5	ST2	Structural steel beam installation	kg/h	269.1	89.3
6	ST3	Structural steel roof truss installation	kg/h	126.6	18.3
7	RF3	Roof Installation - EPDMd roofing	m ² /h	6.0	1.9
8	CF4	Concrete form square column	m ² /h	0.4	0.3
9	CF5	Concrete form beam	m ² /h	0.7	0.2
10	CF6	Concrete form elevated slab	m ² /h	1.0	0.3
11	MS1	4-inch-thick brickwork 4x4x8 inch	m ² /h	0.7	1.2
12	MS6	8-inch foundation wall	m ² /h	1.0	1.6

The source of the U.S.A labour productivity data was RSMMeans Building Construction Cost Data, which was cross validated by data from the Walker’s Building Estimator’s Reference Book. The source of Chinese labour productivity data was mainly the Beijing construction quota, which was also cross validated by Chinese quotas from several other cities and provinces in China. According to Shen, et al. (2011), the findings of this study provided quantitative evidence at the operational level that lack of adequate construction equipment was one of the major causes of low productivity in the Chinese construction industry. Shen, et al. (2011) further added that many other factors such as labour training, management skills and activity coordination may have contributed to the productivity

difference between the two countries. Regardless of the importance of CLP metrics or standards, it is difficult to find productivity standards or metrics especially in undeveloped or developing countries. For example, in the case of Zambia, there was little literature on the existence of published CLP standards. This posed a question as to whether there are published CLP standards in Zambia.

ii. Construction Labour Productivity Standards by International Labour Organisation (ILO)

The International Labour Organisation is a United Nations agency whose mandate is to advance social and economic justice by setting international labour standards (International Labour Organisation, 2023). The ILO was founded in October 1919 under the League of Nations, and it is considered the first and oldest specialised agency of the UN. It is headquartered in Geneva, Switzerland, with around 40 field offices around the world, and employs about 3,381 staff across 107 nations, of whom 1,698 work in technical cooperation programmes and projects. The ILO's standards are aimed at ensuring accessible, productive, and sustainable work worldwide in conditions of freedom, equity, security and dignity. They are set forth in 189 conventions and treaties, of which eight are classified as fundamental according to the 1998 declaration on fundamental principles and rights at work; together they protect freedom of association and the effective recognition of the right to collective bargaining, the elimination of forced or compulsory labour, the abolition of child labour, and the elimination of discrimination in respect of employment and occupation (International Labour Organisation, 2023).

The ILO is considered a major contributor to international labour law and has funded numerous researches on labour-based activities in the construction industry (International Labour Organisation, 2023). The ILO funded the research by David Stiedl on productivity norms for labour-based construction. From this study, productivity figures were recommended as labour productivity norms. This study was based on activities such as site clearing, excavation, wheelbarrow haulage, compaction, culvert laying and loading, unloading and spreading. Table 2.2 shows the summary of the recommended productivity rates by (David Stiedl, 1998)

Table 2.2: Labour productivity rates (David Stiedl, 1998)

ACTIVITIES	PRODUCTIVITY					
	Average labour productivity by type of cover - m3 / worker day					
Site Clearance	Dense bush	Medium bush	Light bush	Grubbing	De-stamping	
Recommended value	100.0	200.0	350.0	175.0	By experience	
	Average labour productivity by soil classification - m3 / worker day					
Excavation	Soft	Medium	Hard	Very had	Rock	
Recommended value	5.0	3.5	3.5	2.0	0.8	
	Wheelbarrow haulage norms by haul distance - m3 / worker day					
Wheelbarrow Haulage	0-20m	20-40m	40-60m	60-80m	80-100m	100-150m
Recommended value	8.5	7.0	6.5	5.5	5.0	4.5
	Compaction productivity by Manual and machine					
Compaction	Manual compaction m3 / worker day		Machine compaction m3 / worker day			
Recommended value	9.0		700			
	Productivity of Loading, Unloading and Spreading					
Loading, unloading and spreading	Loading m3 / worker day		Unloading m3 / worker day		Spreading m3 / worker day	
Recommended value	8.5		10.0		13.5	
	Culvert Laying Productivity					
Culvert Laying	Culvert installation m /worker day		Concrete m3 / worker day		Concrete m3 / worker day	
Recommended value	0.9		1.0		1.0	

The labour productivity rates shown in table 2.2 were arrived at following the measurement of outputs from numerous site trials. In addition, other documents were consulted to obtain data from completed projects and from other regions. From this study, a “daywork” as measurement of labour meant a situation where a worker is paid a fixed rate for being present on site for a full working day, which is eight hours of work. The

study was also based on ideal circumstances that is; workers are well organised, understand work to be done and have correct hand tools in good condition. The study also assumed that workers are healthy, properly paid and have good access to food and water, and are working normal hours. From the table, it is clear that productivity rates varied from activity to activity and from condition to condition. This study further highlighted the factors that were perceived to influence productivity as; motivation and experience of the workforce, organisation of work, type and condition of tools/equipment provided and monitoring of performance.

iii. Existing Construction Labour Productivity Standards in Zambia

Institutions concerned with construction in Zambia expected to have done works leading to the development and publication of CLP standards in ZCI include the Academia (UNZA, CBU, TAVETA, etc.), National Council for Construction, Engineering Institution of Zambia, Ministry of Labour and Social Security, Ministry of Infrastructure, Housing and Urban Development and the Association of Building and Civil Engineering Contractors among others. Although some of these institutions may have done several works on labour standards and labour-based construction, there was little literature on published CLP standards in Zambia. For instance, a review of various standards was reported in National Council for Construction 2021 Annual report. However, from these standards reported, there were no CLP standards. According to NCC 2021 Annual report, a total of 54 standards were planned for consideration and 45 were deliberated on and were categorised; as general standards, road standards, energy building standards, tests on soils, gravels, and aggregates, tests on Asphalt and bituminous binders and tests on concrete and aggregates. Although it is acknowledged that NCC has done several works on construction with various institutions such as ILO, still there was no literature specifically giving CLP standards. On NCC website under the section of publications, there were no publications on CLP standards.

ABCEC is also an institution that is concerned with the interest of its members (contractors) and sits on the Collective Bargaining Commission with the National Union of Building, Engineering and General Workers (NUBEGW). ABCEC also sits on

committees such as that of NCC and is involved in skills training and dispute resolution on labour related matters. However, there was no literature pointing to the development of CLP standards by ABSCEC. Further, Literature did not indicate the existence of any published CLP standards developed by EIZ or ongoing process regarding CLP standards development. However, literature on EIZ was more inclined to the registration of engineering firms and individuals. From the services offered by the MLSS in line with the inspection of factories, labour and construction places, there were no services pointing to the implementation of published CLP standards in the construction places other than those relating to health and safety. Additionally, none of the essential services of MLSS were pointing to the ministry's development of CLP standards. In conclusion, regardless of several functions of institutions such as EIZ, MLSS, MIHUD, ABCEC, NCC and many other institutions, literature did not indicate the existence published CLP standards in Zambia.

2.3 Practices of Estimation of Construction Labour Productivity

CLP estimate is a fundamental piece of information that is required in budgeting, scheduling and performance evaluation of construction projects. However, scholars have argued that estimating labour productivity in construction has always been difficult due to the nature of the work, the privacy of the workers, and the inherent difficulty involved in gathering data (Kisi et al., 2018). CLP estimation is the application of various tools, techniques and strategies to work out or calculate output of construction operation given defined resources and conditions. Since CLP estimate is a crucial piece of information in project budgeting, scheduling and evaluation, it must be accurate, realistic and as consistent as possible. Hence, it is important to ensure that data, techniques, procedures or methods used in CLP estimation are as reliable as possible. This is because incorrect CLP leads to wrong budgeting and incorrect projections, a situation that can be devastating in construction project management. Alinaitwe (2006) pointed out that the success of a construction company in today's competitive business environment largely depends on accurate estimation of productivity.

Methods of estimating CLP include, but not limited to; engineering method (which make use of the CLP formular; $CLP = \text{unit input} / \text{man hours}$), the use of historical productivity data (comparative method), analytical and parametric methods, the use of CLP standards and the use of estimator's experience. Song and AbouRizk (2008) argued that the practice of CLP estimation relies primarily on the traditional method, which uses the published productivity data and/or the estimator's own experience. Alinaitwe (2006) also presented two methods of generating productivity estimates as; (1) accountancy-based; one that relies on the analysis of historical data to establish work hour requirements for specific types of work, and (2) Engineering based methods; one that involve breaking down complex work processes into small manageable parts and analysing these parts for the length of time required to complete these processes.

2.3.1 Estimation of Construction Labour Productivity Using the Formular

CLP is one of the partial factors of productivity and it has been defined as the ratio of total output to the unit labour input (hour). Shehata and Ei-Gohary (2012) expressed CLP using the following formular:

$$\text{Construction Labour Productivity (CLP)} = \frac{\text{Output (unity)}}{\text{Labour (hour)}}$$

Therefore, if units of expected or completed work output and labour man hours are available, CLP can be estimated using the above formular. For instance, if it takes 2 hours for a gang of workers to pour 2 cubicmetres of concrete, then CLP can be calculated as; CLP is equal to 2 cubicmetres divide by 2 hours, which is; 1 cubicmetre per hour. This method of estimating CLP using a formular relies on the availability of output and inputs. The determination of output and input can be done through experience or by physically measuring the executed works on site and the time it takes for a worker or gang of workers to complete the task. This method is used by estimators and planning engineers in many countries including Zambia.

2.3.2 Estimation of Construction Labour Productivity Using Historical Productivity Data (Comparative Method)

Historical productivity data refers to records of productivity from previous projects. Historical productivity data include information on units of output and the time it took for labourforce to complete the task (Whiteside, 2006). In instances where the work has not yet been executed, or where there is need to evaluate CLP on the executed work, the estimator can use historical productivity data to estimate CLP. This method of estimating CLP using past project data combined with a top-down approach to estimate CLP is called comparative method. If the average completion time of similar projects was for instance eight months, it would then be assumed that the current one would also take eight months. Comparative method of estimating CLP is used when planning, budgeting and scheduling construction projects. If well utilised, historical productivity data can be of help in estimating CLP on current similar projects. Estimators and planning engineers in ZCI also use historical productivity data to estimate CLP.

However, scholars have advised that historical productivity data must be used carefully as they may not indicate some factors or conditions under which previous projects were performed. As supported by Thomas and Sudhakumar (2014) that researchers maintain that the major productivity factors vary from country to country, place to place and project to project. Kisi (2015) further argued that just because actual productivity equals average historical productivity does not necessarily mean that an operation is efficient; the case may be that the operation's efficiency is only in line with historical averages, which may be way below optimal productivity. Additionally, the purpose for which historical productivity data was recorded may influence its reliability as there could be a possibility to purposely overstate or understate productivity.

2.3.3 Estimation of Construction Labour Productivity Using CLP Standards

CLP standards are labour productivity average values that are established and published to be used in a particular region or country as benchmarks for labour productivity under defined conditions. CLP standards are established values of optimal or ideal labour productivity under good conditions and management. CLP standards are easy to use as the

estimator just need to understand their originality in terms of conditions and factors under which they were developed. If the conditions are similar to those under the current project, then the estimator can take that CLP standard value as their CLP estimate. The estimator is therefore urged to understand assumptions and factors under which CLP standards were developed so as to be able to use them correctly in generating their own CLP estimates on the current similar project.

One advantage of CLP standards is that they are likely to indicate assumptions and factors under which they were developed. This makes it easy for the estimator to take into account any differing conditions or factors as they generate their own productivity rates. The other advantage of CLP standards is that they are published productivity data, and hence providing a benchmark. Since CLP standards are published data to which everybody in the construction sector can refer, they provide consistence and reliability as estimators and planning engineers are likely to generate similar and accurate labour productivity, project duration and project cost. As a matter of emphasis, CLP standards are created for a specific country or region taking into account various factors that influence labour productivity in that particular place. Therefore, the use of foreign CLP is likely to influence the accuracy, consistency or reliability of the estimates as factors that influence CLP which are fundamentals of CLP standards may differ from country to country or region to region. As supported by Thomas and Sudhakumar (2014) that productivity factors identified by researchers in one country may not be relevant in another country due to different social, political and economic environment factors.

Although CLP standards maybe existing in developed countries, Zambia like many other developing countries has not seen the existence and wide use of locally published CLP standards. Low productivity is a major issue in the construction industry in developing countries because of the absence of documented data for project estimation, planning, and management (Bamfo-Agyei, 2022). Thomas and Sudhakumar (2014) concluded that it is difficult to obtain a standard method to measure construction labour productivity because of project complexity and the unique characteristics of construction projects. Thomas and Sudhakumar (2014) added that the uniqueness and nonrepetitive operations of

construction projects make it difficult to develop a standard productivity definition and measure.

2.3.4 Parametric Method of Estimating Construction Labour Productivity

According to Swei et al. (2017), CLP can be linked to several parameters such as labour itself, materials, tools/equipment, management efforts, type of work and work environment among others. Therefore, production of accurate CLP estimates requires the evaluation or analysis of the parameters that are likely to influence or challenge productivity. It is important to note that there are empirical estimation relationships that exist between these parameters. Parametric models of estimation aggregates such relationships in a functional way to generate CLP estimates with relatively greater precision. Whether simple or highly sophisticated, parametric models have one thing in common, and that is, the attaching of values to specific ratios or variables (Swei et al., 2017). CLP standards are to a large extent typical example of CLP estimates established through parametric models. This is because in developing CLP standards, a lot of parameters and factors are taken into account and their relationships and impacts are analysed extensively.

2.3.5 Estimation of Construction Labour Productivity Using Estimator's Experience

Experience refers to knowledge that is gained through practical execution, contact with or observation of facts or events. Experience enables people to understand facts or events and be able to refer to them in future. Experience plays an important role in one's life as people refer to them in their day to day lifetime. Equally with regards to estimating CLP, the aspect of estimator's experience cannot be ignored. The research conducted by Malisiovas (2010) revealed that despite the technological advancement and the numerous measuring techniques now existing, more than 20 percent of contractors still rely on estimators' experience for the majority of their estimates. An estimator should be a knowledgeable practitioner on the existing construction technology, should take into account performances of equipment and machines together with workforce, and should have deep experience on the factors that can affect productivity and requirements of

workforce (Ulubeyli et al., 2014). Estimators in ZCI also make use of their experience in generating labour productivity estimates.

Regardless of the importance of estimator's experience, many scholars have highly discouraged overreliance on individual experience in generating CLP estimates due to its limitations. Ulubeyli et al. (2014) argued that sometimes experience-based estimates may be unreliable or incorrect due to estimator's unawareness of some inefficiencies or factors that could have affected productivity on the previous projects. Malisiovas (2010) also stated that the limitation of relying on estimator's experience is that the accuracy and reliability of this approach are influenced by personal prejudice and can highly be subjective. This means that there is no guarantee of accuracy, consistency and reliability of experience-based labour productivity estimates.

2.3.6 Analytical Method of Estimating Construction Labour Productivity

Analytical methods refer to an approach of generating construction labour productivity through logical and sensible reasoning of the situation by the estimator (Daschbach and Apgar, 1988). This approach makes use of the estimator's experience, knowledge and ability to analyse the circumstance and be able to objectively determine reasonable CLP. The estimator analyses the relationship of parameters such as labour skill, materials, tools/equipment, site conditions and many other factors to determine the ideal CLP. This approach is closely related to the use of estimator's experience as the estimator's ability to generate accurate estimate largely depends on his/her experience regarding the relationship of various variables or factors that influence CLP (Daschbach and Apgar, 1988).

2.4 Practice of Evaluation of Construction Labour Productivity

Evaluation refers to an assessment to compare predetermined against actuals. Evaluation can also be described as an assessment or analysis to compare planned (baselines or benchmarks) against actuals to ascertain the variance. With regards to construction, CLP evaluation refers to an assessment to compare values of planned or estimated CLP against actual values of CLP achieved on construction site (Ulubeyli et al., 2014). In this regard, planned or estimated values of CLP serve as baselines to which values of actual CLP are

compared. Evaluation is an essential aspect of project management, and the key project parameters that are usually evaluated include; quality, time, cost, health and safety and the overall project performance. At the end of the project or as the project progresses, project managers conduct an evaluation of various project parameters so as to establish whether targets are being achieved or are likely to be achieved. If there is a variance between planned and actual, corrective actions are taken. Therefore, it is crucial to have correct and reliable CLP estimates (optimal) as they form a benchmark for performance evaluation. Kisi (2015) supported this by stating that optimal productivity is useful in the determination of the absolute efficiency of construction operations because an accurate estimate of optimal labour productivity allows for the comparison of actual versus optimal (unbiased). Therefore, if CLP estimates which forms the baseline are incorrect or unreliable, evaluation of actual CLP is equally rendered unrealistic.

2.5 Factors that Influence Construction Labour Productivity

Understanding factors that influence productivity is a prerequisite to developing strategies for efficient and effective management of construction labour. As argued by Attar et al. (2012) that understanding critical factors affecting labour productivity can be used to prepare a strategy to reduce inefficiencies and consequently improve the effectiveness of projects performance. CLP is influenced by a wide range of factors, and probably this is the reason why CLP is a complex subject as some of those factors cannot easily be measured or analysed. Different scholars have categorised factors that influence CLP differently depending on their focus. However, in this particular study factors that influence CLP were categorised as; those related to workers, those related to work, those related to weather and those related to management.

2.5.1 Work-Related Factors that Influence Construction Labour Productivity

There are several factors related to work that influence CLP. These include; site conditions, construction site plan, tools/equipment, work schedule, health and safety, materials availability, type of materials and supervision.

i. Site Conditions

Site conditions can pose challenges that cause operatives to be tired earlier than they would if conditions were different. Site conditions dictate how difficult or easy it is for a worker to execute the task, and hence influencing productivity (Shehata and Ei-Gohary, 2012). For instance, a confined site may affect working space, making it difficult for workers to execute the work. Therefore, site condition is a factor that has an influence on labour productivity and is worth considering when analysing or estimating CLP.

ii. Construction Site Plan

Construction site plan refers to the arrangement and positioning of things on site such as offices, material stores, entrance to site, position of bulk materials, position of construction equipment, toilets, etc. Construction site plan affects the procedure of work on site and ultimately affects productivity (Shehata and Ei-Gohary, 2012). Therefore, at every stage of construction works, construction site layout must be designed in such a way to improve productivity. For instance, construction site can influence the flow of materials on site and ultimately affect labour productivity.

iii. Construction Tools and Equipment

Tools and equipment are very crucial in achieving optimal productivity. If workers are not provided with the right tools or equipment that are in good condition, productivity would surely be low (Shehata and Ei-Gohary, 2012). For instance, tools/equipment breakdown or the use of wrong equipment is likely to negatively affect productivity. Therefore, right tools and equipment which are in good condition must be provided for workers to be more productive.

iv. Construction Materials

Materials management system attempts to ensure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost (Vyas, 2011). This is because late delivery of materials affects labour productivity as there is unnecessary labour idle time. Delivering materials of wrong quality or inadequate quantity may also affect productivity. However, it must be noted that sometimes the type of materials can affect productivity not necessarily because

of incorrect quality. Therefore, the emphasis is that correct quality and quantity of materials must be provided to the workers in good time. Managers or supervisors must also understand how materials affect labour productivity.

v. Construction Methods

The methodology of work execution employed is also cardinal in productivity. It is obvious that the objective of developing modern construction methods is to improve productivity. The methodology encompasses the types of materials, tools and equipment and sequency of activities among others (Shehata and Ei-Gohary, 2012). Therefore, the construction method employed should also be given attention with reference to CLP.

vi. Project Drawings and Specifications

Supervisors and workers rely on various project information such as construction drawings and specifications to execute works (Mamlook et al., 2020). Therefore, poorly drafted project drawings and specifications can cause delays in interpretation and understanding of the work to be executed. In other situations, errors in project drawings and specifications cause reworks, a thing that is very demotivating to workers on site. Therefore, project drawings and specifications must be properly drafted to expedite the rate of work on site.

vii. Supervision

The objective of supervision is to ensure that planned work is safely executed and completed on site in accordance with work specifications, cost and within the scheduled time. Therefore, supervision focuses on controlling quality, cost and the rate of work execution. Hence, all the factors that are likely to impact on quality, cost, safety and the rate of work execution are in the interest of the supervisor. Poor supervision can lead to incorrect instructions, poor communication, reworks, delay in material flow, delay in commencing works and more, and all these factors affect labour productivity (Mamlook et al., 2020). Therefore, poor supervision is likely to negatively affect labour productivity on site and vice versa.

viii. Work Schedule

Work schedules also affect labour productivity. Work schedules with more than adequate time can slow down labour productivity especially if workers are aware that there is enough time to complete the task. However, that is not to say planning engineers must generate tight work schedules to enhance productivity as that can put unnecessary pressure on the workers and make them neglect other important factors such as quality and their safety. Therefore, with good supervision, realistic schedules are good enough to yield optimal labour productivity on site keeping other things constant (Shehata and Ei-Gohary, 2012).

ix. Occupational Health and Safety Management System

Occupational health and safety are crucial on construction sites. A healthy and safe work place gives workers a free mind and boosts their morale and confidence towards work, and hence increasing productivity. On the contrary, unsafe work environment affects workers mental state and their rate of work execution for fear of being injured. Lee et al. (2021) conducted a study on the correlation analysis of safety climate and construction productivity in South Korea and concluded that a higher level of safety perception can increase construction productivity. Poor safety management leads to accidents which further affect employee's output. For instance, worker's productivity drops after seeing their fellow worker being injured on the job site. Hence, issues of health and safety must be prioritised to enhance workers' productivity.

2.5.2 Worker-Related Factors that Influence Construction Labour Productivity

There are several factors related to the worker which influence CLP on site. These include, worker experience and skill, motivation and morale, worker's state of mind, worker-supervisor relationship, age, fatigue, health condition and physical fitness.

i. Worker Experience and Skills

Worker experience is another factor that cannot be neglected in the analysis of labour productivity on the construction site. Other than providing the worker with the right materials, right tools, good working conditions and clear instructions, worker's

experience is another factor that comes into play (Shehata and Ei-Gohary, 2012). Given the same conditions, a more experienced worker would yield high productivity than one with the lower experience. Therefore, worker's experience must be regarded as the factor with significant influence on CLP.

ii. Worker Morale / Motivation

Morale can be described as the confidence, enthusiasm, and discipline of the employee towards work. Morale is closely related to employee's motivation which also results in employee's confidence, enthusiasm and discipline towards works. Worker's confidence, enthusiasm, and discipline towards work is likely to result into enhanced productivity (Mamlook et al., 2020). Although it is not easy to measure morale and motivation, worker morale and positive motivation are factors that influence CLP on the construction site.

iii. Worker Age, Physical Fitness and Health Condition

Alaghbari et al. (2019) stated that strength, physical structure of labour, health condition and labour's age are among human factors that influence productivity. Hickson and Ellis (2014) also argued that extended work hours have great effect on fatigue during which workmanship and safety practice begin to wane. Therefore, worker related factors such as worker's state of mind, age, fatigue, health condition and physical fitness influence CLP in ZCI.

iv. Worker-Supervisor Relationship

Worker-supervisor relationship refers to how the worker and supervisor gets along in the work environment. Poor worker-supervisor relationship creates an antagonistic work environment leading to poor communication, not following instructions, late coming, absenteeism and reduced morale and motivation, all with potential to negatively affect labour productivity on the work site (Mamlook et al., 2020). Therefore, it is important that to ensure that a good relationship exist between workers and supervisors as lack of it negatively affects labour productivity.

2.5.3 Weather-Related Factors that Influence Construction Labour Productivity

Weather conditions include temperature, wind, humidity and rainfall. Weather conditions in a particular place may affect productivity factors such as labour, materials and

tools/equipment and in return affect productivity. Weather can impact on construction projects in ways such as decreasing productivity and sometimes halting construction, ruining unprotected and exposed constructed elements, disrupting communications and/or blocking access to site locations (Ballesteros-Pérez et al., 2018). For instance, extremely hot weather affects energy levels of workers. High humidity may also affect the human beings and equipment performance. Extremely cold weather may also have its own impact on the human beings, equipment and materials. Bad weather due to rainfall can also affect work on site. Since workers, materials, equipment and work sites are factors of CLP, weather related effect on any of these ultimately may influence CLP. However, Schuldt et al. (2021) argued that simple weather mitigation methods such as observing work-rest cycles and providing weather-appropriate protective gear can be employed. Other mitigation methods may also be used such as planning the project schedule within the proper construction season or ensuring that the construction contract has the right language to prevent ambiguity (Schuldt et al., 2021). Mitigation strategies can help construction managers adapt, avoid, or anticipate delays due to weather (Schuldt et al., 2021).

2.5.4 Management-Related Factors that Influence Construction Labour Productivity

There are several factors related to management that influence labour productivity. These factors include but not limited to; poor occupational health and safety management systems, delay to pay salaries / wages, casualisation, lack of incentives, poor communication channels and many more. Hickson and Ellis (2014) argued that there are many facets related to management that are crucial to encouraging labour such as; management relations, adequate and prompt salary payment and job security in addition to job satisfaction.

i. Delay to Pay Salaries and Wages

Compensation is a fundamental component of human resource management and it covers economic reward in the form of wages and salaries as well as benefits, indirect compensation or supplementary pay (Salisu et al., 2015). However, delays or inconsistent

payment of salaries / wages to workers results to stressed workers due to unsettled or pending financial related matters. Most of these individual issues resulting from delayed payment include unsettled debts, outstanding rental bills, lack of food and transport among others. These factors affect the employer's morale and concentration at work, resulting into reduced CLP on site (Salisu at el., 2015).

ii. Casualisation

Casualisation is the engagement of workers on temporal basis. There are several factors that cause high level of casualisation, the common one is economic hardships. For construction sector, the temporal nature of construction projects also contributes to casualisation as construction companies engage workers on project basis (Mamlook at el., 2020). Casualisation has an impact on CLP, as casual workers tend to deliberately slow the rate of work execution so as to prolong their employment duration. According to Okoye at el. (2014), casualisation denies workers good training, promotion, human capital investment, career prospects and job security among others. All these factors negatively influence workers' behaviour and impact on productivity.

iii. Lack of Incentive Schemes

Many times, workers are aware of their experiences, skills, strengths and weakness, and usually they know how much they contribute to the company in terms of productivity. Therefore, incentives cannot be ignored when analysing labour productivity in construction. Hardworking employees feel intitled to some form of appreciation from their employers. There are several ways of incentivising workers, one of them being financial bonus for extra performance. When workers are incentivised for their hard work, they feel appreciated and they are motivated to work even extra harder (Mamlook et al., 2020). Additionally, when hard working employees are incentivised in workplaces, other workers are also motivated, and are willingly to work hard so that they too can be incentivised.

iv. Poor Communication Systems

It is obvious that effective and efficient communication system in any organisation is very crucial for high productivity. Poor communication leads to various problems such as

inconsistence in information flow, delayed responses and misunderstandings among others (Mamlook et al., 2020). Therefore, with regards to construction, failure by the construction companies to develop and maintain good communication systems negatively affect CLP on work sites.

v. Management’s Commitment to Workers’ General Welfare

There are a lot of labour related issues in workplaces that requires management’ attention. These issues can be different from company to company, but would include issues such as transport of workers, salaries/wages, working conditions, level of responses to workers’ complaints and issues of safety among others. Management level of commitment to addressing workers’ general welfare can either motivate or demotivate workers and ultimately affect CLP on work site. Sampa (2016) concluded that ensuring employees’ well-being through provision of welfare facilities is essential in stimulating desired conduct and performance.

2.6 Construction Stakeholder Mapping

There are several construction stakeholders who are cardinal and cannot be ignored in studies that focusses on establishing major considerations in developing CLP standards. According to Manowong and Ogunlana (2010), a “stake” is an interest or a share in an undertaking, while a “stakeholder” is an individual or organisation with a stake. In the construction context, construction stakeholders are defined as individuals, groups and organisations who are actively involved or whose interest are positively or negatively affected by activities or results of construction undertaking (Chinyio and Olomolaiye, 2009). Construction stakeholders can be further classified as internal and external stakeholders. Internal construction stakeholders comprise of project owners, clients, funders, design and project management consultants, contractors, suppliers/manufacturers and construction workers (Chinyio and Olomolaiye, 2009). External construction stakeholders on the other hand include local and national statutory bodies (regulatory and non-regulatory), the public / community groups, media, end users and other independent concerned groups with special interests (Chinyio and Olomolaiye, 2009).

2.6.1 Construction Stakeholders in Zambia

There several internal and external stakeholders that are actively involved and/or have interest in construction activities in ZCI. Internal construction stakeholders comprise of clients/developers, project funders, project management consultants, contractors, suppliers/manufacturers and construction workers among others. External construction stakeholders in Zambia include the public / community groups, media, project end users, independent groups and regulatory bodies such as National Council for Construction, Engineering Institution of Zambia and government and NGO organisations. Table 2.3 shows construction stakeholder mapping in Zambia.

Table: 2.3 Construction Stakeholder Mapping in Zambia

Classification	No.	Stakeholder	Functions / Interests in ZCI
Internal Stakeholders	1	Clients	Developers or project owners
	2	Funders	Financing projects
	3	Facilities Managers	Management of facilities
	4	Projects Management Consultants	Planning and Project Management
	5	Contractors	Responsible for projects execution
	6	Ministry of Infrastructure	Responsible for infrastructure development, maintenance and management.
	7	Suppliers / Manufacturers	Provision of materials, tools and equipment.
External Stakeholders	8	National Council for Construction (NCC)	Regulation of contractors and provision of trainings.
	9	Engineering Institution of Zambia (EIZ)	Regulation of engineering firms and professionals.
	10	Road Development Agency (RDA)	Implementing and management of road infrastructure development.
	11	Ministry of Labour and Social Security	Responsible for industrial Labour Related Matters
	12	Non-Governmental Organisations (NGOs)	Can be funders, Clients, or Researchers, etc.
	13	Zambia Compulsory Standards Agency (ZCSA)	Implementing Compulsory Standards.
	14	The Academia.	Conducting Researches
	15	The Public	Public interest
	16	The Media	Data recording and sharing

i. National Council for Construction (NCC)

National Council for Construction (NCC) is a statutory body governed by the National Council for Construction Act No. 10 of 2020 under the Laws of Zambia. Under this Law, NCC is charged with the responsibility of providing for the promotion, development, training and regulation of the construction industry in Zambia. NCC has a huge responsibility and its main aim is to develop and improve the performance of ZCI. NCC is concerned with issues of performance of contractors, quality control of construction, efficient use of resources and minimum standards and best practices in Zambian Construction Industry. In fulfilling its mandate, NCC undertakes several activities that include; registration of contractors, registration of manufacturers and suppliers, registration of projects, testing of construction materials, conducting research into the use of local construction materials, monitoring of contractors and capacity building of medium and small-scale contractors.

ii. The Engineering Institution of Zambia (EIZ)

The Engineering Institution of Zambia (EIZ) is a statutory professional regulatory body mandated by the EIZ Act No. 17 of 2010 to promote and regulate the engineering profession in Zambia. It is a membership-based corporate body established under Section 3 of the Engineering Institution of Zambia Act No. 17 of 2010. The institution was founded in 1955, and its mandating instrument has since then undergone a number of legislative changes through the 1972, 1992 and 2010 Acts of Parliament. The EIZ was re-established under the EIZ Act No. 17 of 2010 for the purpose of promoting and regulating the engineering profession. Under regulation, the institution provides for the registration of engineering organisations and professionals and regulates their professional conduct.

iii. Road Development Agency (RDA)

The Road Development Agency is a statutory body that was established through the Public Roads Act No. 12 of 2002 to provide for the care, maintenance and construction of public roads in Zambia. RDA is a stakeholder in the construction sector of Zambia. However, RDA's functions are more on the Road infrastructure as opposed to other

infrastructure. However, RDA still finds itself collaborating with other stakeholders in the
Zambian Construction Industry.

iv. Construction Contractors

Construction contractors are companies or organisations that carry out construction works. Construction contractors offer a service to Clients or Developers to execute their projects through some form of contractual arrangements (Masterman,1996). Unlike consultants whose functions on the construction projects are managerial or supervisory in nature, contractors are direct on the ground carrying out construction works. Contractor's main objective is to safely execute construction works in accordance with project designs and specifications and within the approved budgets and timeframe. Contractors are therefore given a responsibility of managing quality, cost, time and health and safety. Contractors' ability in using sophisticated methods and their rationalisations at the tender development stage are considered crucial in achieving cost success (Doloi, 2013). In order to manage these key project parameters, which are in essence project performance indicators, contractors employ experts such as Engineers and Quantity Surveyors who perform various functions relating to quality, cost, safety and time control on the project. One of the critical functions of contractors on the building project is to effectively manage labour productivity, especially that CLP influences quality, cost and project duration. In Zambia, the National Council for Construction (NCC) is the body mandated to register contractors in grade 1,2,3,4,5 and 6, and in various fields such as; General building and housing (B), mining (M), General civil engineering (C), Electrical (E) and Mechanical engineering works (M).

v. Project Management Consultants

Project management consultants include consultants such as Architectural, Engineering, Safety/environmental, Quantity Surveying and other consultants. According to Shi et al. (2014), Construction Management Consultancy is an integral part of construction professional services that are created by a set of knowledgeable consultants including architects, engineers, engineer-contractors, architect-engineers, engineer-architects, environmental, planners, and geotechnical engineers, landscape architects. On private

projects, these are mostly engaged by the client for professional services required for the implementation of the project to the requirement and satisfaction of the client and other interested stakeholders. Project Management Consultants are one of the key construction stakeholders.

vi. Suppliers and Manufacturers

The manufacturers of construction components and materials are the suppliers in construction projects, and represent a significant portion of their value. The suppliers are product-oriented companies that sell products and components to contractors working on construction projects (Sariola, 2018). Suppliers and Manufacturers are therefore key stakeholders in the construction industry. Furthermore, suppliers are regarded as a key source for construction innovation, because they invest more in research and development programs than other actors in the construction industry (Sariola, 2018).

vii. Non-Governmental Organisations (NGO's)

Non-government organisations (NGOs) have been an indispensable part of societies in many countries (Maddison and Hamilton, 2007). There are various NGOs with diverse interest in various areas of the society such as political, social and economical areas. Examples of specific areas that are of interest to NGOs are gender, political, economical, health, labour and many others. According to Jakimow (2009), NGOs' close links with marginalised people can aid in the representation of the poor, thereby strengthening democratic processes in accordance with pluralist conceptions of civil society. Because of the NGOs interest in various sections of the society, they happen to be stakeholders in the construction sector. They may take various positions such as Client, Funder or other external. NGOs are the repository of an enormous amount of information about how things work in their part of the world and governments today simply cannot make effective policy without access to that bank of knowledge (Maddison and Hamilton, 2007).

viii. Ministry Of Infrastructure, Housing and Urban Development

The Ministry of Infrastructure, Housing and Urban Development is responsible for Public Infrastructure except road infrastructure. It has 7 Departments that operates and core exist

in ensuring the planning, development, maintenance and management of the public infrastructure. These 7 departments include; Department of Public Infrastructure (DPI), Department of Housing Development, Department of Preventive Maintenance and Services, Government Valuation Department, Department of Human Resources and Administration, Department of Planning, Monitoring and Research, Department of Finance.

ix. Ministry of Labour and Social Security (MLSS)

In Zambia, the Ministry of Labour and Social Security (MLSS) is one of the government institutions which play a key role in the socio-economic recovery programme of the country aimed at achieving sustainable economic growth and improving wellbeing of Zambians. In accordance with Government Gazette Notice No. 1123 of 2021, the Ministry implements basic social protection services that seek to provide social assistance and promotional services, and is responsible for the following portfolio functions: Employment Policy, Social Security Policy, Labour Policy, Educational and Occupational Assessment Services, Occupational Safety and Health Services, Industrial and Labour Relations and Monitoring Productivity. The ministry undertakes several services that include; Registration of employers, employment agents and representative bodies. The ministry also offers services such as accidents investigations, career counselling and guidance, approval of occupational pension schemes, dispute resolution, attestation of employment contracts and examination of plant and machinery. Last but not the least, the ministry offer services of inspection of factories, labour and construction works.

Under inspection of factories and construction works, the MLSS is mandated to ensure that safety and health standards are adhered to in all factories and construction work places. The equipment, materials and persons working in factories and construction sites are a source of hazards and risks which can result in harm to personnel and damage to the equipment. Therefore, factory inspections are undertaken to ensure that the standards of safety and health, as provided for under the Factories Act are adhered to in order to prevent any loss that may arise due to accidents. Supporting Documents include the Factories Act Cap 441 Inspection checklists.

Under inspection of labour, the MLSS conducts inspections so as to ensure that employers and employees are in compliance with the labour laws. Under inspection of labour, the following are the four types of labour inspections.

x. The Academia

The academia provides trainings, skills and knowledge through researches aimed at solving real world problems. The academia therefore collaborates with various stakeholders. In the case of Zambia, there are various academic institutions which are stakeholders in the construction industry. Some of these include the University of Zambia (UNZA), the Copperbelt University (CBU), TAVETA and many others.

xi. Zambia Compulsory Standards Agency (ZCSA)

The mandate of the Zambia Compulsory Standards Agency (ZCSA) is to administer, maintain and ensure compliance with compulsory standards for the purpose of public safety and health, consumer protection and environmental protection. The functions of ZCSA include the following.

- Administer, maintain and ensure compliance with compulsory standards
- Give premarket approval of high-risk commodities falling within the scope of compulsory standards.
- Conduct market surveillance for products falling within the scope of compulsory standards in order to monitor post market compliance of commodities with compulsory standards.
- Educate the public on compulsory standards and provide public information for the protection of the consumers on products and services which do not comply with the Act.
- Cooperate with Ministries and other State institutions and international organisations in enforcing compulsory standards.
- Do all such things as are connected with, or incidental to, the functions of the Agency under the Act.

2.7 Process of Developing Construction Labour Productivity Standards

Standards are developed on a need basis and the need for a new standard can be initiated by stakeholders, an individual, a manufacturer, or a government institution. In every

country, there are statutory bodies that are concerned with development, maintenance and improvement of standards. For instance, the National Regulator for Compulsory Specifications (NRCS) is a statutory body of the Department of Trade, Industry, and Competition in South Africa. It was established to administer compulsory specifications and other technical regulations with the view to protect human health, safety, the environment and ensure fair trade in accordance with government policies and guidelines. Its overall objective is to develop compulsory specifications and technical regulations, and maximise compliance of regulated products and services. NRCS also covers the South African construction industry. Standards are developed by technical committees comprises of various experts whose discussions culminate into draft standards which are subjected to public scrutiny after which the standards are published in government gazette as standards upon approval by stakeholders. The value of standards is derived from the contributions of a variety of stakeholders such as manufacturers, regulators, members of the public sector and consumers/users (Wilcock and Colina, 2007).

2.7.1 Development of Construction Labour Productivity Standards in Zambia

In Zambia, the statutory bodies concerned with standards are Zambia Bureau of Standards (ZABS) and Zambia Compulsory Standards Agency (ZCSA). Zambia Bureau of Standards (ZABS) is mandated to facilitate for the development and publication of all standards in Zambia. ZCSA administer, maintain and ensure compliance with compulsory standards for the purpose of public safety and health. According to ZABS, standards are the result of a consultative process involving all interested parties (Stakeholders) who agree on the contents of these standards through consensus. ZABS has the uniform process for developing standards in Zambia. ZABS process of standards development has five stages and the development and publication of construction labour productivity standards in Zambia would follow these stages and would be facilitated by ZABS.

i. Zambia Bureau of Standards

Zambia Bureau of Standards (ZABS) is a statutory body under the Ministry of Commerce Trade and Industry established in 1982. Over the years, ZABS has carried on its role of developing standards and providing conformity assessment services to industries. With

the realignment of the National Quality Infrastructure (NQI) in 2018, to international best practices, ZABS role is now more focused towards supporting industry to implement standards that enhance the quality of products and services for industry growth and competitiveness. ZABS facilitates for the development and publication of standards for the different sectors of the economy in Zambia. These Standards are developed to help the industries produce quality products that meet the expectations of the consumers and complies with the health, safety, and environmental regulations. ZABS has facilitated the development of standards in various sectors which include Food and Agriculture, Building and Construction, Information Communication Technology, Chemicals and Health, Electro technical, Textiles, Timber and Timber products, among others. ZABS Documentation and Information Center (DIC) holds a collection of National and International standards, technical regulations, technical books and journals. The mandate of ZABS include the following;

- To facilitate for development, publication, maintenance, or withdraw Zambian National Standards and related normative publications serving the standardization needs for Zambia.
- To provide inspection services, testing services and system and product certification.
- To provide a voluntary certification mark scheme for the assurance of product conformity to standards.
- To promote quality, health and safety standards for commodities, products and services.
- To facilitate efficiency in industry and promote trade through standardization.
- To provide for a Research and Development program for new standards, improvement of existing standards, standardisation of test methodology and the articulation of future needs that might affect the standards environment.

ii. Stages of Construction Labour Productivity Standards Development

Since ZABS is a statutory body mandated to facilitate for the development and publication of all standards for all sectors in Zambia, the development of CLP standards in Zambia would follow suit in the ZABS process of standards development. Figure 2.1 shows the stages of CLP Standards development as developed from ZABS.

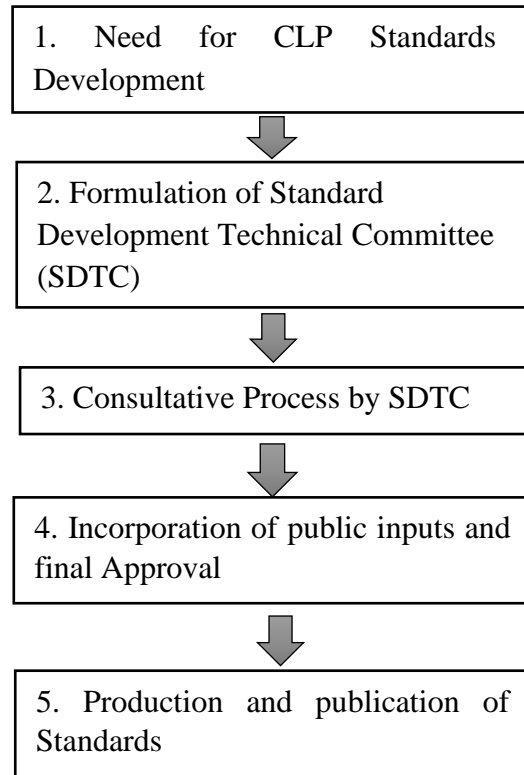


Figure 2.1: Stages of CLP Standards development in Zambia. Developed from ZABS.

➤ **Step 1: Need for Developing Construction Labour Productivity Standards**

Stakeholders concerned with the construction sector in Zambia would need to agree on the need to have CLP standards and engage other relevant stakeholders and bodies such as ZABS to initiate the process of CLP standards development.

➤ **Step 2: Formulation of Standard Development Technical Committee**

Upon consensus by stakeholders on the need to develop CLP standards in Zambia, the next step would be to formulate the Standard Development Technical Committee (SDTC) whose primary purpose would be to conduct the consultative process. Since the construction sector in Zambia interacts with many sectors, the SDTC for developing CLP standards would have representation of relevant stakeholders such as contractors, consulting firms, materials/equipment manufacturers and suppliers, professional bodies, academic institutions and relevant statutory bodies.

➤ **Step 3: Consultative Process**

The Consultative process by SDTC would include review of international data on the subject of CLP and existing standards. From international level, the consultative process would be narrowed down to local, reviewing previous studies and conducting new studies on the subject of construction labour productivity. The consultative process would then result into draft of standards which would be released for public scrutiny for two months.

➤ **Step 4: Public Scrutiny and Incorporation of Public Inputs and Final Approval**

When developing standards, it is crucial to seek the public inputs. Therefore, the consultative process would allow the public to review and scrutinise the draft of construction labour productivity standards and give their views. After public scrutiny, the SDTC would review the public inputs and incorporate them into the final approved copy.

➤ **Step 5: Development and Publication of Construction Labour Productivity Standards**

The last stage would be to produce and publish standards in government gazette as *Zambian Construction Labour Productivity standards* upon approval by the stakeholders. Figure 2.2 shows CLP standards development by ZABS' typical process of standards development.

iii. Framework of CLP Standards Development in Zambia

The process of developing all standards in Zambia involves several stakeholders and passes through various stages. Equally the development of CLP standards in Zambia would have a similar framework established by ZABS to ensure that the procedure results into acceptable CLP standards for ZCI. Figure 2.2 shows the framework of CLP Standards Development in Zambia adopted from ZABS.

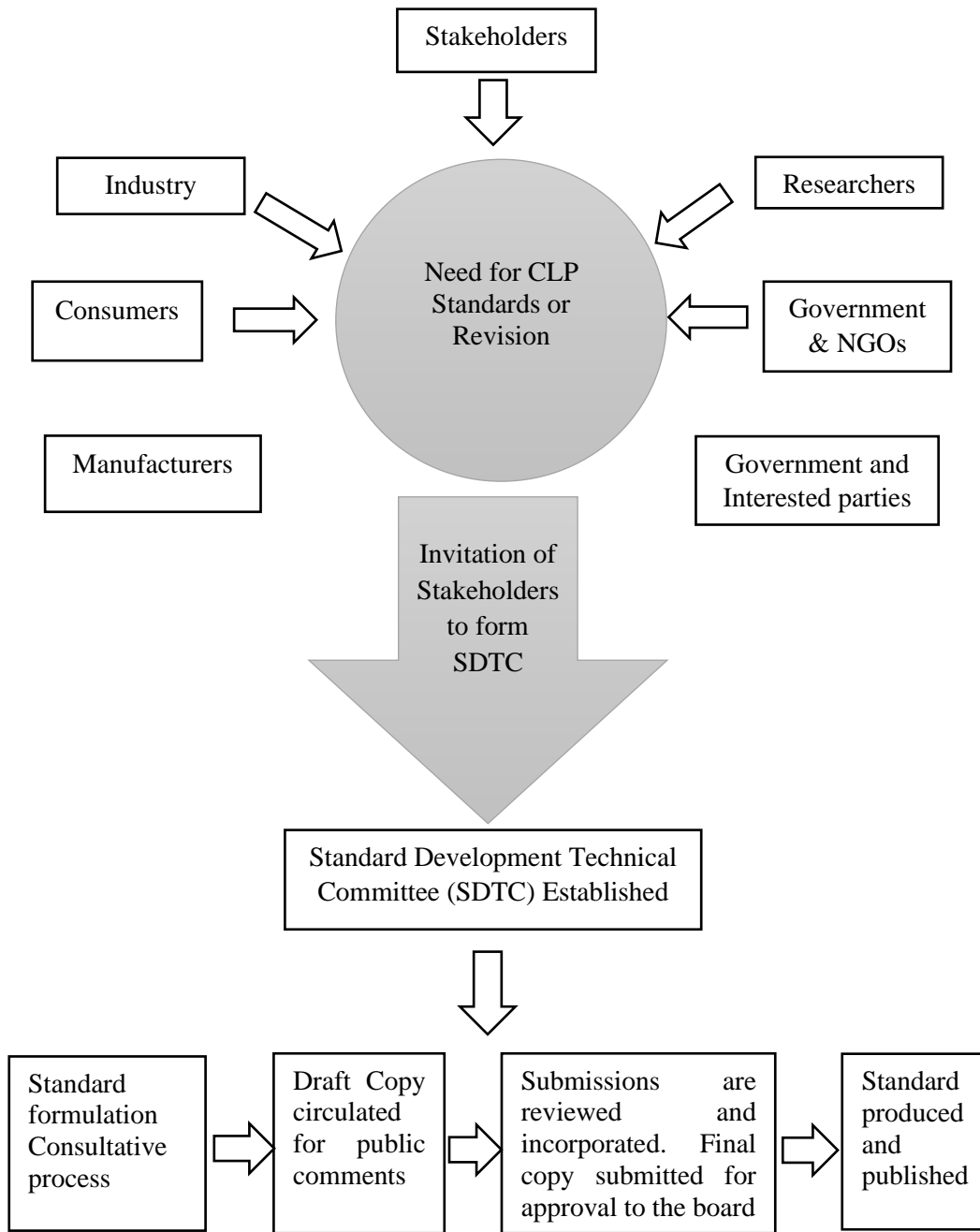


Figure 2.2: CLP Standards Development Framework in Zambia. Adopted from ZABS.

2.8 Hypotheses of the Research

The following Hypothesis were formulated on which this study was based:

- i. **HN₁:** Construction materials, labour and tools/equipment are not the major resources required for optimal construction labour productivity.
HA₁: Construction materials, labour and tools/equipment are the major resources required for optimal construction labour productivity.
- ii. **HN₂:** Work related factors do not influence construction labour productivity in ZCI.
HA₂: Work related factors influence construction labour productivity in ZCI.
- iii. **HN₃:** Worker related factors do not influence construction labour productivity in ZCI.
HA₃: Worker related factors influence construction labour productivity in ZCI.
- iv. **HN₄:** Weather related conditions do not influence construction labour productivity in ZCI.
HA₄: Weather related conditions influence construction labour productivity in ZCI.
- v. **HN₅:** Management related factors do not influence construction labour productivity in ZCI.
HA₅: Management related factors influence construction labour productivity in ZCI.

2.9 Conceptual Framework

Table 2.4 shows the conceptual framework for this study from which hypotheses and research questions were formulated. From literature review, several factors that influence construction labour productivity (CLP) were identified and were therefore included in the conceptual framework as independent variables. These factors included major resources required for optimal CLP, and those factors related to work, workers, weather and management as shown in the first column of Table 2.4. Additionally, factors related to CLP standards development process in Zambia were also included as independent variables. The dependent variable was construction labour productivity (CLP) as shown in Table 2.4.

Table 2.4: Conceptual Framework

Independent Variables		Dependent Variables
Construction Resources	<ul style="list-style-type: none"> a. Labour b. Materials c. Tools/Equipment 	<p style="text-align: center;">Technology, Extent and Time- Variability</p> <p style="text-align: center;">Construction Labour Productivity (CLP)</p>
Work Related Factors	<ul style="list-style-type: none"> a. Materials management b. Type of Materials c. Construction Site Layout d. Site Condition e. Construction Equipment f. Construction Methods g. Supervision h. Occupational health and safety 	
Worker Related Factors	<ul style="list-style-type: none"> a. Worker Experience and skill b. Motivation and Morale c. Worker state of Mind d. Age e. Worker-Supervisor Relationship f. Fatigue g. Health Condition h. Physical Fitness 	
Weather Related Factors	<ul style="list-style-type: none"> a. Temperature b. Wind c. Humidity d. Rainfall 	
Management Related Factors	<ul style="list-style-type: none"> a. Casualisation b. Low Wages and Salaries c. Incentive Schemes d. Training schemes e. Communication System f. Management's Commitment to Workers' general Welfare 	
Process of CLP Standards Development	<ul style="list-style-type: none"> a. Formulation of Technical Committee Comprising of Experts from various sectors. b. Consultative Process by Technical Committee c. Cost and Time requirement 	

2.10 Chapter Summary

This chapter reviewed literature relevant to the study. Areas of interest were; building construction activities, construction labour productivity standards, factors that influence Construction Labour Productivity (CLP) and the practice of CLP estimation and evaluation. The chapter also mapped construction stakeholders, and further reviewed literature on the process of CLP standards development. Lastly, the research hypotheses and conceptual framework were formulated. Table 2.5 shows the summary of the content of literature review.

Table 2.5: Summary of the content of literature review.

Item	Content
1	Building construction activities and construction labour productivity standards.
2	Factors that influence construction labour productivity.
3	Practices of construction labour productivity estimation.
4	Practices of construction labour production evaluation.
5	Construction stakeholder mapping.
6	Process of developing construction labour productivity standards.
7	Research hypotheses and conceptual framework

CHAPTER THREE: METHODOLOGY

3.1 Introduction

Research methodology refers to principles and procedures that are applied to a scientific investigation, and they are concerned with the techniques for data collection, data analysis and methods for deriving conclusions (Gupta and Gupta 2022). Research methods / techniques are those methods used in performing research operations (Greener, 2008). Sekeran (1992) stated that a methodological research design represents a planned and structured process of investigating identified research questions that are logically conceived, developed and answered as reliably, accurately and as objectively as possible. As stated by the New Age International (2013) that it is important not only to know how to develop and apply various methods and techniques, but also to know which methods and/or techniques are relevant and which are not, and what they would mean and indicate. This chapter therefore discussed the methodology that was employed in conducting this research.

3.2 Research Approach

The research approaches that can be used to investigate a phenomenon are; qualitative, quantitative and qualitative / quantitative approach (Kothari, 2004). Daniel and Sam (2011) argued that in social research, a researcher can only investigate either a qualitative (descriptive) or a quantitative (quantifiable) phenomenon. However, there are instances where the combination of both qualitative and quantitative approaches is required. Qualitative / quantitative research is a type of research which uses both qualitative and quantitative research methodologies to investigate either a qualitative or a quantitative phenomenon (Myers, 2009). However, this study employed a quantitative research approach.

3.3 Research Design

Research design is a conceptual framework work within which research is conducted. Sahu and Singh (2016) argued that a research design is a plan that describes how, when, where and how data is to be collected and analysed. In order to achieve the research

objectives, this study used quantitative approach of the research design. The target population selected from the study area (Lusaka) included; Contractors, QS professional firms, MLSS and statutory bodies such as NCC, EIZ, ZABS and ZCSA. A survey was conducted on samples of the targeted population and data collected was analysed using Statistical Package for Social Science (SPSS) to draw conclusions and make recommendations. The specific tools that were used for data analysis include frequency tables, chai-square and regression test. Figure 3.1 shows the research design that was adopted for this study.

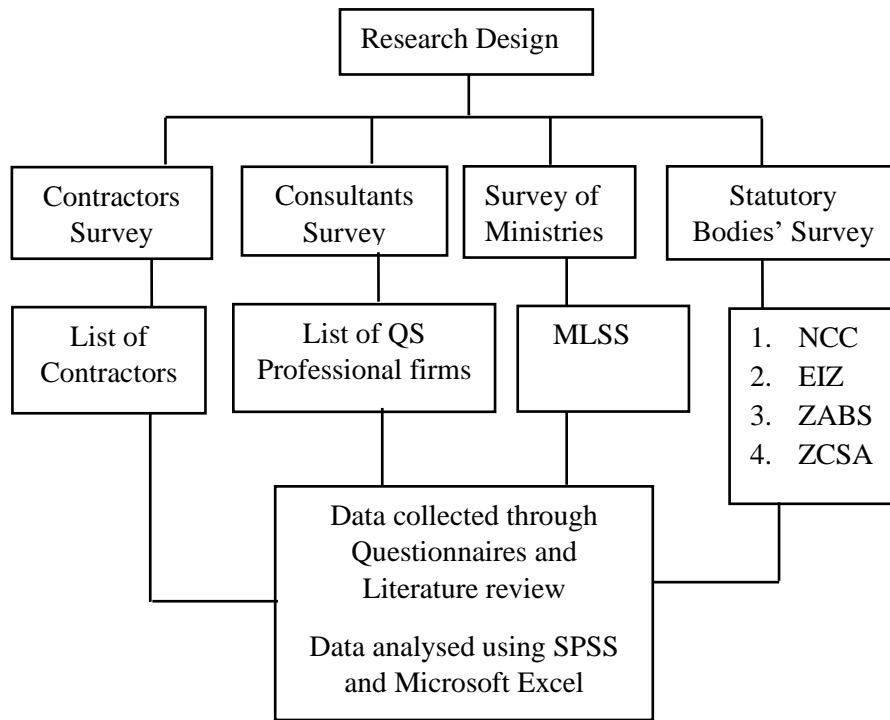


Figure 3.1: Research methodology design developed from Parahoo (1997)

3.4 Study Area

This research was conducted in Lusaka province of Zambia. The suitability of Lusaka province was easy access to the targeted population who were Contractors, QS Consulting firms, MLSS and statutory bodies (NCC, EIZ, ZABS and ZCSA). Further, adequate samples of the target groups could be obtained from Lusaka.

3.5 Study Population

Gupta and Gupta (2022) emphasised that selecting the right population is an important aspect of planning and designing a research study. Therefore, population for this study was carefully selected with particular attention to the research objectives. The selected target population included; Contractors, QS professional firms, Ministry of Labour and Social Security (MLSS) and statutory bodies such as NCC, EIZ, ZABS and ZCSA. Table 3.1 below shows the population in terms of the target groups that were selected for this study.

Table 3.1: Target groups

Construction Contractors	Consulting Firms	Govt. Ministries	Statutory Bodies
1. Grade 2 Contractors 2. Grade 3 Contractors 3. Grade 4 Contractors	1. QS Professional Firms	1. MLSS	1. NCC 2. EIZ 3. ZABS 4. ZCSA

3.5.1 Construction Contractors

Construction contractors are companies that offer a service to execute construction projects on behalf of Clients or Developers through some contractual arrangements (Masterman, 1996). Contractor's main responsibility is to safely execute construction works in accordance with project designs and specifications and within the approved budgets and timeframe. Contractors employ various professionals such as Quantity Surveyors, Construction Managers, Architects and Civil/structural engineers among others to lead construction teams. These professionals perform various functions such as tendering and estimation, project quality control, cost control, safety control and time control to ensure that projects are executed and completed within the set parameters. Contractors' ability in using sophisticated methods and their rationalisations are considered crucial in achieving cost success (Doloi, 2013). One of the critical functions of contractors on construction projects is to effectively manage construction labour especially that labour productivity influences quality, cost and project duration. Hence,

contractors were selected to be the source of information required for this study. The three criteria for selecting contractors were; significance of population (in terms of NCC registration), experience and involvement in the execution of medium and large capital building projects.

From the 6 number of grades (1 to 6) of contractors at NCC, grade 1 contractors were found to have a very low population in terms of NCC registration, while grade 6 contractors were found to be involved mostly in small works and with relatively low experience in construction sector. Therefore, the selected Contractors were only those registered with NCC in category B (general building and housing) and grades 2, 3 and 4. Although grade one contractors are involved in medium and large projects, they were not included on the basis of low population in terms of NCC registration. On the other hand, grade 6 contractors were not included on the basis of relatively low experience and not being involved in medium and large capital projects. Contractors were included in this study on the basis of having a significant population in terms of NCC registration, experience and having been involved in the execution of medium and large capital building projects in Zambia. The selected contractors were better placed to provide information relating to building construction activities, construction resources, factors that influence construction labour productivity (CLP) in ZCI, existence of CLP standards in Zambia and the practice of CLP estimation and evaluation in ZCI. The targeted respondents from contractors were construction professionals including; Quantity Surveyors, Construction Managers, Architects and Civil/structural engineers.

3.5.2 Quantity Surveying Professional Firms

Quantity Surveying (QS) Consultants are engaged by the client or employer through contractual arrangement to provide QS Consultancy services on the project. Literature revealed that QS Consultants play a significant role in ensuring that the construction project is executed and completed within the set budget, time and contractual framework. Over the years, Quantity Surveyors have provided financial services and economic consultations for construction projects, contributing to the planning and controlling of construction projects (Shayan et al., 2022). At planning stage, QS Consultants set the

project parameters in terms of project budget, duration and contractual framework. At construction stage, QS consultants monitor project progress and adherence to project budget and contractual provisions. There is a general understanding that one of the key responsibilities of a QS at the construction phase of a project is to help keep costs on track (Mbachu, 2015).

Therefore, QS Consultants are stakeholders concerned with issues of construction labour productivity (CLP) on the project especially that CLP has potential to influence key project parameters such as quality, time and cost. Owing to that, QS professional firms were included in this study as the source of information relating to building construction activities, construction resources, factors that influence construction labour productivity (CLP) in ZCI, existence of CLP standards in Zambia and the practice of CLP estimation and evaluation in ZCI. Notwithstanding the fact that other projects are implemented without professional QS, this study was limited to QS professional firms as other consultants such as Architectural and Engineering were considered to be more inclined to project designs and specifications in as far as construction projects planning and execution is concerned.

3.5.3 Ministry of Labour and Social Security

Literature revealed that the Ministry of Labour and Social Security (MLSS) undertakes to offer several services relating to labour issues such as accidents investigations, career counselling and guidance, approval of occupational pension schemes, dispute resolution, attestation of employment contracts and examination of plant and machinery. Last, but not the least, the MLSS offers services such as inspection of factories, labour and construction works. Therefore, it was prudent to obtain information from the MLSS as a custodian of the labour sector in Zambia. Information obtained from MLSS was that related to their understanding of construction labour productivity (CLP) standards, existence of CLP standards in Zambia, and the process of CLP standards development and publication in Zambia. From the MLSS, the targeted respondents were Inspectors from labour inspection department.

3.5.4 National Council for Construction

Literature revealed that National Council for Construction (NCC) is a statutory body governed by the National Council for Construction Act No. 10 of 2020 under the Laws of Zambia. Under this law, NCC is charged with the responsibility of providing for the promotion, development, training and regulation of the construction industry in Zambia. In fulfilling its mandate, NCC undertakes several activities that include; registration of contractors, registration of manufacturers and suppliers, registration of projects, testing of construction materials, conducting researches on the use of local construction materials, monitoring of contractors and capacity building of medium and small-scale contractors. In order to fulfil its mandate, NCC also carries out several functions. Therefore, NCC was selected to be the source of reliable and pertinent information for this study. Information obtained from NCC was that related to their understanding of construction labour productivity (CLP) standards, existence of CLP standards in Zambia and the process of CLP standards development and publication in Zambia. From NCC, the targeted respondents were Monitoring and Compliance Specialists.

3.5.5 The Engineering Institution of Zambia

The Engineering Institution of Zambia (EIZ) is a statutory professional regulatory body mandated by the EIZ Act No. 17 of 2010 to promote and regulate the engineering profession in Zambia. It is a membership-based corporate body established under Section 3 of the Engineering Institution of Zambia Act No. 17 of 2010. The institution was founded in 1955, and its mandating instrument has since then undergone a number of legislative changes through the 1972, 1992 and 2010 Acts of Parliament. The Engineering Institution of Zambia was re-established under the EIZ Act No. 17 of 2010 for the purpose of promoting and regulating the engineering profession. Under regulation it provides for the registration of engineering organisations and professionals and regulates their professional conduct. Since EIZ is the professional body for a wide range of engineers concerned with ZCI and has been in existence for over 65 years, the institution was worth being considered in this study as the source of information. Information obtained from EIZ was that related to their understanding of construction labour productivity (CLP) standards, existence of CLP standards in Zambia and the process of

CLP standards development and publication in Zambia. From EIZ, the targeted respondents were Technical and Quality Manager and Compliance Inspectors.

3.5.6 Zambia Bureau of Standards

As revealed by literature, ZABS is a statutory body under the ministry of Commerce Trade and Industry established in 1982. ZABS facilitates for the development and publication of standards for different sectors in Zambia. These standards are developed to help the industries produce quality products that meet the expectations of the consumers and complies with the health, safety, and environmental regulations. ZABS has facilitated for the development and publication of standards in various sectors which include food and agriculture, building and construction, information communication technology, chemicals and health, electro technical, textiles, and timber products among others (ZABS, 2022). ZABS standards development section has two major functions that include; development of standards through technical committees and information dissemination on standardisation through the Documentation and Information Centre (DIC). With this huge responsibility of ZABS regarding standards development and publication in Zambia, the statutory body was considered to be the source of pertinent information for this study. ZABS provided information relating to their understanding of construction labour productivity (CLP) standards, existence of CLP standards in Zambia and the process of CLP standards development and publication in Zambia. From ZABS, the targeted respondents were Standards Development Officers.

3.5.7 Zambia Compulsory Standards Agency

From literature, it was revealed that ZCSA is the statutory body mandated to administer, maintain and ensure compliance with Zambian compulsory standards for the purpose of public safety and health, consumer protection and environmental protection. Literature further indicated that ZCSA undertakes to execute various functions regarding the administration and maintenance of compulsory standards in Zambia. Therefore, ZCSA was worth considering to be a source of information in completing this study. Information that was obtained from ZCSA included their understanding of construction labour productivity (CLP) standards, existence of CLP standards in Zambia and the process of

CLP standards development and publication in Zambia. From ZCSA, the targeted respondents were Quality Assurance Officers and Field Inspectors.

3.6 Sample Design

Although the researcher may wish to contact the entire population when carrying out the research, other factors such as cost and time would completely make it is practically impossible to complete the study in time especially for complex studies. As argued by Andrade (2020) that studies are conducted on samples because it is usually impossible to study the entire population. Hence, the concept of “sampling”. In a research context, a sample is a group of items, people or objects that are taken as a representative of the large population for measurement purposes. Thompson (2012), describes sampling as the act, process or technique of selecting a suitable sample or representative part of the population for the purpose of determining parameters or characteristics of the whole population. Therefore, a sample need to be a representative of the population so that the findings can be generalised to the entire population. There are two major categories of sampling namely; probability and non-probability sampling (Etikan and Bala, 2017). In this study both probability and non-probability sampling methods were used to obtain samples of the target groups from the target population.

3.6.1 Non-Probability Sampling

Etikan and Bala (2017) describes non-probability sampling as the type of sampling where the researcher has some measure of control over who is selected and on the selection methods. With this type of sampling each unit from the population has a different chance of being included in the sample. Purpose or judgmental is a typical type of non-probability sampling. Purpose or judgmental is one of the types of non-probability sampling technique where units are selected subjectively by the researcher who attempts to obtain a sample that seems to be a representative of the population (Etikan and Bala, 2017). In this research QS Consulting firms, Ministry of Labour and Social Security (MLSS) and statutory bodies such as NCC, EIZ, ZABS and ZCSA were selected based on the knowledge and judgement of the researcher.

3.6.2 Probability Sampling

Probability sampling is the sampling technique where each unit of the population has an equal and independent chance of being included in the sample in a single draw from the population (Etikan and Bala, 2017). Stratified sampling is the type of probability sampling where sampling is done within particular sections of target groups that share the same characteristics (Neville, 2007). Stratified sampling ensures that different groups of a population are adequately represented in the sample to increase the level of accuracy in estimating parameters. Stratified sampling technique was used to select contractors registered with National Council for Construction (NCC) in category B (general building and housing) grade 2, 3 and 4.

3.6.3 Sample Sizing

Other than selecting the right method of sampling, determining the suitable size of the sample is another important part of aspect of sample design. Sample size is determined by factors such as what the researcher intends to do with the findings and the type of relationships or characteristics being investigated (Fraenkel et al., 2012). The sample sizes for contractors registered with NCC in category B and grade 2, 3 and 4 were 20 percent, 15 percent and 10 percent respectively. For QS Consulting firms, the sample size was 75 percent. For the MLSS and statutory bodies (NCC, EIZ, ZABS and ZCSA) the sample size was 100 percent for each institution. Considering the information that was to be obtained from the target groups, the sample sizes stated above were adequate for this study.

i. Sample Sizing for Contractors using Stratified Sampling Technique.

The formular for calculating sample size for contractors using stratified sampling technique is; n_i is equal to (N_i/N) multiply by n , where n_i is sample size for contractors in each grade, N_i is population for contractors in each grade, N is the total study population (which is the sum of grade 2, 3 and 4 contractors) and n is strata or percentage size for contractors in each grade. The number of contractors for each grade have been obtained from NCC list of registered contractors for the year 2022. Percentage size or Strata n for contractors in each grade is computed by; n is equal to required percentage size of sample

multiply by population **N**. Computation of sample size for each grade (2, 3 and 4) of selected contractors is shown in table 3.2. The two formular are shown as follows.

- a) Sample required (**ni**) = (**Ni/N**) x **n**
- b) Strata (**n**) = Percentage sample size x **N**.

i. Sample Sizing for Quantity Surveying Consulting Firms using Judgmental Sampling Technique.

The formular for calculating sample size for contractors using stratified sampling technique is; sample (**ni**) is equal to **n** multiply by **Ni**, where **ni** is sample size for the consultants being considered, **n** percentage sample size of the consultant being considered and **Ni** total population of the category of consultants being considered. The population for the Quantity Surveying (QS) consulting firms was obtained from the Quantity Surveyors Registration Board (QSRB).

- a) Sample (**ni**) = **n** x **Ni**

ii. Sample Sizing for MLSS, NCC, EIZ, ZABS and ZCSA using Judgmental Sampling Technique.

ni = **Ni**, where **ni** sample size and **Ni** population of the statutory body being considered. The sample size for MLSS and each statutory body (NCC, EIZ, ZABS and ZCSA) were taken as 100 percent for each institution using judgmental sampling technique as shown in table 3.2 below.

- b) Sample (**ni**) = **Ni**

Table 3.2 shows the summary of the sample design for this study. The table shows the target group, sampling method used, study population, percentage sample size, sample computation and the sample size for all the target groups.

Table 3.2: Sample Design

Target Groups	Sampling Method	Study Population as at 2022	% Sample Size	Strata Size	Sample Computation	Sample Size
Building Contractors				$n = \% \times N$	$ni = (Ni/N) \times n$	
Grade 2 Contractors	Stratified	$Ni = 17$	60%	$0.6 \times 147 = 88.2$	$[17/147] \times 88.2$	11
Grade 3 Contractors	Stratified	$Ni = 21$	50%	$0.5 \times 147 = 73.50$	$[21/147] \times 73.50$	10
Grade 4 Contractors	Stratified	$Ni = 109$	30%	$0.3 \times 147 = 44.10$	$[109/147] \times 44.10$	33
Consultants					$ni = n \times Ni$	
QS Consulting Firms $Ni = 12$	Judgmental	$Ni = 12$	75%	-	0.75×12	9
Govt. Ministries					$ni = Ni$	
MLSS	Judgmental	$Ni = 1$	100%	-	$ni = 1$	1
Statutory Bodies					$ni = Ni$	
NCC	Judgmental	$Ni = 1$	100%	-	$ni = 1$	1
EIZ	Judgmental	$Ni = 1$	100%	-	$ni = 1$	1
ZABS	Judgmental	$Ni = 1$	100%	-	$ni = 1$	1
ZCSA	Judgmental	$Ni = 1$	100%	-	$ni = 1$	1

3.7 Methods of Data Collection

Rajasekar et al. (2006) described a social research as a systematic way of gaining knowledge on a particular subject through a systematic process involving; defining the problem, formulating the hypothesis or research questions, organising, collecting data, analysing the findings and making deductions to reach a conclusion. Data collection is therefore an important part of the social research. Information gathered for the research can be classified as either primary (first hand) or secondary (second hand) data. Methods that can be used to collect data are; interviews, focus groups, observations and questionnaires among others. In order to select the suitable data collection methods, the researcher need to understand their research, type of the data required and any anticipated challenges and how they intend to deal with them. In this research, primary (firsthand)

data was collected using questionnaires while secondary data was gathered through literature review.

3.7.1 Questionnaires

Questionnaires are widely used in social research and may contain open and or closed questions (Sahu and Singh, 2016). This research employed questionnaires to collect data from the target groups. Questionnaires were suitably designed and administered to ensure that required primary data was obtained from the target groups. Respondents were divided into two sets. The first set of respondents was for Contractors and QS professional firms. The second set of respondents was for the Ministry of Labour and Social Security (MLSS) and statutory bodies; NCC, EIZ, ZABS and ZCSA. Therefore, one questionnaire was designed for each set of respondents. Hence, there were two types of questionnaires. The first questionnaire was for Contractors and QS professional firms, and the second questionnaire was for MLSS and statutory bodies (NCC, EIZ, ZABS and ZCSA). However, few questions which applied to respondents from both groups were included in both type of questionnaires.

3.8 Techniques / Methods for Data Analysis

Data analysis is an approach to de-synthesising data, information or factual elements to answer research questions, and it involves working with data, organising it, breaking it into manageable units, synthesising it, searching for patterns, discovering what is important and what is to be learned, and deciding what to tell others (Morrill et al., 2000). Techniques of analysing data can be classified as qualitative and quantitative data analysis techniques (Rapport, et al., 2015). In this research, the data gathered was analysed using Statistical Package for Social Science (SPSS) and Microsoft Excel. Statistical techniques that were used was frequencies, chi-square and regression test.

Table 3.3: Research Methodology

Target Groups	Sampling Method	% Sample Size	Sample Size	Data Collection Methods	No. of Questionnaires Distributed	Data Analysis
Building Contractors						
Grade 2 Contractors Ni = 17	Stratified	60%	11	Questionnaire	11	Frequency tables, Chi-square & Regression test
Grade 3 Contractors Ni = 21	Stratified	50%	10	Questionnaire	10	
Grade 4 Contractors Ni = 109	Stratified	30%	33	Questionnaire	33	
Consultants						
QS Consulting Firms Ni = 12	Judgmental	75%	9	Questionnaire	9	Frequency tables, Chi-square & Regression test
Govt. Ministries						
MLSS	Judgmental	100%	1	Questionnaire	3	Frequency tables, Chi-square & Regression test
Statutory Bodies						
NCC	Judgmental	100%	1	Questionnaire	3	Frequency tables, Chi-square & Regression test
EIZ	Judgmental	100%	1	Questionnaire	4	
ZABS	Judgmental	100%	1	Questionnaire	3	
ZCSA	Judgmental	100%	1	Questionnaire	4	

3.9 Chapter Summary

This study employed quantitative research methodology. Lusaka province was the targeted area and the targeted groups of population were; contractors, QS professional firms, MLSS and statutory bodies. Contractors included those registered with NCC in category B (General Building and Housing) grade 2, 3 and 4. Statutory bodies included NCC, EIZ, ZABS and ZCSA. Stratified probability sampling was used to select contractors while judgmental probability sampling was used to select QS professional firms, MLSS and statutory bodies such as NCC, EIZ, ZABS and ZCSA. Methods / techniques for collecting secondary data included literature review while primary data was gathered through questionnaires. Information gathered was analysed using SPSS and Microsoft Excel. The tools used for data analysis were frequency tables, chi-square and regression test.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presented results gathered from the survey that was conducted between 12th November 2022 and 20th December 2022. There were 2 types of questionnaires and 2 sets of respondents. Type 1 questionnaires were for Contractors and Quantity Surveying (QS) professional firms, while type 2 questionnaires were for the Ministry of Labour and Social Security (MLSS) and statutory bodies; NCC, EIZ, ZABS and ZCSA. Questions which were applicable to both sets of respondents were included in both type 1 and type 2 questionnaires. In most instances, questions were designed with a 5-point Likert scale. However, a 6th option for “not applicable” was introduced in questions which were not applicable to other respondents.

4.2 Questionnaire Administration Response Rate and Profile of Respondents

A total of 80 questionnaires were distributed to the target groups who were Contractors, QS professional firms, MLSS, NCC, EIZ ZABS and ZCSA. Out of 80 questionnaires that were distributed, 63 were type 1 questionnaires for Contractors and QS professional firms while 17 were type 2 questionnaires for Ministry of Labour and Social Security (MLSS) and statutory bodies; NCC, EIZ, ZABS and ZCSA. Out of the total 80 questionnaires that were distributed, a total of 65 questionnaires were successfully completed and collected, and this translated to 81 percent overall response rate. Figure 4.1 shows questionnaire administration response rate. Background information was also obtained from both sets of respondents. From Contractors and QS professional firms, the background information obtained was; the type of services offered by respondents’ company, NCC grade of respondents’ company, respondents’ field of specialisation and respondents’ years of experience. From respondents of government institutions, the background information obtained was respondents’ name of institution, respondents’ position in the institution and respondents’ years of experience. Table 4.1 shows the profile of type 1 respondents (Contractors and QS professional firms) and Table 4.2 shows the profile of type 2 respondents (MLSS, NCC, EIZ ZABS and ZCSA).

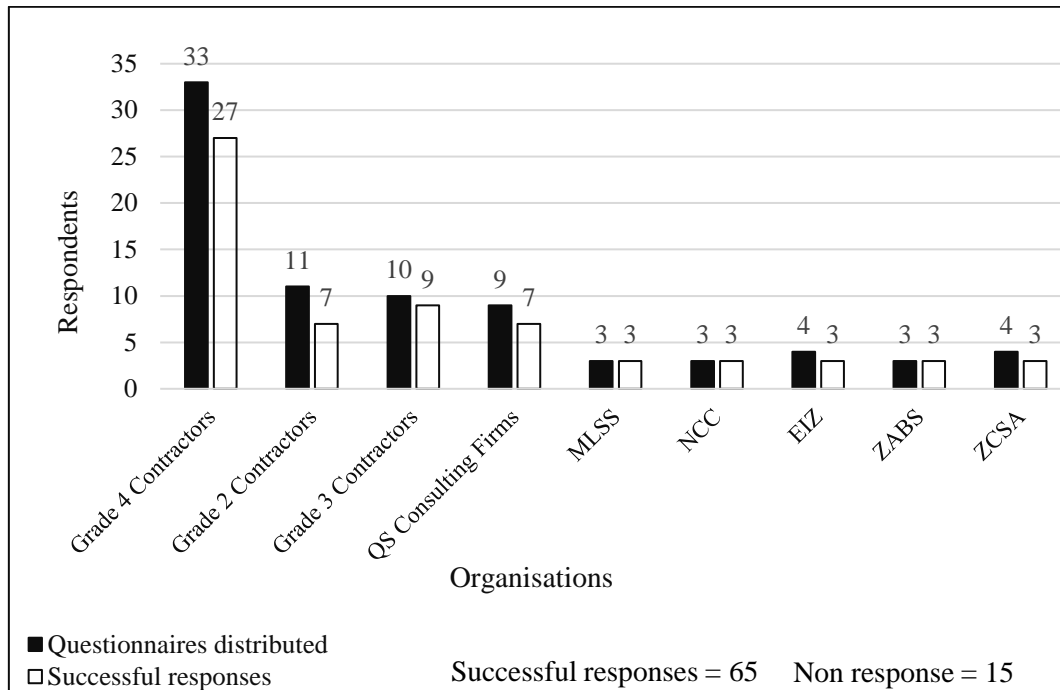


Figure 4.1: Questionnaire administration and response rate

Table 4.1: Profile of Contractors and QS Professional Firms (Type 1 Respondents)

Organisation	Respondent's Field of Specialisation	No. of Respondents
Contractors	Quantity Surveyors	28
	Civil/Structural Engineers	7
	Construction Managers	4
	Architects	4
QS Professional Firms	Quantity Surveyors	7
Total Respondents		50
Experience of Respondents		No. of Respondents
0 - 5 years		5
5 - 10 years		23
10 - 15 years		18
15 years and above		4

Table 4.2: Profile of Statutory Bodies (Type 2 Respondents)

Statutory Body	Respondents Position in the Organisation	No. of Respondents
MLSS	Labour Inspector	3
NCC	Compliance and Monitoring Specialist	3
EIZ	Technical and Quality Manager	1
	Inspector	2
ZABS	Standards Development Officer	3
ZSCA	Quality Assurance Officer	2
	Inspector	1
Total Respondents		15
Experience of Respondents		No. of Respondents
5 - 10 years		8
10 - 15 years		6
15 years and above		1

4.3 Building Construction Activities and Construction Labour Productivity Standards

The following were the results on building construction activities, construction resources, and construction labour productivity standards.

4.3.1 Percentage of Labour-Intensive Construction Activities on Building Projects

Results from the first set of respondents (Contractors and QS Consultants) are shown in Figure 4.2. According to 82 percent of respondents as shown in Figure 4.2, the percentage of labour-intensive construction activities in building projects is between 60 to 80 percent.

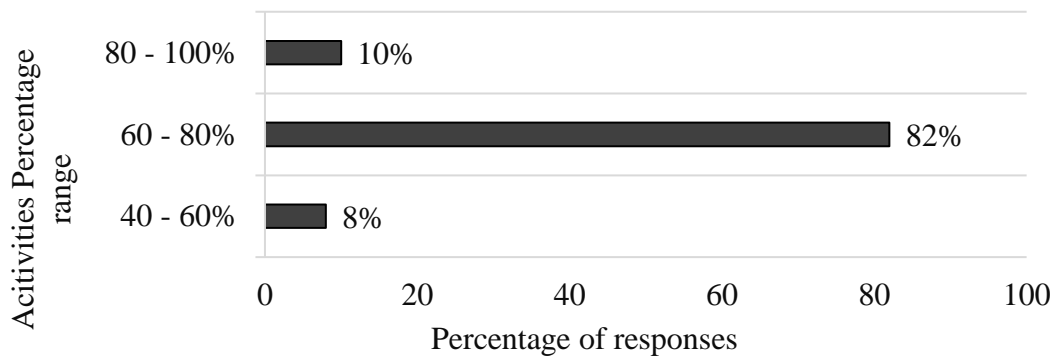


Figure 4.2: Percentage of labour-intensive construction activities in building projects.

4.3.2 Major Resources Required for Optimal Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.3. According to 72 percent of respondents as shown in Figure 4.3, construction materials, construction labour and construction tools/equipment are the major resources required for optimal CLP. Table 4.3 shows the association of the major resources required for optimal CLP with the percentage of labour-intensive construction activities in building projects. Results indicate statistical significance between the major resources required for optimal CLP (P- value 0.00, less than 0.05) and the percentage of labour-intensive construction activities in building projects. Therefore, the Null hypothesis H_{N1} which stated that; construction materials, construction labour and construction tools/equipment are not the major resources required for optimal CLP in ZCI was rejected.

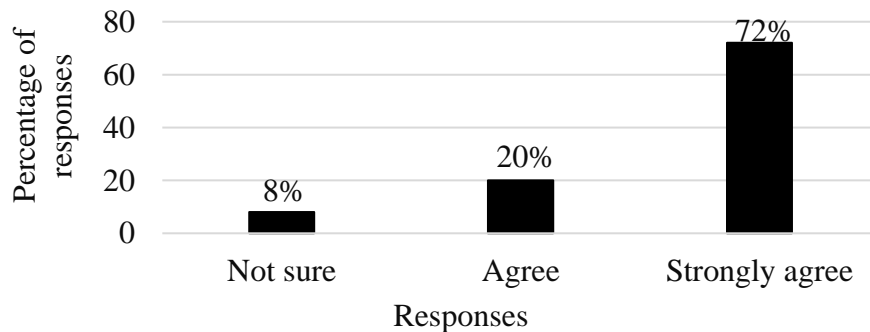


Figure 4.3: Major construction resources required for optimal CLP.

Table 4.3: Association of major resources required for optimal CLP in ZCI and Percentage of labour-intensive construction activities in building projects

		Major resources required for optimal CLP in ZCI			Chi-square test		
		Not sure	Agree	Strongly agree	Pearson Chi-square	d.f	P-value
Percentage of labour-intensive activities in building projects	40 - 60%	4	0	0	7.951	4	0.00
	60 - 80%	0	5	36			
	80 - 100%	0	5	0			
Total		4	10	36			

4.3.3 Respondents' Understanding of Construction Labour Productivity Standards

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.4 and results from the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) are shown in Figure 4.5. According to 80 percent of the first set of respondents (Contractors and QS professional firms) as shown in Figure 4.4, construction labour productivity standards are labour outputs per man hour. According to 40 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) as shown in Figure 4.5, construction labour productivity standards are labour outputs per man hour. Further, 40 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) as shown in Figure 4.5 were not sure whether construction labour productivity standards are labour outputs per man hour.

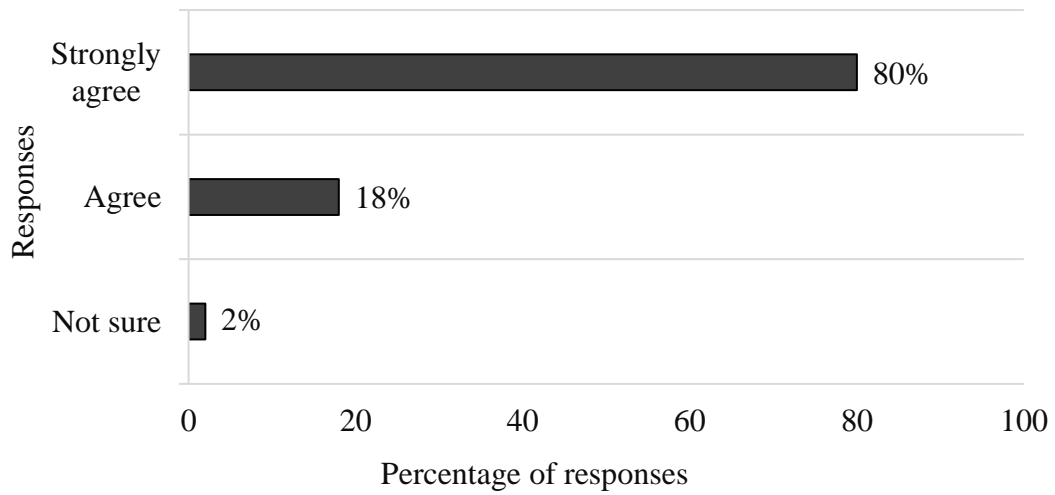


Figure 4.4: Respondents’ understanding of CLP standards: Contractors and QS Consultants

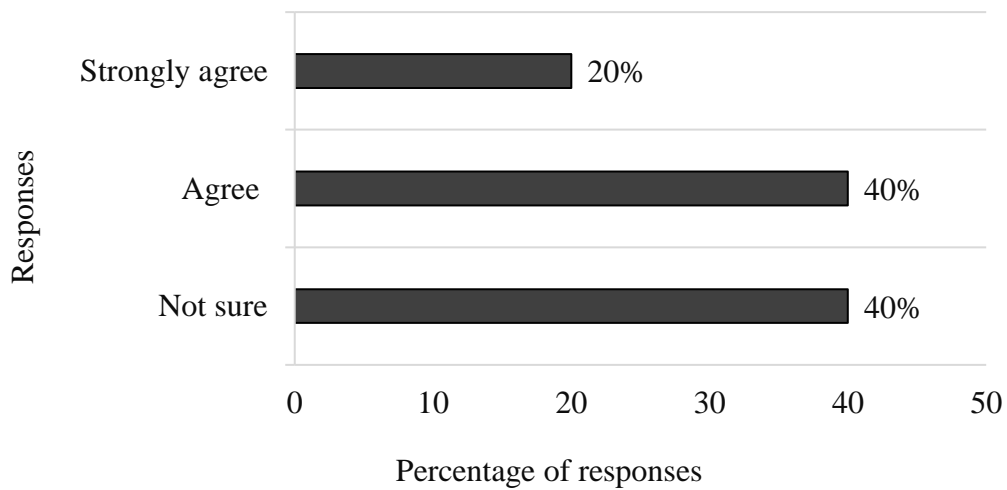


Figure 4.5: Respondents’ understanding of CLP standards: MLSS, NCC, EIZ, ZABS and ZCSA.

4.3.4 Existence of Published Construction Labour Productivity Standards in Zambia

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.6 and results from the second set of respondents (MLSS, NCC, EIZ,

ZABS and ZCSA) are shown in Figure 4.7. According to 62 percent of the first set of respondents (Contractors and QS professional firms) as shown in Figure 4.6, there were no construction labour productivity standards in Zambia whose development and publication were facilitated by Zambia Bureau of Standards (ZABS). According to 53.3 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) as shown in Figure 4.7, there were no construction labour productivity standards in Zambia whose development and publication were facilitated by Zambia Bureau of Standards (ZABS).

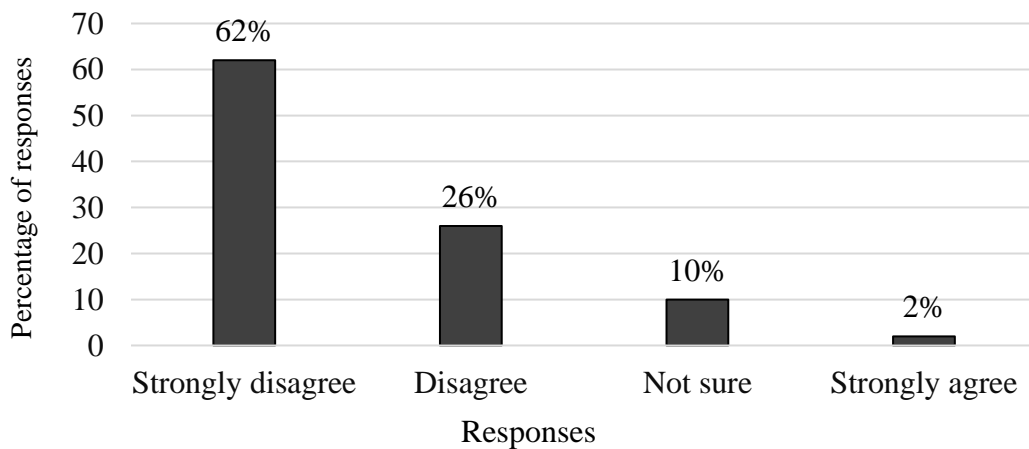


Figure 4.6: Existence of published CLP standards in Zambia: Contractors and QS Consultants

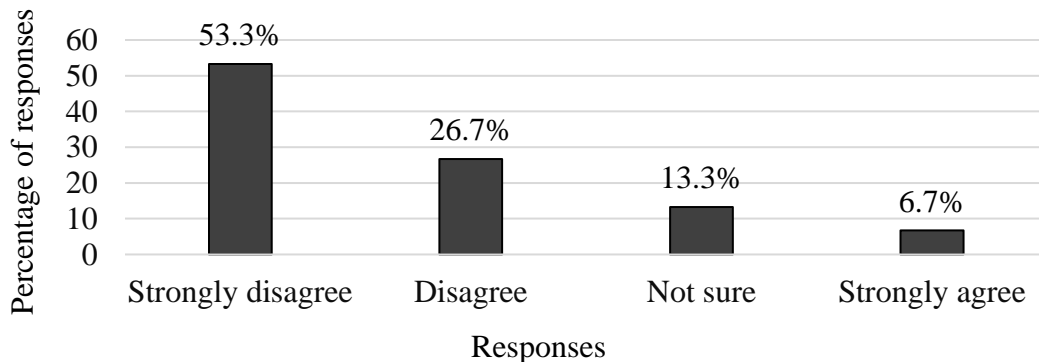


Figure. 4.7: Existence of published CLP standards in Zambia: MLSS, NCC, EIZ, ZABS and ZCSA.

4.4 Practices of Estimation and Evaluation of Construction Labour Productivity in Zambian Construction Industry

The following were the results on the practice of the estimation and evaluation of construction labour productivity in the Zambian Construction Industry.

4.4.1 Methods of Estimation and Evaluation of Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are presented in Figure 4.8, Figure 4.9, and Figure 4.10. In all the cases, the figure shows the respondents' answer and its corresponding percentage out of the total successful responses. According to 58 percent of respondents as shown in Figure 4.8, individual experience is highly used in estimation and evaluation of CLP in ZCI. According to 64 percent of respondents as shown in Figure 4.9, historical labour productivity data is highly used in estimation and evaluation of CLP in ZCI. According to 72 percent of respondents as shown in Figure 4.10, the use of published CLP standards in the estimation and evaluation of CLP in ZCI is very low.

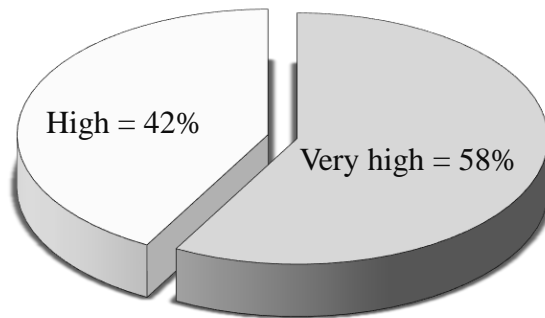


Figure 4.8: Use of individual experience in CLP estimation and evaluation

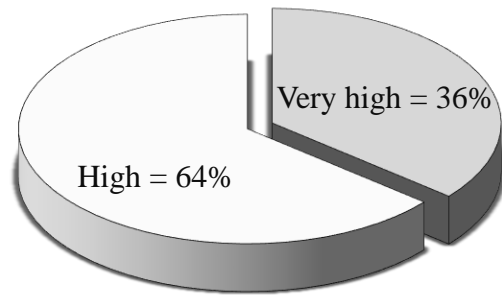


Figure 4.9: Use of historical productivity data in CLP estimation and evaluation

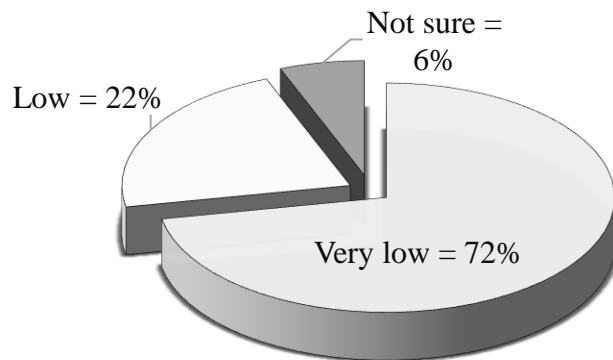


Figure 4.10: Use of published CLP standards in CLP estimation and evaluation

4.4.2 Consistence in the Estimation and Evaluation of Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.11. According to 44 percent of respondents, they agreed that sometimes estimators in ZCI generate different estimates and evaluations of CLP on the same or similar works. According to 38 percent of respondents as shown in Figure 4.11, they strongly agreed that sometimes estimators in ZCI generate different estimates and evaluations of CLP on the same or similar works. According to 18 percent of respondents as shown in Figure 4.11, they were not sure if sometimes estimators in ZCI generate different estimates and evaluations of CLP on the same or similar works.

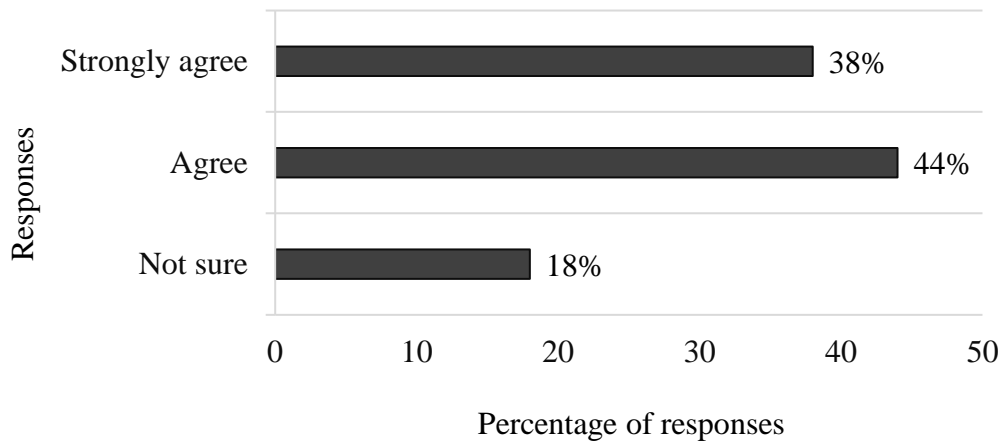


Figure 4.11: Consistence in CLP estimation and evaluation in ZCI.

4.4.3 Causes of Inconsistence in the Estimation and Evaluation of Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.12 in terms of respondents' answer and its corresponding percentage out of the total successful responses. According to 54 percent of respondents as shown in Figure 4.12, inconsistency in CLP estimation and evaluation in ZCI is caused by the use of different labour productivity data and different individual experience among estimators.

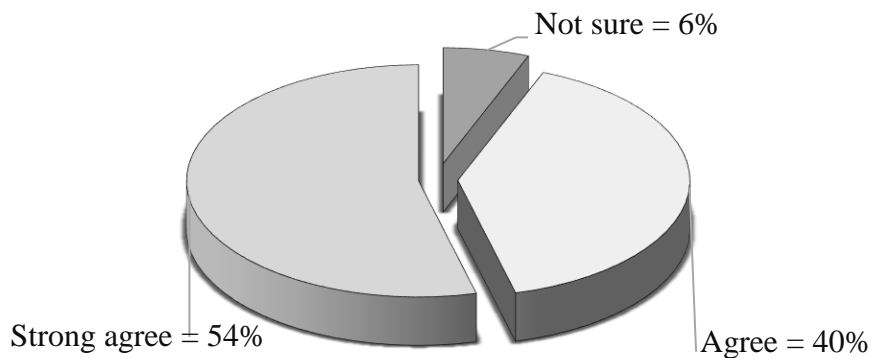


Figure 4.12: Use of different labour productivity data and different individual experience causing inconsistence in CLP estimation and evaluation in ZCI.

4.5 Factors that Influence Construction Labour Productivity in Zambian Construction Industry

The following were the results on the factors that influence construction labour productivity in Zambian Construction Industry.

4.5.1 Factors that Influence Construction Labour Productivity in Zambian Construction Industry

The results were based on four categories of factors that influence construction labour productivity. These four categories included; those related to work, those related to workers, those related to weather and those related to management.

i. Work Related Factors

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.13 in terms of the number of responses per each answer and its corresponding percentage out of the total successful responses. According to 68 percent of respondents as shown in Figure 4.13, work related factors such as materials management, types of materials, construction site plan, site condition, tools/equipment, construction methods, supervision and occupational health and safety influence CLP in the ZCI.

Table 4.4 shows the association of work-related factors that influence CLP in ZCI with the percentage of labour-intensive construction activities on building projects. Results indicate statistical significance between work-related factors that influence CLP (P-value 0.012, less than 0.05) with the percentage of labour-intensive activities on building projects. Therefore, the Null hypothesis H_{N2} which stated that; Work related factors such as; materials management, types of materials, construction site plan, site condition, tools/equipment, construction methods, supervision, and occupational health and safety do not influence construction labour productivity in ZCI was rejected.

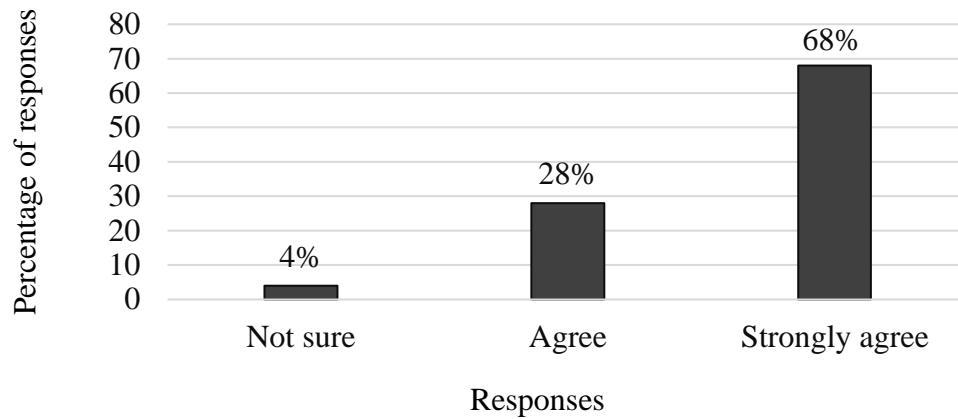


Figure 4.13: Influence of work-related factors on CLP in the ZCI

Table: 4.4: Association of work-related factors that influence CLP in ZCI Vs. Percentage of labour-intensive construction activities in building projects

		Work related factors that influence CLP in ZCI			Chi-square test		
		Not sure	Agree	Strongly agree	Pearson chi-square	d.f	P-value
Percentage of labour-intensive activities in building projects	40 - 60%	1	3	0	12.953	4	0.012
	60 - 80%	1	11	29			
	80 - 100%	0	0	5			
Total		2	14	34			

ii. Worker Related Factors

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.14 in terms of the respondents' answers and the corresponding percentage out of the total successful responses. According to 74 percent of respondents as shown in Figure 4.14, worker-related factors such as worker experience and skill, motivation and morale, worker state of mind, worker-supervisor relationship, health condition, fatigue and physical fitness influence CLP in ZCI.

Table 4.5 shows the association of worker-related factors that influence CLP in ZCI with the percentage of labour-intensive construction activities on building projects. The results indicate statistical significance between worker-related factors that influence CLP in ZCI (P-value 0.033, less than 0.05) with the percentage of labour-intensive construction activities on building projects. Therefore, the Null hypothesis HN_3 which stated that; Worker related factors such as; worker experience and skill, motivation and morale, worker state of mind, worker-supervisor relationship, health condition and physical fitness do not influence construction labour productivity in ZCI was rejected.

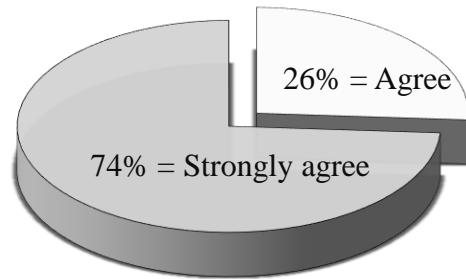


Figure 4.14: Influence of worker-related factors on CLP in the ZCI

Table: 4.5: Association of worker-related factors that influence CLP in ZCI and Percentage of labour-intensive construction activities in building projects

		Worker related factors influence CLP in ZCI.		Chi-square test		
		Agree	Strongly agree	Pearson chi-square	d.f	P-value
Percentage of labour-intensive activities in building projects	40 - 60%	3	1	6.804	2	0.033
	60 - 80%	10	31			
	80 - 100%	0	5			
Total		13	37			

iii. Weather Related Conditions

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.15. According to 62 percent of respondents as shown in Figure 4.15, weather related factors such as temperature, wind, humidity and rainfall influence CLP in the ZCI.

Table 4.6 shows an association of weather-related factors that influence CLP in ZCI with the percentage of labour-intensive construction activities on building projects. However, results indicate no statistical significance between weather-related factors that influence CLP in ZCI (P-value 0.333, more than 0.05) with the percentage of labour-intensive construction activities on building projects. Therefore, the Null hypothesis HN_4 which stated that; weather-related factors such as temperature, wind, humidity and rainfall do not influence construction labour productivity in ZCI was accepted.

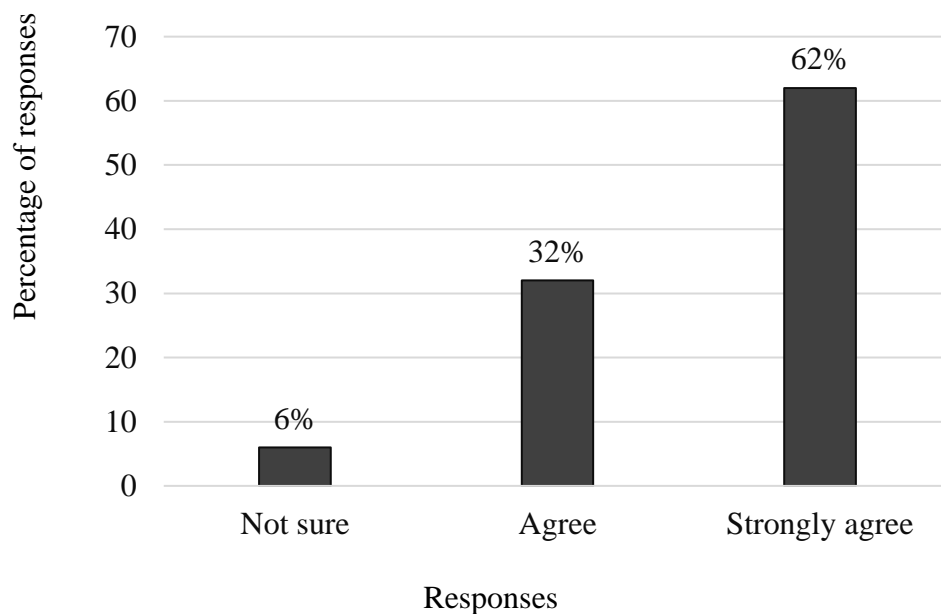


Figure 4.15: Influence of weather-related factors on CLP in the ZCI

Table: 4.6: Association of weather-related factors that influence CLP in ZCI and Percentage of labour-intensive construction activities in building projects

		Weather related factors influence CLP in ZCI.			Chi-square test		
		Not sure	Agree	Strongly agree	Pearson chi-square	d.f	P-value
Percentage of labour-intensive activities in building projects	40 - 60%	1	2	1	4.582	4	0.333
	60 - 80%	2	13	26			
	80 - 100%	0	1	4			
Total		3	16	31			

iv. Management Related Factors

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.16. According to 54 percent of respondents as shown in Figure 4.16, management-related factors such as casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare influence CLP in ZCI.

Table 4.7 shows the association of management-related factors that influence CLP in ZCI with the percentage of labour-intensive construction activities on building projects. Results indicate a statistical significance between management related factors that influence CLP in ZCI (P-value 0.005, less than 0.05) and the percentage of labour-intensive construction activities on building projects. Therefore, the Null hypothesis H_{N5} which stated that; management-related factors such as casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare do not influence construction labour productivity in ZCI was rejected.

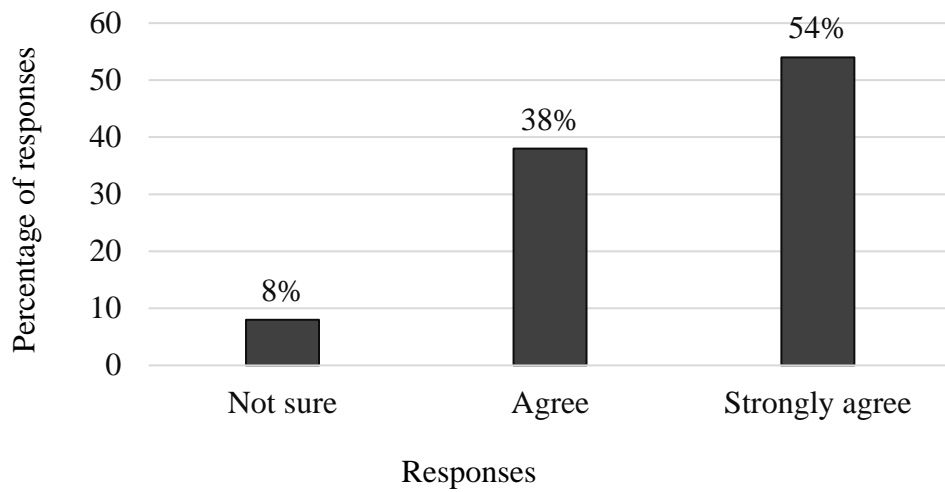


Figure 4.16: Influence of management-related factors on CLP in the ZCI

Table: 4.7: Association of Management-related factors that influence CLP in ZCI and Percentage of labour-intensive construction activities in building projects

		Management related factors			Chi-square test		
		Not sure	Agree	Strongly agree	Pearson chi-square	d.f	P-value
Percentage of labour-intensive activities in building projects	40 - 60%	2	0	2	14.821	4	0.005
	60 - 80%	2	15	24			
	80 - 100%	0	4	1			
Total		4	19	27			

4.5.2 Difference in the Extent of Factors that Influence Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.17. According to 74 percent of respondents as shown in Figure 4.17, the extent of factors that influence CLP in ZCI may differ from project to project, company to company or location to location.

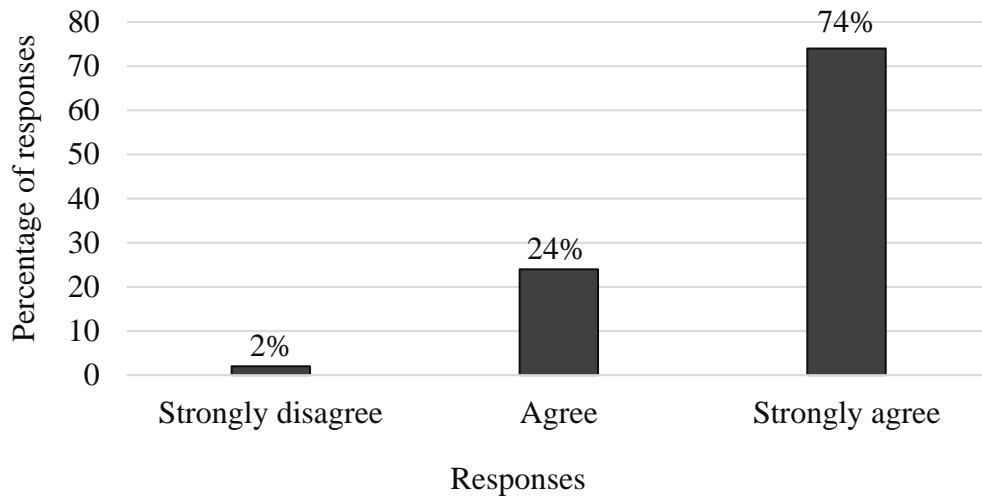


Figure 4.17: Difference in the extent of factors that influence CLP in ZCI.

4.5.3 Time Related Variability of Factors that Influence Construction Labour Productivity in Zambian Construction Industry

Results from the first set of respondents (Contractors and QS professional firms) are shown in Figure 4.18 in terms of respondents' answer and the corresponding percentage out of the total successful responses. According to 68 percent of respondents as shown in Figure 4.18, factors that influence CLP in ZCI may change from time to time.

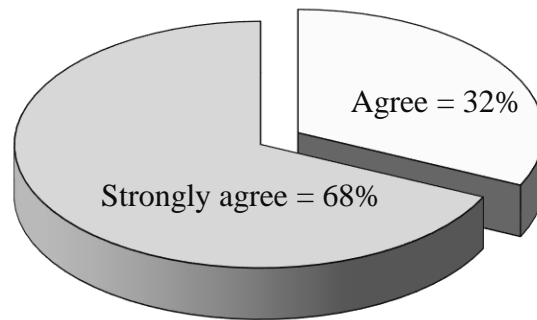


Figure 4.18: Time related variability of factors that influence CLP in ZCI.

4.6 Construction Stakeholders and the Process of Developing Construction Labour Productivity Standards in Zambia

The following were the results on construction stakeholders and the process of developing construction labour productivity standards in Zambia.

4.6.1 Construction Stakeholders to Initiate the Process of Developing Construction Labour Productivity Standards in Zambia

Results from the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) are shown in Figure 4.19. According to 86.7 percent of respondents as shown in Figure 4.19, the process of CLP standards development in Zambia would be initiated by government institutions such as MLSS, NCC, EIZ, ZABS and ZCSA in collaboration with other relevant construction stakeholders.

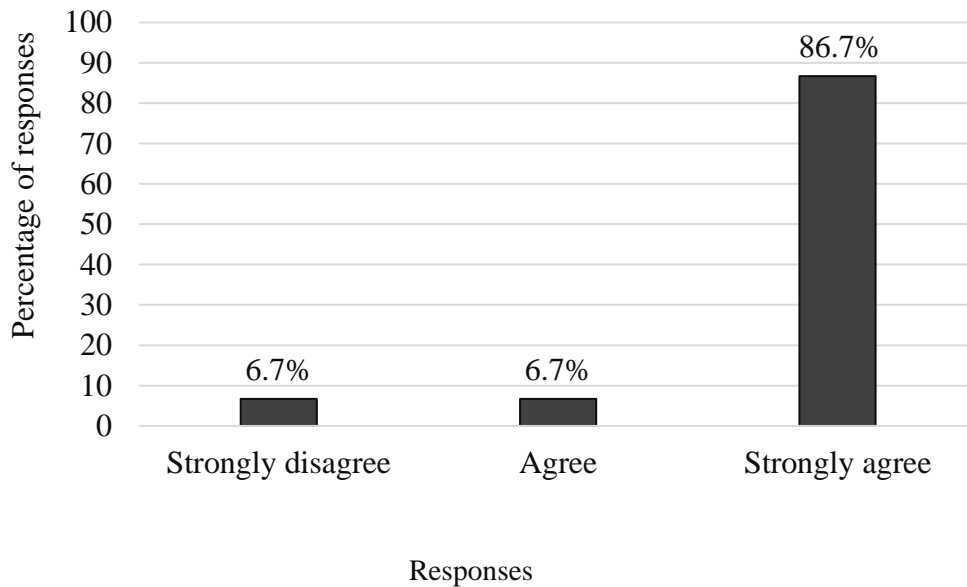


Figure 4.19: Initiating the development of CLP standards in Zambia.

4.6.2 Consultative Process by SDTC for Developing Construction Labour Productivity Standards in Zambia

Results from the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) are shown in Figure 4.20 in terms of respondents' answer and the corresponding percentage out of the total successful responses. According to 93.3 percent of respondents as shown in Figure 4.20, developing CLP standards in Zambia would involve a consultative process by Standard Development Technical Committee (SDTC) comprising of various experts from various sectors to conduct detailed reviews and surveys on construction labour productivity so as to reach a consensus.

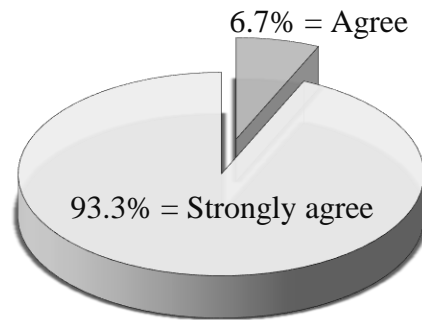


Figure 4.20: Consultative process of CLP standards development in Zambia.

4.6.3 Challenges in the Process of Developing Construction Labour Productivity Standards in Zambia

Results from the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) are shown in Figure 4.21. According to 60 percent of respondents as shown in Figure 4.21, developing CLP standards in Zambia would be possible but would not be an easy undertaking owing to the complexity nature of the subject of construction labour productivity and the involvement of various experts from various sectors.

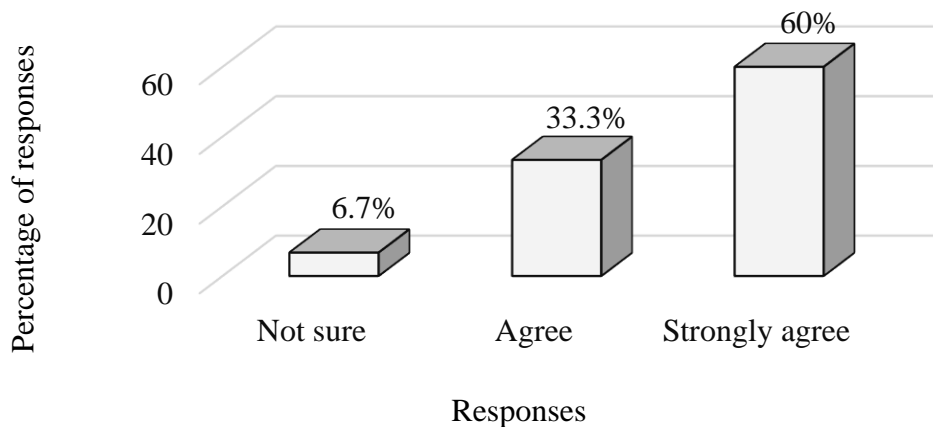


Figure 4.21: Complexity of CLP standards development in Zambia.

4.6.4 Cost and Time Implication of Developing Construction Labour Productivity Standards in Zambia

Results from the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) are shown in Figure 4.22 in terms of respondents' answer and the corresponding percentage out of the total successful responses. According to 73.3 percent of respondents as shown in Figure 4.22, the procedure of developing construction labour productivity standards in Zambia would require sufficient funding and specific timeframe.

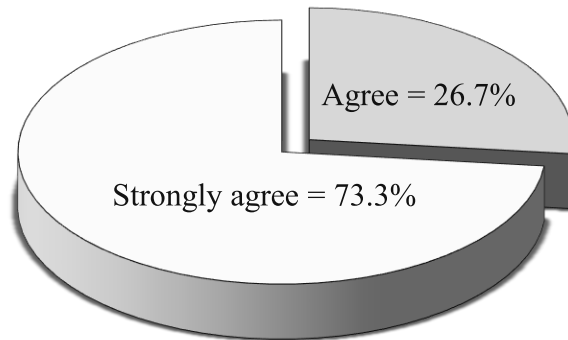


Figure 4.22: Cost and time implication of CLP standards development in Zambia.

4.7 Regression

Regression test was performed on the categories of factors found to be statistically significant in influencing CLP in ZCI as shown in Table 4.8. In table 4.9, these factors are rearranged in accordance with the importance, from the highest to the lowest. The value of the standardised coefficients (Beta) signifies the extent of influence of the factors on CLP. The ranking was as follows; work related factors number 1, worker related factors number 2, resources required for optimal CLP number 3 and management related factors number 4.

Table: 4.8: Regression of independent variables

Model		Unstandardised Coefficients		Standardised Coefficient	t
		B	Std. Error	Beta	
1	(Constant)	1.386	0.736		1.882
	Resources Required for Optimal CLP: Construction materials, construction labour and construction equipment	0.136	0.090	0.201	1.506
	Factors Related to Work that influence CLP: Materials management, types of materials, construction site layout, site condition, errors in drawings tools/equipment, construction methods, supervision, and occupational health and safety.	0.300	0.105	0.394	2.855
	Factors related to Workers that Influence CLP: Worker experience and skill, motivation and morale, worker state of mind, age, fatigue, worker-supervisor relationship, health condition and physical fitness.	0.213	0.157	0.221	1.355
	Factors Related to Management that Influence CLP: Casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, poor communication systems and management's lack of commitment to workers' general welfare influence LP.	-0.107	0.092	-0.161	-1.158

In table 4.9, 4 categories of factors that influence construction labour productivity are rearranged in accordance with the importance from the highest to the lowest.

Table 4.9: Hierarchy of factors that influence CLP in ZCI

Item	Factor	Standardised Coefficient (Beta)	Rank
a	Factors related to Work: Materials management, types of materials, construction site layout, site condition, tools/equipment, construction methods, supervision, and occupational health and safety.	0.394	1
b	Factors related to workers: Worker experience and skill, motivation and morale, worker state of mind, worker-supervisor relationship, fatigue, health condition and physical fitness.	0.221	2
c	Resources Required for optimal CLP: Construction materials, labour and equipment	0.201	3
d	Factors related to Management: Casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, poor communication systems and management's lack of commitment to workers' general welfare influence CLP.	-0.161	4

4.8 Chapter Summary

This chapter presented results of the study. Information gathered was analysed using SPSS and Microsoft Excel. Frequencies, chi-square and regression test were used to analyse data. The study revealed that 60 to 80 percent of activities on building projects are labour-intensive and that resources required for optimal CLP are construction materials, construction labour and construction tools/equipment. The study also revealed that there are no published CLP standards in Zambia, and hence estimators are relying on their individual experience and historical productivity data (comparative method) in estimation and evaluation of CLP. The study also revealed 4 categories of factors that have significant influence on CLP in ZCI as those related to work, those related to workers, and those related to management. The study further revealed that the process of CLP standards development in Zambia would be initiated by stakeholders such as MLSS,

NCC, EIZ, ZABS and ZCSA and would require the formulation of SDTC to conduct consultative process. The study further showed that the process of developing CLP standards is possible but there would be some challenges due to complex nature of CLP and involvement of various experts. Lastly, the study showed that CLP standards development would have a cost implication and the process would need to be completed within a specific timeframe.

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Introduction

This chapter discussed the findings of the study. As observed from the previous chapter, there were two types of questionnaires; type 1 questionnaires were for the first set of respondents (Contractors and QS professional firms) and type 2 questionnaires were for the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA).

5.2 Building Construction Activities and Construction Labour Productivity Standards

This section discussed results on building construction activities and construction labour productivity standards.

5.2.1 Percentage of Labour-Intensive Construction Activities in Building Projects

According to 82 percent of respondents, concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation together account for 60 to 80 percent of scope of work in building projects. This study revealed that labour-intensive construction activities such as concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation together account for about 60 to 80 percent of scope of work in building projects. Scholars such Karim et al. (2013) supported these results by stating that except for heavy civil, railway or road projects, most construction projects are labour intensive with basic hand tools and equipment as labour costs comprise 30 to 50 percent of overall projects cost. Employing of large proportion of labour on building projects signifies that most activities are labour intensive. Therefore, construction labour productivity is crucial on building projects as 60 to 80 percent of activities on these projects are labour intensive as revealed by this study.

5.2.2 Major Resources Required for Optimal Construction Labour Productivity

According to 72 percent of respondents, construction materials, labour and tools/equipment are the major resources required for optimal CLP in ZCI. These results were subjected to chi-square test and were found to be statistically significant, leading to

the rejection of the Null hypothesis HN1; which stated that construction materials, labour and tools/equipment are not the major resources required for optimal CLP.

Results from this study were supported by Parthasarathy et al. (2017) who argued that, the three types of major resources required for execution of buildings are manpower, materials, and equipment. Hamza et al. (2022) also ranked worker efficiency / skill, materials, tools and equipment as some of the major factors of CLP. Sweis (2009) further argued that the assignment decisions of resources such as labour, equipment and materials control the project duration and cost. Odesola (2015) stated that good project management in construction must vigorously pursue the efficient utilisation of labour, material and equipment, and that improvement of labour productivity should be a major and continuous concern of those who are responsible for cost control of constructed facilities. The foregoing arguments and findings of various scholars regarding the importance of materials, labour and tools/equipment signifies that the three resources are indeed required for optimal CLP in ZCI as revealed by this study.

5.2.3 Respondents' Understanding of Construction Labour Productivity Standards

According to 80 percent of the first set of respondents (Contractors and QS professional firms), CLP standards are published values of labour output per man hour. These responses clearly indicated that Contractors and QS professional firms understood what CLP standards are. It is likely that contractors would understand what CLP standards are as their work revolve around productivity from tendering, planning, estimating and execution of construction projects. As supported by International Labour Organisation (2012) that the first action of any planning engineer on a labour-intensive project is to determine the type of work to be carried out, divide this work into quantities of activities that can be carried out by individuals or gang of workers, and lastly apply labour productivity standard to determine the required labourforce and project duration. Equally QS professional firms were likely to understand CLP standards as they usually use construction labour productivities as inputs in generating project cost information.

However, 40 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA) were not sure as to what CLP standards are. Further, 40 percent of this second set of respondents strongly agreed that CLP standards are published values of labour output per man hour. However, these results still indicated that the majority of statutory bodies (MLSS, NCC, EIZ, ZABS and ZCSA) did not understand what CLP standards are. This could be possible as it was also found that most of these statutory bodies (MLSS, EIZ, ZABS and ZCSA) were not doing anything to do with CLP except for NCC whose construction school deals with aspects of construction labour productivity in ZCI.

5.2.4 Existence of Published Construction Labour Productivity Standards in Zambia

According to 62 percent of the first set of respondents (Contractors and QS Consulting firms), there were no published CLP standards in Zambia. According to 53.3 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA), there were no published CLP standards in Zambia. These results were supported by lack of literature on the existence of published CLP standards in *Zambian gazette*. MLSS, NCC, EIZ, ZABS and ZCSA did not have any published CLP standards for Zambia. Additionally, overreliance of estimators and planning engineers on historical labour productivity data and their experience in estimating and evaluation of CLP as revealed by this study indicated non-existence of published CLP standards in Zambia. As stated by Malisiovas (2010) that in the absence of advanced technology and measurement techniques, actual productivity on construction site is evaluated by experience-based estimations.

5.3 Practices of Estimation and Evaluation of Construction Labour Productivity in *Zambian Construction Industry*

This section discussed results on the practices of CLP estimation and evaluation in the *Zambian Construction Industry*.

5.3.1 Methods of Estimation and Evaluation of Construction Labour Productivity in *Zambian Construction Industry*

According to 58 percent of the first set of respondents (Contractors and QS Consulting firms), individual experience is highly used in estimation and evaluation of CLP in ZCI.

In the absence of advanced technology and measurement techniques, actual productivity in construction site is evaluated by experience-based estimations (Malisiovas, 2010). Malisiovas (2010) further argued that despite the technological advancement and the numerous measuring techniques now existing, surveys revealed that more than 20 percent of contractors still rely on estimators' experience and notions for the majority of their estimates. However, Malisiovas (2010) further added that the limitation of relying on estimator's experience is that the accuracy and reliability of this approach are influenced by personal prejudice and can be highly subjective. This meant that there was no satisfaction in terms of accuracy and reliability of estimates generated by estimators in ZCI due to overreliance on their individual experience.

According to 64 percent of the first set of respondents (Contractors and QS professional firms), historical labour productivity data is also highly used in estimation and evaluation of CLP in ZCI. The study revealed that project managers and estimators in ZCI often compare actual productivity with historical productivity for similar operations in an attempt to estimate or evaluate labour-intensive construction operations. However, Kisi (2015) argued that the approach of examining labour productivity by comparing actual and historical only provides a relative benchmark for efficiency and may lead to the characterisation of operations as objectively efficient when in reality such operations might simply be comparably efficient. Kisi (2015) further argued that just because actual productivity equals average historical productivity does not necessarily mean that an operation is efficient; the case may be that the operation's efficiency is only in line with historical averages, which may be well below optimal productivity. The determination of the absolute efficiency of construction operations can only be done by comparing an accurate estimate of optimal labor productivity versus actual productivity not historical productivity. This also showed that the estimation and evaluation of CLP in ZCI needed new approach as the use of historical productivity data does not guarantee consistent and accurate estimation and evaluation of labour productivity on construction operations.

Lastly, 72 percent of respondents indicated that the use of published CLP standards in the estimation and evaluation of CLP in ZCI is very low. Kisi (2015) defined Optimal labour

productivity has the highest sustainable productivity achievable under good management and typical field conditions. Optimal labour productivity is more of a CLP standard. Results from this study meant that estimators in ZCI rarely use optimal labour productivity as there are no established CLP standards. This leaves estimators and planning engineers in ZCI with no option other than relying on their historical productivity data and their individual experiences with which they are not likely to generate consistent and accurate estimation and evaluation of CLP.

5.3.2 Consistence in the Estimation and Evaluation of Construction Labour Productivity in the Zambian Construction Industry

According to 44 percent of the first set of respondents (Contractors and QS professional firms), they agreed that sometimes estimators in ZCI generate different estimates and evaluation of CLP on the same or similar works. According to 38 percent of respondents, they strongly agreed that sometimes estimators in ZCI generate different estimation and evaluation of CLP on the same or similar works. However, with these results it could not be concluded that there was inconsistency in the estimation and evaluation of CLP in the ZCI due to insufficient percentage of the results which were below 50 percent. Nevertheless, the methods (historical productivity data and individual experience) estimators and planning engineers often used to estimate and evaluate CLP in ZCI gave less confidence regarding the reliability, consistency and accuracy of CLP estimates and evaluation. As supported by Malisiovas (2010) that the limitation of relying on estimator's experience is that the accuracy and reliability are highly influenced by personal prejudice and can be highly subjective. Kisi (2015) further argued that the approach of examining labour productivity by comparing actual and historical data only provides a relative benchmark for efficiency, and may lead to the characterisation of operations as objectively efficient when in reality such operations might simply be comparably efficient. This means that the aspect of estimation and evaluation of CLP in ZCI still need other approaches as the accuracy, consistence and reliability of estimates is highly questionable due to the methods of estimation often used.

5.3.3 Causes of Inconsistence in the Estimation and Evaluation of Construction Labour Productivity in Zambian Construction Industry

According to 54 percent of respondents, the use of different historical labour productivity data and different individual experience among estimators were causing inconsistence in CLP estimation and evaluation in ZCI. Park (2006) argued that construction productivity rates differ between projects because of varying environments, characteristics and project management efforts for each project. Yunus and Hashim (2013) also stated that projects in construction are never designed or built exactly in the same manner due to environmental factors such as landscape, weather and physical location, and other aesthetic factors. Due to this uniqueness of construction projects, estimators who have worked on different projects have different experience. Further, historical productivity data is also recorded based on different project conditions and assumptions. Therefore, if estimators in ZCI were overlying on historical productivity data and their different individual experience, they were likely to generate different or inconsistent estimates and evaluations of CLP.

5.4 Factors that Influence Construction Labour Productivity in Zambian Construction Industry

This section discussed results on the factors that influence CLP in the Zambian Construction Industry

5.4.1 Work-Related, Worker-Related, Weather-Related and Management-Related Factors that Influence Construction Labour Productivity in Zambian Construction Industry

i. Work-Related Factors

According to 68 percent of the first set of respondents (Contractors and QS professional firms), work related factors such as materials management, types of materials, construction site plan, site condition, tools/equipment, construction methods, supervision and occupational health and safety influence CLP in ZCI. These results were subjected to chi-square test and were found to be statistically significant, leading to the rejection of the Null hypothesis HN2; which stated that; work related factors such as materials

management, types of materials, construction site plan, site condition, tools/equipment, construction methods, supervision and occupational health and safety do not influence CLP in ZCI.

Patel and Vyas (2011) defined materials management as the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. Since construction material is one of the major resources required for optimal CLP, materials management is likely to influence CLP. For instance, poor materials management leads to late delivery of materials or delivery of incorrect quality or quantity of materials and hence affecting productivity on site.

Different types of construction materials have different physical and chemical characteristics, some of which determine how they should be handled during construction, and may even have an impact on productivity. Materials characteristics such as weight, shape and performance have an influence on productivity. For example, keeping other things constant, productivity of a bricklayer on a 6-inch blockwork job is likely to be higher than his/her productivity on an 8-inch blockwork due to block weight difference. Therefore, the type of materials is a factor that influence CLP and should therefore be considered when analysing productivity.

According to Mustafa et al. (2018), construction site layout planning involves determining, sizing and placing of temporary facilities within the boundaries of a construction site by considering many factors such as; location/design features of the permanent structures to be built, project type/scale, the location of the site, machinery used during construction and organisation of the construction works. Mustafa et al. (2018) added that in the absence of an effective and a systematic approach to site layout planning, construction projects involving a high number of manpower, subcontractors, and equipment may face time loss, cost overruns and jeopardised construction site safety. This clearly shows that construction site planning has an influence on CLP as revealed by this study.

Many scholars have also acknowledged that factors related to site conditions do affect productivity on construction site. Abrey and Smallwood (2014) for instance argued that productivity is affected by variables such as site conditions, the weather, organisation factors, health and safety and personal problems, which should be considered when completing the activity and calculating productivity, as they may adversely affect productivity.

Scholars have also argued that tools and equipment have an influence on productivity on construction site. Gurmu and Aibinu (2017) developed a framework of construction equipment and tools management practices perceived to be useful in enhancing productivity on construction projects. Gurmu and Aibinu (2017) concluded that construction equipment maintenance, construction equipment procurement plans, and construction equipment productivity analysis are the three most important construction equipment management practices that could enhance productivity in multistory building projects.

Supervision is very cardinal in ensuring efficiency and effectiveness in work execution on construction site. The supervisor's job is highly complex and requires extensive knowledge and skills. The supervisor must be familiar with the job procedures, materials, equipment and craft skills required to execute the project, and must be highly skilled in both written and oral communication (Rounds and Segner, 2010). Rounds and Segner (2010) further added that the supervisor must be able to read and interpret project technical information. Therefore, poor supervision is likely to negatively influence construction productivity as revealed by this study.

Construction methods to be employed is dictated by the design or contract, but sometimes it is at the discretion of the contractor depending on the resources available to employ his/her preferably construction technique. Expertise plays a pivotal role in choosing the construction method and execution of the system (Hickson and Ellis 2014). Poor construction methods affect labour productivity. Hickson and Ellis (2014) added that severe disruptions can arise when the workforce is not familiar with the construction technique.

Site conditions such as confined access and confined work space can affect productivity. When work is in a confined space with limitations on egress and ventilation, this can result in non-productive labour to provide hole watch, along with other issues. Time is also lost when getting to and from the work area. Difficulties in accessing the site result to interferences to the convenient or planned access to work areas due to blocked stairways, roads, walkways, insufficient man-lifts, or congested work sites.

Therefore, work related factors such as materials management, types of materials, construction site layout, site condition, tools/equipment, construction methods, supervision and occupational health and safety influence CLP in ZCI as revealed by this study.

ii. Worker-Related Factors

According to 68 percent of the first set of respondents (Contractors and QS professional firms), worker related factors such as worker experience and skill, motivation and morale, worker's state of mind, worker-supervisor relationship, age, fatigue, health condition and physical fitness influence CLP in ZCI. These results were subjected to chi-square test and were found to be statistically significant, leading to the rejection of the Null hypothesis HN3; which stated that worker related factors such as worker experience and skill, motivation and morale, worker's state of mind, worker-supervisor relationship, age, fatigue, health condition and physical fitness do not influence CLP in the ZCI.

Many researches across the world have revealed several factors related to workers believed to have an influence on CLP. Alaghbari et al. (2019) categorised factors that influence CLP as human/labour factors, management factors, technical and technology factors and external factors. According to Alaghbari et al. (2019), human/labour factors that influence CLP include; labour's experience and skill, leadership and efficiency in site management, clarity of instructions and communication on the site, managing and follow-up subcontractors, absence from work (labours/supervisors), strength and physical structure of labor, labour's age and labour's education level. Hickson and Ellis (2014) also argued that extended work hours have great effect on fatigue during which

workmanship and safety practice begin to wane. Therefore, worker related factors such as worker experience and skill, motivation and morale, worker's state of mind, worker-supervisor relationship, age, fatigue, health condition and physical fitness influence CLP in the ZCI as revealed by this study.

iii. Weather-Related Factors

According to 62 percent of the first set of respondents (Contractors and QS professional firms), weather-related factors such as temperature, wind, humidity and rainfall influence CLP in the ZCI. However, when these results were subjected to chi-square test, they were not found to be statistically significant, leading to the acceptance of the Null hypothesis HN4; which stated that weather-related factors such as temperature, wind, humidity and rainfall do not influence CLP in the ZCI. However, whereas weather is not significant in ZCI, it is significant in other countries or region as acknowledged by Ballesteros-Pérez et al. (2018) that the impact of adverse weather is a common cause of delays, legal claims and economic losses in construction projects. However, Schuldt et al. (2021) concluded that weather mitigation methods can be as simple as observing work-rest cycles and providing weather-appropriate protective gear. Other methods may be more involved, such as planning the project schedule within the proper construction season or ensuring that the construction contract has the right language to prevent ambiguity (Schuldt et al., 2021). Mitigation strategies can help construction managers adapt, avoid, or anticipate delays due to weather (Schuldt et al., 2021). Additionally, generally weather conditions such as wind, temperature and humidity for most parts of Zambia are not so severe that they could result to severe impact on CLP as compared to other countries.

iv. Management-Related Factors

According to 54 percent of the first set of respondents (Contractors and QS professional firms), management related factors such casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare influence CLP in ZCI. These results were subjected to chi-square test and were found to be statistically significant, leading to the rejection of the Null hypothesis HN5; which stated that management related factors

such casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare do not influence CLP in ZCI.

Hickson and Ellis (2014) argued that there are many facets related to management that are crucial to encouraging labour such as; management relations, adequate and prompt salary payment and job security in addition to job satisfaction. Most labourers lament the lack of employee benefits available to them and their insecure future in the construction industry. Labourers perceive their jobs to be stagnant rather than a rewarding career and this has a negative effect on their output (Hickson and Ellis, 2014). Alaghbari et al. (2019) also identified some management factors influencing labour productivity as; wages level for labours, services provided in site (water/electricity/sanitation), daily hours of rest during work, incentives and rewards, payment for overtime, good management during crises (political issues/demonstrations/natural disasters), nature of work management (individual or companies) and services provided to labours (social security/insurance/Medicare). Sampa (2016) also concluded that ensuring employees' well-being through provision of welfare facilities is essential in stimulating desired conduct and performance, and further recommended that contractors in ZCI needed to improve the provision of appropriate welfare and safety facilities to employees on construction sites.

Therefore, management related factors such casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare influence CLP in ZCI as revealed by this study.

5.4.2 Difference in the Extent of Factors that Influence Construction Labour Productivity in Zambian Construction Industry

According to 74 percent of the first set of respondents (Contractors and QS professional firms), the extent of factors that influence CLP in ZCI may differ from project to project, location to location and company to company. Karim et al. (2013) argued that projects in construction are never designed or built exactly in the same manner due to environmental factors such as the landscape, weather and physical location, and also aesthetic factors.

Karim et al. (2013) further added that this uniqueness is the reason for varying productivity on different projects. Karim et al. (2013) concluded that project uniqueness requires modifications in the construction processes where workers are required to go through a learning curve at the beginning stages of each project activity. Construction productivity rates differ between projects because of varying environments, characteristics, and project management efforts for each project (Park, 2006). Therefore, project uniqueness proves to be one of the major reasons why the extent of factors that influence CLP in ZCI may differ from project to project, location to location and company to company. As supported by Sweis et al. (2009) that although some factors could have similar influences on the productivity of a number of tasks or projects, their rate of impact on productivity may vary.

5.4.3 Time Related Variability of Factors that Influence Construction Labour Productivity in Zambian Construction Industry

According to 74 percent of the first set of respondents (Contractors and QS professional firms), factors that influence CLP in ZCI may change from time to time. This is true as many scholars have argued that technological and other economic development factors lead to improved productivity in the construction sector. On the other hand, economic downfall may have a negative impact on productivity of various sectors of the economy including construction. Kiki et al. (2018) explained that many factors that influence the process of construction can change over time, so productivity cannot be easily judged by the same data or information that was documented in the past. Alaghbari et al. (2019) also identified some external factors that influence productivity including; political situation, economic condition, weather condition, social condition, project location and resource availability, and all these may change over time and the change can impact on CLP.

5.5 The Process of Developing Construction Labour Productivity Standards in Zambia

This section discussed results on construction stakeholders and the process of developing and publication of CLP standards in Zambia.

5.5.1 Stakeholders to Initiate the Process of Developing Construction Labour Productivity Standards in Zambia

According to 86.7 of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA), the process of CLP standards development in Zambia can be initiated by government institutions such as MLSS, NCC, EIZ, ZABS and ZCSA in collaboration with other relevant stakeholders. Murashov and Howard (2011) argued that standards are mostly developed by organised group of stakeholders assembled from various sectors primarily focusing on facilitating communication, promoting commercial and ensuring safety and health. The value of standards is derived from the contributions of a variety of stakeholders such as manufacturers, regulators, members of the public sector and consumers/users (Wilcock and Colina, 2007). Therefore, with respect to CLP standards development in Zambia, institutions such as MLSS, NCC, EIZ, ZABS and ZCSA would be better placed to initiate and develop CLP standards as revealed by this study.

5.5.2 Consultative Process of Developing Construction Labour Productivity Standards in Zambia

According to 93 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA), developing CLP standards in Zambia would involve a consultative process by standard development technical committee (SDTC) comprising of various experts from various sectors to conduct detailed reviews and surveys on CLP so as to reach a consensus. As supported by Nambisan (2013) that in most technology-based markets and industries, there are technical committees that establish new technical standards and specifications and considers companies as a critical source of information on existing and emerging technologies. Murashov and Howard (2011) further argued that standards are mostly developed by organised group of stakeholders assembled from various sectors primarily focusing on facilitating communication, promoting commercial and ensuring safety and health. The Standards Council of Canada collaborates with more than 400 organisations and with consumers on standards development (Wilcock and Colina, 2007). Wilcock and Colina (2007) argued that the value of standards is derived from the contributions of a variety of stakeholders such as manufacturers, regulators, members of the public sector and consumers/users. This means that even in Zambia, the consultative

process by SDTC comprising of experts from various concerned sectors would result into development of suitable CLP standards.

5.5.3 Challenges in Developing Construction Labour Productivity Standards in Zambia

According to 60 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA), the process of CLP standards development in Zambia is possible but would not be an easy undertaking owing to the complexity nature of the aspect of labour productivity and the involvement of various experts from various sectors. The complexity nature of construction productivity has been acknowledged by various scholars. For instance, Motwani and Novakoski (1995) argued that productivity, especially in the construction industry has always been very difficult to measure and control because of external and internal factors. Hickson and Ellis (2014) also supported this by stating that CLP is a complex variable to measure, its constituents are vague and are difficult to quantify. Mahamid (2015) added that construction industry is complex due to sophistication of the construction process itself, the large number of parties involved in the construction process, and its sensitivity to external changes. Park et al. (2005) clearly stated that the uniqueness and non-repetitive operations of construction projects make it difficult to develop standard productivity. Therefore, the complex nature of CLP and involvement of various experts would pose some challenges in the process of CLP standards development as revealed by this study. However, this is not to say that the development of CLP standards in Zambia would be impossible.

5.5.4 Cost and Time Requirements for Developing Construction Labour Productivity Standards in Zambia

According to 73 percent of the second set of respondents (MLSS, NCC, EIZ, ZABS and ZCSA), the process of developing CLP standards in Zambia would require sufficient funding and timeframe. From literature review, standards development process in Zambia facilitated by ZABS requires consultative process which involve reviewing similar international and local standards and conducting new studies. Although many scholars have not tackled the aspect of cost and time implication of standards development, it is

still worth acknowledging that procedures by standards development technical committees (SDTC) require financial resources and adequate timeframe. With regards to developing CLP standards in Zambia, the SDTC would need to conduct several practical surveys to arrive at ideal labour productivity values for different construction operations under various conditions. This process would definitely have a cost implication and would need to be completed within a set timeframe. Therefore, sufficient funding and specific timeframe would be required in developing CLP standards in Zambia as revealed by this study.

5.6 Regression of Factors that Influence CLP in ZCI

Factors that influence CLP were categorised as those related to work, workers, weather and management. Additionally, resources required for optimal CLP were included as an independent factor influencing CLP. From these 5 factors, weather related factors were not statistically significant. The remaining 4 factors that were statistically significant were subjected to regression test so as to appreciate their importance. From the regression, the order of importance is as follows:

- Factors related to work: materials management, types of materials, site layout, site condition, tools/equipment, construction methods, supervision, and occupational health and safety were ranked number 1 as the most important factors to consider.
- Factors related to workers: worker experience and skill, motivation and morale, worker's state of mind, worker-supervisor relationship, age, fatigue, health condition and physical fitness were ranked number 2 as the second important factors to consider.
- Resources required for optimal CLP: Construction materials, construction labour and construction tools/equipment were ranked number 3 as the third important factors to consider.
- Factors related to Management: casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, communication systems and management's level of commitment to workers' general welfare were ranked number 4 as the last important factors to consider.

The ranking of “factors related to work” as 1 in influencing CLP from this study is similar to the results of the study conducted by Bekr (2016). Many items of work-related factors such as materials/equipment management, site planning, supervision and construction methods are in line with works planning and scheduling which Bekr (2016) also ranked 1 in influencing CLP. Bekr (2016) argued that the planning and scheduling process in the construction industry, in recent years have been well developed to improve labour productivity as the supervisor would plan the works to be accomplished ahead of time.

The ranking of “resources required for optimal CLP” as 3 in influencing CLP from this study is also similar to the results of the study conducted by Bekr (2016). According Bekr (2016), equipment, labour and tools shortage has a great negative effect on labour productivity and were ranked third. Bekr (2016) argued that the shortage of equipment, labour and tools causes major idle time. Bekr (2016) further added that lack of skilled labour has negative influence on labour productivity.

Bekr (2016) also ranked some management related factors as last in influencing CLP. These factors include delay in paying suppliers and workers, and slow response of consultants. This is similar to the ranking of management related factors in this study as last. The payment delay to suppliers and labour might cause stoppage of material delivered by the suppliers and low labor productivity. At the same time, the payment delay makes the suppliers lose their confidence in the credibility of the contractor. Payment delay to workers is in line with other labour factors that demotivate workers such as casualisation, lack of training/incentives and management’s lack of commitment to workers’ welfare.

Whereas weather is not significant in Zambia as established from this study in terms of influencing CLP, it is significant in other areas or regions. For instance, Senouci et al. (2018) studied the impact of temperature, humidity and wind on labour productivity in Qatar. This study revealed that one of the major causes of projects delays is ignoring

Qatar's extreme weather conditions on labour productivity. However, areas of not extreme weather conditions can record low or insignificant weather impact on productivity as was established from this study in the case of Zambia. Additionally, weather mitigations methods can also significantly reduce weather impact on productivity. For instance, Schuldt et al. (2021) concluded that weather mitigation methods can be as simple as observing work-rest cycles and providing weather-appropriate protective gear. Other methods may be planning the project schedule within the proper construction season or ensuring that the construction contract has the right language to prevent ambiguity (Schuldt et al., 2021). Mitigation strategies can help construction managers adapt, avoid, or anticipate delays due to weather (Schuldt et al., 2021).

5.7 Chapter Summary

This chapter presented the discussion of the results under the following headings: construction activities and construction labour productivity standards, estimation practices of construction labour productivity, evaluation of construction labour productivity, factors that influence construction labour productivity and process of developing construction labour productivity standards in Zambia. The chapter further presented discussion of the regression test.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter presented the discussion of the results. This chapter presented the conclusions from the study and made recommendations in line with the following research objectives:

- i. To review existing construction activities and construction labour productivity standards.
- ii. To assess the practices of estimation of construction labour productivity.
- iii. To assess the practices of evaluation of construction labour productivity.
- iv. To determine the factors that influence construction labour productivity.
- v. To map construction stakeholders.
- vi. To establish the process of developing construction labour productivity standards in ZCI.

6.2 Conclusions

In an attempt to establish the major considerations in developing construction labour productivity standards in Zambia, literature was reviewed and questionnaires were administered to the target population. Information was gathered and analysed to draw conclusions from which recommendations were made. This section in particular presented the conclusions of the study.

6.2.1 Building Construction Activities and Construction Labour Productivity Standards

Building construction activities are specific activities that are performed or carried out during the execution of building projects. They include; Site clearance, trench excavations, backfilling and compaction, steel fixing, concreting, blockwork, plastering, structural steel work, roofing, carpentry, ceiling, painting, tiling, electrical installation, plumbing works. Labour intensive construction activities; such as concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling together account for 60 to 80 percent of the scope of work for building projects. In executing construction activities to

achieve optimal CLP, major construction resources required include construction labour, materials and tools/equipment. CLP standards are values established and or published as references or benchmarks for quantities of construction activities that can be completed by a worker or a gang of workers per hour given specific conditions. CLP standards are useful in estimating, measurement, scheduling and CLP evaluation. However, there were no published CLP standards in Zambia.

6.2.2 Practices of Estimation of Construction Labour Productivity in Zambian Construction Industry

Estimators and planning engineers in Zambian Construction Industry rely on historical labour productivity data and personal experience to estimate CLP due of lack of published CLP standards. However, there are several limitations of overreliance on historical productivity data and individual experience in estimating CLP. Hence, due to overreliance on historical labour productivity data and different personal experience in estimating CLP, the consistence, accuracy and reliability of estimates generated by estimators and planning engineers in ZCI was highly questionable.

6.2.3 The Practice of Evaluation of Construction Labour Productivity in Zambian Construction Industry.

In evaluating CLP, estimators and planning engineers in ZCI often compare their planned labour productivity targets to actual CLP. However, CLP estimates (targets) are generated using historical labour productivity data, personal experience or other methods without using published CLP standards. Since there are several limitations of overreliance on historical productivity data and individual experience in estimating CLP estimates, evaluation of actual CLP is also rendered unrealistic due to reduced reliability, accuracy and consistence of CLP estimates which are used as benchmarks.

6.2.4 Factors that Influence Construction Labour Productivity in Zambian Construction Industry

There are several factors related to work, workers, weather and management found to have an influence on CLP in ZCI. However, the extent of factors that influence CLP in ZCI differ from project to project, company to company and location to location.

Additionally, factors that influence CLP can change overtime due to various factors such as change in law, technological, political and economic development among others.

6.2.5 Construction Stakeholders

There are several stakeholders with interest in construction undertakings in ZCI and can be classified as either internal or external. Internal construction stakeholders include Clients/ developers, projects management consultants, contractors, Suppliers/manufacturers, Facilities managers and Ministry of infrastructure. External construction stakeholders include statutory bodies such as National Council for construction, Engineering institution of Zambia, Road development Agency, Ministry of labour and social security, Zambia Compulsory Standards Agency, the Academia, general public and non-government organisations.

6.2.6 The Process of Developing Construction Labour Productivity Standards in Zambia

Upon stakeholders' agreement on the need to develop CLP standards, the next step would be to formulate Standard Development Technical Committee (SDTC) comprising of various experts whose primary purpose is to conduct the consultative process. Experts from all sectors such as construction sector, government institutions, NGOs, manufacturing/suppliers, labour organisation and professional/academic institutions among others would be represented in SDTC.

The consultative process by SDTC would involve conducting reviews and studies on CLP and would result into draft of CLP standards which would be released for public scrutiny. After incorporating public inputs, a final approved copy would then be published in Zambia gazette as CLP standards. The involvement of different experts in SDTC would pose a risk of conflicting interests or views among exerts. The procedure of developing CLP standards would also require sufficient funding and specific timeframe.

6.3 Recommendations

In view of the foregoing conclusions from the study, the following recommendations were made:

- i. The process of developing CLP standards in Zambia should be facilitated by Zambia Bureau of Standards (ZABS) as the statutory body mandated to facilitate for the development and publication of all standards in Zambia.
- ii. A well-coordinated standard development technical committee (SDTC) should be formulated to review existing studies and conduct new surveys on factors related to work, workers and management that influence CLP in ZCI so as to determine the ideal CLP values as standards. Additionally, SDTC should critically analyse the major resources required for optimal CLP with respect to productivity.
- iii. The principle of averaging should be employed in developing CLP standards in Zambia so as to ascertain the average or ideal values of CLP for works considered under similar but unequal conditions.
- iv. Upon developing CLP standards, there should periodical review so as to ascertain the need for revision of CLP standards at any particular time.
- v. Stakeholders; Contractors, consultants, professional institutions (E.g., EIZ, ZIQS), MLSS, ZABS, NCC, ZSCA and other government and NGO organisations should be adequately represented in the SDTC for CLP standards development in Zambia.
- vi. Government of the republic of Zambia in collaboration with other relevant stakeholders should consider financing the development, publication and maintenance of CLP standards in Zambia.

6.4 Study Limitations

This study established the major considerations in developing CLP standards in Zambia by looking at factors that influence CLP and the process of CLP standards development. However, this study did not go in detail to measure the extent to which various factors influence CLP on construction sites in ZCI. Detailed measurement and evaluation of the extent to which various factors influence CLP in ZCI would be best tackled during CLP standards development by Standard Development Technical Committee (SDTC) during the consultative process. This study also established that the process of CLP standards

development in Zambia would involve formulation of SDTC comprising of various experts. However, the study did not go in detail to explore the specific inputs or roles of various experts to be involved in the consultative process for CLP standards development. Last but not the least, other than understanding the benefits of having CLP standards, this study did not explore any other possible effects of implementing CLP standards in ZCI if they were to be developed and published.

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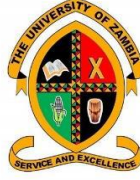
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LIST OF APPENDICES

Appendix I: Questionnaire Type 1 for Contractors and QS Professional Firms



The University of Zambia

School of Engineering

Department of Civil and Environmental Engineering

P.O Box 32379, Lusaka.

Dear respondent,

I am a student at the University of Zambia (UNZA) pursuing a Master of Engineering degree in Construction Management. I am undertaking a research project in partial fulfilment for the award of the Master degree in my field of study. This questionnaire is part of my research project entitled “**Major Considerations in Developing Construction Labour Productivity Standards in Zambia: A Quantity Surveyors Perspective**”. Your responses are important, and are therefore requested to enable me complete this research project.

Kindly be assured that your identity and the information you will provide shall be handled with utmost care and confidentiality as this research is purely for academic purposes.

Complete this questionnaire as per guidance provided.

Thank you so much for your cooperation.

Yours faithfully.

Robby Malipilo (Master of Engineering Student)

Mobile: (+260) 972 447 127 / 969 535 056

robbymalipilo@gmail.com

Q1. What type of services does your company offer? Tick in the applicable box below.

a. Quantity Surveying Services

b. Construction Services

Q2: Respond to the following by ticking where applicable.

What is your company's NCC Grade and Category?	Tick
Grade 2 Category B	
Grade 3 Category B	
Grade 4 Category B	
Not applicable	
What is your Individual Field of Specialisation?	Tick
Quantity Surveying	
Construction management	
Civil / Structural Engineering	
Architecture	

What is your experience?	0 - 5 yrs	5 -10 yrs	10 -15 yrs	15 -20 yrs	20 yrs and above
Concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation together accounts for the scope of building project in the range.	0 - 20%	20 - 40%	40 - 60%	60 -80%	80 - 100%

Concrete works, blockwork, roofing, plastering, painting, floor screed, tiling and ceiling installation together accounts for the scope of building project in the range.	0 - 20%	20 - 40%	40 - 60%	60 -80%	80 - 100%
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Q3. Rate the statements according to the scale provided: 1=Very low, 2=Low, 3=Not sure, 4=High 5=Very high.

Statements	1	2	3	4	5
Estimation and evaluation of construction labour productivity in ZCI using Individual experience.					
Estimation and evaluation of construction labour productivity in ZCI using Historical productivity data from previous projects.					
Estimation and evaluation of construction labour productivity in ZCI using Zambian Published construction labour productivity standards.					

Q4. Rate the following statements according to the provided scale of; 1=Strongly disagree, 2=Disagree, 3=Not sure, 4=Agree, 5 =Strongly agree.

Statements	1	2	3	4	5
Construction materials, labour and equipment are the major resources required for optimal construction labour productivity.					
Work related factors such as; materials management, types of materials, construction site layout, site condition, tools/equipment, construction methods, supervision, and occupational health and safety influence labour productivity sites in ZCI.					
Worker related factors such as; worker experience and skill, motivation and morale, worker state of mind, worker-supervisor relationship, health condition, fatigue and physical fitness influence labour productivity in ZCI.					
Weather related conditions such as; temperature, wind, humidity and rainfall influence labour productivity in ZCI.					
Management related factors such as; casualisation, low and delayed salaries/wages, lack of incentives, lack of training schemes, poor communication systems and management's lack of commitment to workers' general welfare influence labour productivity in ZCI.					
Construction labour productivity standards are published values of labour output per man hour.					
There are published construction labour productivity standards in Zambia whose development and publication were facilitated by ZABS.					
The extent of factors that influence construction labour productivity in ZCI may differ from project to project, location to location and company to company.					
Factors that influence construction labour productivity in ZCI may change from time to time.					

Q5. Rate the statements according to the scale provided: 1= Strongly disagree, 2=Disagree, 3=Not sure, 4=Agree, 5=Strongly agree.

Statements	1	2	3	4	5
Sometime estimators in the ZCI generate different estimates of construction labour productivity on the same or similar works.					
The use of different historical labour productivity data and different individual experiences among estimators causes inconsistency in the estimation and evaluation of construction labour productivity in ZCI.					

Appendix II: Questionnaire Type 2 for MLSS, NCC, EIZ, ZABS and ZCSA



The University of Zambia

School of Engineering

Department of Civil and Environmental Engineering

P.O Box 32379, Lusaka.

Dear respondent,

I am a student at the University of Zambia (UNZA) pursuing a Master of Engineering degree in Construction Management. I am undertaking a research project in partial fulfilment for the award of the Master degree in my field of study. This questionnaire is part of my research project entitled “**Major Considerations in Developing Construction Labour Productivity Standards in Zambia: A Quantity Surveyors Perspective**”. Your responses are important and are therefore requested to enable me complete this research project.

Kindly be assured that your identity and the information you will provide shall be handled with utmost care and confidentiality as this research is purely for academic purposes.

Complete this questionnaire as per guidance provided.

Thank you so much for your cooperation.

Yours faithfully.

Robby Malipilo (Master of Engineering Student)

Mobile: (+260) 972 447 127 / 969 535 056

robbymalipilo@gmail.com

Q1: Respond to the following by ticking where applicable.

What is the name of your Institution?	Tick
Ministry of Labour and Social Security (MLSS)	
National Council for Construction (NCC)	
Zambia Bureau of Standards (ZABS)	
Zambia Compulsory Standards Agency (ZCSA)	
What is your Position in this Institution?	Tick
Monitoring and Compliance Specialist	
Technical and Quality Manager	
Inspector	
Standards Development Officer	
Quality and Assurance Officer	

Q2: Respond to the followings by ticking where applicable.

What is your experience?	0 - 5 yrs	5 -10 yrs	10 -15 yrs	15 - 20 yrs	20 yrs and above

Q3. Rate the following statements according to the provided scale of; 1=Strongly disagree, 2=Disagree, 3=Not sure, 4=Agree 5 =Strongly agree, 6 = Not applicable.

Statements	1	2	3	4	5	6
Construction labour productivity standards are published standard values of labour output per man hour.						
There are published construction labour productivity standards in Zambia whose development and publication were facilitated by ZABS.						
The development of construction labour productivity standards in Zambia can be initiated by government institutions such as MLSS, NCC, EIZ and ZABS in collaboration with other stakeholders.						
Developing construction labour productivity standards in Zambia would involve a consultative process by technical committee comprising of various experts from various sectors to conduct detailed reviews and surveys on labour productivity so as to reach a consensus.						

Q4. Rate the statements according to the scale provided: 1=Strongly disagree, 2=Disagree, 3=Not sure, 4=Agree, 5=Strongly agree.

Statements	1	2	3	4	5
Developing construction labour productivity standards in Zambia is possible but would not be an easy undertaking owing to the complexity nature of the aspect of labour productivity and the involvement of various experts from various sectors.					
The process of developing construction labour productivity standards in Zambia would require sufficient funding and specific timeframe.					