A SKILLS MEASUREMENT FRAMEWORK FOR THE CONSTRUCTION INDUSTRY IN ZAMBIA: A CASE OF LUSAKA PROVINCE

By

Pauline Phiri

A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the Degree of Master of Engineering in Construction Management

THE UNIVERSITY OF ZAMBIA

LUSAKA

2019

DECLARATION

I, **Pauline Phiri** hereby declare that the work that is presented in this dissertation represents my own research work, and that it has not previously been submitted for a degree, diploma or qualification at this or another University.

_____ _____

Signature Date

APPROVAL

This dissertation of **Pauline Phiri** has been approved as fulfilling the requirements of partial fulfilment of the requirements for the award of **Master of Engineering** in **Construction Management** by the University of Zambia.

Examiner 1:_____ Signature:_____ Date:_____

Examiner 2:_____ Signature:_____ Date:_____

Examiner 3:_____ Signature:_____ Date:_____

Chairperson,

Board of Examiners_____ Signature:_____ Date:_____

Supervisor:_____ Signature:_____ Date:_____

ABSTRACT

Human resource is a key input in construction, with productivity being dependent on the efficiency and effectiveness of the workforce. With construction being characterised as labour intensive, the continuous skills development has always been a matter of concern. The cyclic nature of the construction industry gives rise to skills mismatches which cause fluctuations in skills demand and supply. Investigating labour market conditions to assess skills demand and supply cycle of labour is a difficult task because of the scarcity or unavailability of aggregated local labour market information on the construction industry. This study investigated the issue of skills mismatches and developed a skills measurement framework to address it.

The research design employed a mixed method approach to include both quantitative and qualitative data. A total of 162 firms consisting of contractors, consultants, government institutions and local authorities in Lusaka Province whose core of business was inclined towards construction and development of transportation infrastructure were identified and used as the sample frame. Stratified random sampling was used to select respondents in the sample size. The method employed for data collection was the distribution of structured questionnaires and the conducting of semi- structured interviews with the aid of an interview guide. Quantitative data from the questionnaires was analysed using statistical software and qualitative analysis from interviews was analysed using content analysis.

The most influential factors of supply and demand were; defined career paths, education and training requirements, salary scale and technological progression. Results revealed that the type of mismatches that existed were a skills gap and skills shortage. They revealed a shortage of Engineers and Construction Supervisors. Skills gaps were identified in the preparation of design specifications, estimation of project costs and preparing detailed cost plans, preparing construction method statements and technical specifications, as well technical and financial reporting.

Key words: skills mismatch, skill measurement, skill competency

DEDICATION

To Zilole and Gertrude Phiri. Your mentorship yielded fruit.

ACKNOWLEDGEMENTS

This project would not have been possible without the support of many people. Special thanks to my supervisor, Dr B. Mwiya, who read my numerous revisions and helped to make some sense of the confusion. Also thanks to my co-supervisor, Dr E. Mwanaumo who offered guidance and support. I would like to thank the Curriculum development experts from UNZA, TEVETA, and NCC who contributed their time and expertise in my data collection.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

CSO	Central Statistical Office
ILO	International Labour Organisation
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification of All Economic Activities
MoNDP	Ministry of National Development Planning
NCC	National Council for Construction
OECD	Organisation for Economic Cooperation and Development
TEVET	Technical Vocational and Entrepreneurship Training
TEVETA	Technical Vocational and Entrepreneurship Training Authority
ZAQA	Zambia Qualifications Authority

CHAPTER 1: INTRODUCTION

1.1 Background

The construction industry makes a significant contribution to the economy and has been an important catalyst for growth. The average industry contribution to Gross Domestic Product (GDP) in Zambia for the period of 2006-2015 was 9.7 percent. (MoNDP, 2017). According to the Labour Force Survey (LFS) of 2014 construction sector employment constituted 3.1 percent of the total employed persons.

The sector covers a wide range of activities such as construction of buildings, civil engineering works, specialised construction activities and architectural and engineering activities and related technical consultancy. (UN, 2008) Human resource is a key input in construction industry (Neyestani, 2014). The various construction activities in their progressive stages require diverse skill sets at different professional levels and in varying quantities, and thus skills competency will always be a matter of concern in the construction industry, given its labour intensive nature.

A major aspect to consider is the cyclical nature of construction work because it results in fluctuations in potential output, employment and training levels (Agapiou, et al., 1995). This leads to varying skills needs in response to dynamic changes in the construction skills market, which is a key skills challenge. Influential labour market factors such as demography, education and training, technological change, globalization and changes brought about by government policy (CTD, 2004) affect skills demand and supply.

A skill issue that results from the cyclic nature of the labour market is skills mismatch. Obadic (2006) defines the concept of labour mismatch, as the existence of disequilibrium or maladjustment between labour supply and demand. Skills mismatches occur when workers have either fewer or more skills than jobs require. (GACE, et al., 2014). Gauging labour market conditions that determine the skills demand and supply cycle of labour in construction is a challenge in Zambia because construction sector specific aggregated labour market information is scarce (Koyi, et al., 2012). Some of the available sources with scanty construction sector information are the National Development Plans (NDPs).

The Seventh National Development Plan (7NDP) outlines one of development outcomes to be improved transport systems and infrastructure. It highlights how a well-functioning transport system supports growth and creation of jobs which ultimately increases economic productive capacity. The government of Zambia plans to invest in infrastructure development of railway, aviation, road and maritime and inland waterways. (MoFNP, 2014). This signifies a focus on transportation infrastructure development in the Zambian construction sector. Construction of transportation infrastructure is categorised under civil engineering works.

Technological progression is a prominent factor that is influencing construction methods and the nature of skills required in industry. Such technologies employ techniques and methods that are primarily reported at high skill occupational levels. With structural and management capacity lacking in the transportation sector, the issue of development of skills of that nature should be made a priority. Devising an effective method of assessing skills competencies in line with construction industry needs with the challenge of scarce industry specific labour market information is imperative.

According to the 7NDP the focus in the transportation infrastructure will be on projects that are labour intensive for job creation. A skill concern with this notion is that there are changes in technological advancements in construction which result in changes in the demand for various types of skilled labour (Clarke & Wall, 1998).The skills needed to to drive the development or use of technology are reported primarily at higher occupational levels, such as managerial, professional and associate professional and technical occupations (UKCES, 2013).

The Zambian transportation infrastructure has been unsustainable and exhibited slow growth due to weak structural and management capacity (ZDA, 2014). A working paper by Moono and Rankin (2013) indicated that there was difficulty in sourcing and retaining skilled and experienced labour in construction. They identified that there is a limited quantity of graduates with industry relevant practical skills, and that theoretical knowledge was more profound. In addition, they discovered an evident gap between education providers and industry such that relevant skills needs were not being addressed. This leads to the planning of training systems that prove to be inadequate.

The challenge therefore lies in identifying skills mismatches and planning for and implementing skills development programmes that will bridge the gap between education and industry. Skill level assessments require defining task and duty complexities of given occupations. The measurement of these skills would have to consider the nature of work performed in relation to the characteristics of the duties, the level of formal education required for competence and the amount of informal job training and previous experience required for the particular tasks and duties. (ILO, 2012). This would require the formulation of a framework that would need to identify skills supply and demand mismatches at the detailed occupational level, according to standard occupation codes (Rasool, n.d.).

This study investigated construction skills mismatch identification through skills competency analysis. Transportation infrastructure development was the primary focus due to the government's plan to implement transportation infrastructure development projects. With technological progression being a key influential factor of skills demand and supply, skills of managers, professionals and associate professionals were assessed. This was because the skills are 'primarily' reported at these skill levels.

1.2 Problem Statement

With the cyclic nature of construction, skills mismatches arise, which cause fluctuations in skills demand and supply (Agapiou, et al., 1995). The scarcity or unavailability of aggregated local labour market information on the construction industry makes it difficult to gauge the labour market conditions which are used to determine the skills demand and supply cycle of labour **(**Koyi, et al., 2012). In addition, training institutions are insufficiently responsive to market demands which make the labour supply rigid. (DFID, 2014**)**.

1.3 Main Objective

To develop a skills measurement framework that will enhance skills development for the Construction industry in Zambia.

1.3.1 Specific Objectives

1. To identify factors that influence skills demand and supply in the transportation sector of the Construction industry
2. To determine high level skills mismatches that exist in the transportation subsector of the Construction industry
3. To develop a skills measurement framework

1.4 Research Questions

The following research questions were considered in order to suggest possible solutions to the problem;

1. Which factors are currently influencing the construction skills market?

2. What essential skills gaps are present that may require development?

3. How can skills competencies be measured in line with construction industry requirements?

1.5 Scope of the Study

The research was confined to stakeholders in the construction labour market who were involved in transportation infrastructure development projects. These included the road, rail, and air sectors. The choice of these particular sectors arose from the realisation of the Zambian government's plans to invest in infrastructure development of railway, aviation, road and maritime and inland waterways as highlighted in the 7NDP for 2017-2021 (MoNDP, 2017).

The selected construction entities were within Lusaka Province in Zambia. The selection of Lusaka Province as a sample population was based on its percentage of the distribution of employed persons in the construction industry in Zambia. Lusaka Province was the highest contributor to employment at 7.0%, followed by Copperbelt Province at 3.3 percent and Northern Province being the least at 1.2 percent (CSO, 2015).

1.6 Research Methodology

The study involved a mixed method approach. Literature review was carried out to determine emerging skills needs in Construction industry, identify methods used in skills needs assessment, to identify gaps in research and to select and design of research instruments. Data was collected through self-administered questionnaires and the conducting of semi- structured interviews with the aid of an interview guide.

A total of 162 firms consisting of contractors, consultants, government institutions and local authorities in Lusaka Province that had transportation infrastructure development projects were identified and used as the sampling frame. Stratified random sampling was used to select respondents in the sample size. The questionnaires were distributed to managers, professionals and associate professional occupations. The choice of these occupations was on the premise that technological progression was identified from literature as a prevailing influential factor of skills demand and supply, and the skills associated with it are 'primarily' reported at these skill levels.

Data collected from the questionnaires was analysed using statistical software, namely Statistical Package for the Social Sciences (SPSS) and Microsoft Excel. The data was analysed using frequencies, percentages and mean scores for various competency items. Data from the interviews was analysed using content analysis. The results were used in the design of a skills measurement framework.

1.7 Significance of the Study

The research provides an aggregated source of construction labour market information for the analysis of labour resources to assist in skills planning. It takes industry needs and relates them to education and training inputs and outputs, ultimately making a correlation between the two for relative skills development planning. By considering factors that affect demand and supply, the study provides insight on assessing labour market trends. This enables the formulation of training and educational programmes that are specifically tailored to acquiesce with the trend

in labour skills demand and supply patterns which are reflective of the needs of the industry.

1.8 Applications of the Research

The information from this research provides Construction sector specific labour market skills information which will be beneficial to;

Students: The knowledge of current skills demands in the industry can assist students in making appropriate decisions in the selection of careers and educational choices.

Employers: The information can be used to identify the skills available in the labour market and the sources of graduates of specific skills.

Education and training institutes: The information can assist educators and trainers in identifying which skills are needed in the market and their trends.

Government and Policy Makers: The information can be used to identify which skills are required in specific areas of construction, and thereafter influence the decisions on the education and training programmes that can be planned for and implemented in order to enhance the skill sets in the identified fields.

1.9 Structure of Dissertation

This dissertation has six main chapters:

The first Chapter introduces the area of study and its background which leads to the definition of the research problem and the formulation of the objectives and research questions. A brief summary of the methodology is also presented;

Chapter two reviews literature of prior research carried out on the use of labour market information in the identification of labour market needs to match the supply of skills to the demands of the industry;

In Chapter three, the research methodology and its use in investigating the problem are discussed. This includes the research design, the instruments of research, the means of data collection and their relevance in answering the questions in the research, as well as the data analysis.;

Chapter four presents the findings of the research. The content includes data aggregation, comparison, explanation and interpretation of results that were collected in line with conceptual and theoretical frameworks discussed and analysed in literature review;

The fifth Chapter discusses the development of a skills requirement measurement framework for application in the construction industry. It explains what the framework consists of, how it works, and the type of information that is required in order for it to function, as well as how it should be updated and maintained ;and

Finally, Chapter six concludes the research with recommendations on how the results from the research analysis can be used to improve on the current state of the construction industry labour market. It also points out any areas that may require further research which the study was unable to cover.

1.10 Summary

This chapter presented the background to the research which led to the problem statement. A brief summary of the applied method of research was included. The significance of the study and applications of the research were also conveyed. Chapter two presents the review of existing literature relative to the study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The previous chapter provided a background to the research which gave context to emerging skills issues in the construction industry. The purpose of the literature review in this study was to examine and review research studies that are relevant to the objectives of this study. This aided in establishing what the current state of knowledge about how construction industry workforce development issues are addressed, as well as identified the major questions in the area of study that led to knowledge gaps.

The labour intensive nature of the construction industry makes human capacity development one of the core issues to be addressed. This research is a proposed strategy on how to identify skills mismatch in order to anticipate and estimate skills needs in the industry to allow for skills development planning and implementation.

The approach taken in reviewing literature was, firstly an introduction to the concept of skill and skills dimensions. This is followed by discussing construction activities and their associated skills in order to align the nature of skills explored to the research topic. Subsequently, the identification of commonly researched factors that influence the demand and supply of skills was conducted to assess the state of the construction labour market and their relevance to the research. A review explored methodologies on measuring skill demand and supply for the purpose of identifying whether there are balances between skills requirements and skills acquisition inputs and outputs was be reviewed. Finally, implemented global strategies for general skills planning were discussed in order to give a holistic view of how skills imbalances are addressed. On a micro level, methods used to respond to skills needs in the construction industry that are indicated by the skills imbalances were reviewed.

2.2 Concept of skills

2.2.1 Overall skill definitions

There are different perceptions of the definition of skills. Lorenz (2012), in a working paper prepared for the European Training Foundation (ETF) revealed that

all the synthesised national reports on skills matching indicated that there was no clear and shared definition of skills ,as it embraced various aspects to portray different concepts. According to International Labour Organisation (ILO), skill is defined as the ability to carry out the tasks and duties of a given job. The skill level is a function of how complex the range of tasks and duties for a given occupation are. These skills are measured by considering the nature of work performed in relation to the characteristics of the duties, the level of formal education required for competence and the amount of informal job training and previous experience required for the particular tasks and duties (ILO, 2012).

Skills are then then broken down into two dimensions; skill level and skill specialisation. Skill levels are mapped on to skill specialisations which stem from specific occupational needs (ILO, 2012). The description of ISCO-88 skills levels is summarised in Table 2-1. The typical formal education requirements associated with the skill levels are determined according to the International Standard Classification of Education (ISCED-97).

Table 2.1: ISCO skill level definitions

Skill Level	Nature of tasks performed	ISCED Level	Level Descriptor
1	Routine physical or manual tasks	1	Primary Level of Education
2	Operating machinery and equipment, driving vehicles, maintenance and repair of equipment, of information storage, manipulation and ordering	2	Lower Secondary Level of Education
		3	Upper Secondary Level of Education
3	Complex technical and practical tasks requiring knowledge of facts, procedures and technical aspects in specialized fields	5b	First stage of tertiary education in practical/ technical/ occupationally specific programmes
4	Complex problem solving, decision-making and creativity based on theoretical and factual knowledge in a specialized field	5a	First stage of tertiary education in theoretically based programmes which provide sufficient qualifications for entry into advanced research programmes and professions with high skills requirements.

(Source: ISCO-08, 2012)

In Zambia, the Zambia Qualifications Authority (ZAQA) is the regulatory body that is responsible for coordinating the development of National Occupational Standards (NOS) in Zambia. ZAQA defines NOS in terms of the standards of performance which individuals must achieve when performing tasks in the workplace, together with specifications of the underpinning knowledge and understanding. NOS are developed to help employers in all sectors to quantify the skills, knowledge and understanding needed to perform at all levels of the respective sector (ZAQA, 2016).

ZAQA developed a National Qualification Framework (NQF) to classify, accredit, publish and articulate national qualifications in order to link education and training into one system. The Zambian Qualification Framework (ZQF) is prescribed by descriptors from levels 1 to 10 as shown in Table 2.2.

Table 2.2: Qualification Levels and the Sub-frameworks of the ZQF

<table>
<tr><th>ZQF Level</th><th colspan="2">General Education</th><th>Trades and Occupations (TEVET)</th><th>Higher Education</th></tr>
<tr><td>10</td><td colspan="2" rowspan="8"></td><td rowspan="4"></td><td>Doctorate Degree</td></tr>
<tr><td>9</td><td>Master’s Degree</td></tr>
<tr><td>8</td><td>Post- Graduate Diploma</td></tr>
<tr><td>7</td><td>Bachelor’s Degree (Honours)
Bachelor’s Degree (Ordinary)</td></tr>
<tr><td>6</td><td>Diploma</td><td rowspan="5"></td></tr>
<tr><td>5</td><td>Level 5 Certificate</td></tr>
<tr><td>4</td><td>Level 4 Certificate</td></tr>
<tr><td>3</td><td>Level 3 Certificate</td></tr>
<tr><td rowspan="2">2</td><td>B</td><td>Senior Secondary Education Certificate (Grade 12)</td><td></td></tr>
<tr><td>A</td><td>Junior Secondary Education Certificate (Grade 12)</td><td></td></tr>
<tr><td>1</td><td colspan="2">Primary Education Certificate (Grade 7)</td><td></td><td></td></tr>
<tr><td>Quality Assurance</td><td colspan="4">Quality Assurance Bodies established by Acts of Parliament in Zambia</td></tr>
<tr><td>Qualifications</td><td colspan="4">The Zambia Qualifications Authority</td></tr>
</table>

(Source: Zambia Qualifications Authority, 2016)

The qualification levels are described using three competence levels namely foundational competence based on knowledge of comprehension and assimilation, practical competence based on skills developed (creative, technical, communication

and interpersonal) and reflexive competence based on the application of knowledge and skills (ZAQA, 2016).

2.2.2 Construction Skills

The construction sector covers a variety of activities such as the inception of a property or infrastructure development, raw material extraction and processing for project use, the execution of construction works, as well as the design, maintenance and management of the constructed products (DfEE, 2000). The International Standard Industrial Classification (ISIC) (2008) sets out the main sectors in the construction industry to be construction of buildings, civil engineering works, specialised construction activities and architectural and engineering activities and related technical consultancy. Table 2.3 describes the nature of work associated with these construction activities.

Table 2.3: Construction activities

Construction Activity	Nature of work
Construction of buildings	Construction of all types of residential buildings
	Construction of all types of non-residential buildings e.g. buildings for industrial production, public buildings, airport buildings, warehouses etc.
Civil engineering works	Heavy constructions such as motorways, streets, bridges, tunnels, railways, airfields, harbours and other water projects, irrigation systems, sewerage systems, industrial facilities, pipelines and electric lines, outdoor sports facilities, etc.
Specialized construction activities	Construction of parts of buildings civil engineering works
	Building finishings and completion
Architectural and engineering activities and related technical consultancy	Architectural consulting activities
	Engineering design (i.e. applying physical laws and principles of engineering in the design of machines, materials, instruments, structures, processes and systems) and consulting activities
	Elaboration of projects using air conditioning, refrigeration, sanitary and pollution control engineering, acoustical engineering etc.
	Geophysical, geologic and seismic surveying

	Geodetic surveying activities
	Project management activities related to civil engineering works

(Source: ISIC Rev 4, 2008)

The various construction activities in their progressive stages require diverse skill sets at different professional levels and in varying quantities. The skills levels refer to the complexity of the tasks and duties linked to given occupations (ILO, 2012). Key stakeholders in the industry each have interests based on their involvement in construction and the subsequent outputs. Clients, design teams, contractors and project managers are examples of stakeholders that are major participants in many construction projects (Jina, et al., 2017). Table 2.4 shows the different construction occupations and the typical skill level that they possess.

Table 2.4: Typical construction occupations

Occupational Major Group	Occupational Unit Group	Construction occupations	Skill Level (ISCO)
Managers	Construction Managers	Civil Engineering Project Managers, Construction project managers, Project builders	Level 4
Professionals	Engineering Professionals	Civil Engineers, Environmental Engineers, Mechanical Engineer	Level 4
	Architects, Planners, Surveyors and Designers	Building Architects, Landscape Architects, Town and traffic planners, Land surveyors, Quantity surveyors, Building Surveyors	
Technicians and Associate Professionals	Physical and Engineering Science Technicians	Engineering Technicians, Draughts persons	Level 3
	Manufacturing and Construction Supervisors	Construction Supervisors. Site Managers, Clerks of works	
Craft And Related Trades Workers	Building and related trades workers	Stone masons, Bricklayers, Concrete placers and finishers, Carpenters and joiners, Glaziers Roofers, Plasterers, Plumbers, Painters, Welders and metal workers	Level 2

	Electrical and Electronic trades workers	Electricians	
Plant and Machine operators and assemblers	Drivers and mobile plant operators	earth moving plant operators, crane and hoist plant operators	Level 2
Elementary occupations	Mining and Construction Labourers	construction labourers in (civil engineering and building work), earthmoving labourers, maintenance labourers, bricklayer's assistants, demolition labourers, hod carriers	Level 1

(Source: ISCO-88, 2012)

The level of training that is required for each occupational group in construction varies. A comparison of the ZAQA qualification level and ISCO-88 skill level depicts the typical level of education that is required for the various construction professions in the Zambian. The comparison is shown in Table 2.5.

Table 2.5: Education and qualification levels of construction related occupations

ZAQA qualification Level	ZAQA education level	Standard Duration	Closest Equivalent to ISCO Level	Occupational groups
Level 1	Primary Education Certificate (Grade 7)	7 years	Level 1	Construction Labourers
Level 2A	Level 2 A Junior Secondary Education Certificate Grade 9	2 years from previous level	Level 2	Craft And Related Trades Workers, Plant and machine operators and assemblers ,
Level 2B	Senior Secondary Education Certificate (Grade 12)	3 years from previous level		
Level 3	Level 3 Certificate	At least 1 year	Level 3	Technicians and Associate Professionals

Level 4	Level 4 Certificate	At least 1 year		
Level 5	Level 5 Certificate	2 ½ years after Level 2B or 1½ year after Level 4		
Level 6	Diploma	3 years after Level 2B, or 2 years after Level 4 or 1½ year after Level 5	Level 4	Managers and Professionals
Level 7	Bachelor's Degree (Honours) Bachelor's Degree (Ordinary)	4 - 7 years after Level 2B		
Level 8	Post Graduate Diploma	1 year after level 7		
Level 9	Master's Degree	1½ to 2 years after Level 7		
Level 10	Doctorate Degree	A minimum of 3years		

2.3 Industry skill issues

With the construction industry being labour intensive, productivity is dependent on the efficiency and effectiveness of the workforce. A major aspect to consider is the cyclical nature of construction work because it results in fluctuations in potential output, employment and training levels (Agapiou, et al., 1995). This leads to varying skills needs in response to dynamic changes in the construction skills market. It is important to understand skills needs and gaps, by noting that a steady stream of skilled labour is required, at all levels of the labour market (UKCES, 2013).

In the analysis of any labour market, a correlation between skills demand and supply needs to be established, as they are two different variables. The factors influencing the demand and supply assist in assessing current labour market trends as well as forecasting future demands.

2.3.1 Factors influencing skills demand and supply

Existing literature reveals that there are various factors that influence the demand and supply of skills in the labour market. In the general labour market, influential factors include demography, education and training, technological change, globalization and changes brought about by government policy (CTD, 2004). Different studies reveal similarities in the factors that affect local construction labour markets of the areas that are explored.

Research by the Organisation for Economic Development and Cooperation (OECD) has indicated that technological progression, globalisation and ageing population influence and substantially change the demand for skills in the labour market (OECD, 2017). This was discovered in their approach to develop a conceptual framework for low income countries in which statistical indicators of skills for employment and productivity could be used to guide skill development.

Skills availability is a key aspect in construction. This has led to studies in which skills demand and supply causal factors have been assessed extensively. Oseghale et al (2015) investigated factors leading to skilled labour shortages in Nigeria and reported that lack of training in construction was a prevalent factor. In addition, a mean response analysis indicated that no clear career path was ranked the highest contributor to skills shortages. The ageing workforce also played a significant role in skills shortage.

Windapo (2016) conducted a similar study in which he examined the skilled labour supply shortage in the South African construction industry and identified some factors responsible for skilled labour shortages in the construction industry to be the ageing workforce; ageing members near retirement affecting the supply of labour with fewer skilled workers entering the job market, (Mukora, 2008), the cyclical nature of construction work resulting in fluctuations in potential output, employment and training levels (Agapiou, et al., 1995); (Drucker & White, 1996); (Gruneberg, 1997), and changes in technological advancements in construction resulting in changes in the demand for various types of skilled labour (Clarke & Wall, 1998). In

addition, from literature Windapo mentioned that the role of the government was also influential to skills shortage.

In Weddikara & Devapriya's (2011) case study of demand and supply trends and industry development of the Sri Lankan construction industry they identified and analysed the causal factors and their implication on supply characteristics in order to identify the required industry developments required. The demand side factors they identified were government policies, economic conditions, population growth and urbanization, construction price/inflation and foreign aids/loan and grants. On the supply side, causal factors included project procurement, role of contracting firms, project delivery processes, technological applications and usage of construction materials.

The ageing workforce, which is a demographic change, is common matter of concern in construction in the different studies discussed. With new entrants having no clear career path as highlighted by Oseghale et al (2015), a case of fewer skilled workers in the job market upon retirement of ageing members as mentioned by Mukora (2008) would arise. The continued rise of technological advancements is also a recurring driver of skills demand and supply in construction. The need for skills development in application of modern technologies in construction is becoming a priority. The role of the government in implementing policies that respond to cyclic changes in the construction industry can aid in addressing the fluctuations of productivity and output that follow.

2.3.2 Skills Mismatch

In the general labour market, the subject of skills mismatch is continuously being explored. The Global Agenda Council on Employment (GACE) articulated that different forms of labour skills mismatch coexist in modern labour markets. They further explained that skills mismatches occur when workers have either fewer or more skills than jobs require (GACE, et al., 2014). Obadic (2006) defines the concept of labour mismatch, as the existence of disequilibrium or maladjustment between labour supply and demand. An illustration of the forms of skills mismatch that coexist is shown in Table 2.6.

Table 2.6: Forms of Skills Mismatch

Type of Mismatch	Characteristic
Skill shortage	Demand for a particular type of skill exceeds the supply of people with that skill at equilibrium rates of pay.
Qualification mismatch	The level of qualification and/or the field of qualification are different from that required to perform the job adequately.
Over/Under- qualification education	The level of qualification/education is higher/lower than required to perform the job adequately.
Skill gap	The type or level of skills is different from that required to perform the job adequately
Over/Under- skilling	The level of skill is higher (lower) than required to adequately perform the job.

(Sources: Cedefop, 2010; OECD, 2011)

Identifying the form of mismatch that is prevalent enables a direct approach to address the skills issue that is affecting industry performance. Reddy et al (2016) affirm that what needs to be determined is whether there is a skills mismatch or disequilibrium once it is realised that there is a challenge of labour shortage

A key step that should be taken in skills development planning is the determination of the nature of skills incompetency. There is a need to determine whether the lack is in cognitive skills, which are the ability to discern when and how to apply knowledge in a practical sense (Greene & Papalambros, 2016) or non-cognitive skills which deal with individual behaviours, personal characteristics and attitudes in the workplace (Gutman & Schoon, 2013).

Cappelli (2015) discussed an approach of assessing skills mismatches which focused on the labour market to meet skill requirements. The assumption was that the employer job requirements are determined by the labour market skills needs and in turn, applicants with those skills are sought for. Cappelli describes the search process as two-sided and states that when the applicant skills closely meet the job requirements then it is deemed as a good match.

2.3.3 Emerging construction skills needs

Labour market changes result in skills mismatches due to emerging skills needs. GACE explained that skills mismatches occur when workers have either fewer or more skills than jobs require. According to Windapo (2016), most developing countries often experience an abundance of unskilled and untrained labour. With technological progression being a predominant factor of change in the construction industry, technologically inclined skills development at all skills levels is a requirement.

In a report on technology and skills in the construction industry, the UK Commission for Employment and Skills (UKCES) (2013) stated that skills which are needed to drive the development or use of technology are reported primarily at higher occupational levels, such as managerial, professional and associate professional and technical occupations.

A global trend in construction is the use of Building Information Modeling (BIM) in construction projects. This application of technology incorporates the use of information technology for project integration. This brings in joint participation in the building process among architects, engineers and construction industry participants (Burcin Becerik-Gerber & Kensek, 2010). It is inclined more towards managerial professions because it is centered on construction management.

Three-dimensional (3D) printing, which converts three-dimensional computer-aided-design (CAD) models to complex geometric shapes that can be used in the manufacturing of construction materials, is another global technological trend on the rise. Its use is slowly growing on the global front but a skills issue faced is the need for individuals who can integrate both robotics and civil work. (Tay, et al., 2017). This is a high level skill requirement.

The agenda of creating green jobs is emerging on the global market front. In the construction sector, the use of green construction materials and products, the expansion and generation of renewable energy and energy-efficient operation and maintenance are construction sector reforms that are on the rise in wake of climate resilience. This requires skills development of professionals in building

enhancement, architecture and building science with the use of green technologies and materials that are economically friendly (Maclean, et al., 2018).

The Zambian construction industry, despite having positive developments such as a continued steady annual average growth rate of 17.5% over the previous 12 years, faced a number of challenges which required innovative solutions to overcome (MoNDP, 2017). General economic diversification in line with global trends is minimal, and the lack thereof, to some extent, been constrained by the shortage of technical and professional skills in the domestic labour market (UNDP, 2016)

With the progression of the NDPs, an observation over time which is more prominent on the 7NDP is how they state that the development of the construction industry in Zambia will contribute to improving the state of infrastructure in the country and that the focus in the construction industry should be on projects that are labour intensive and create jobs upon implementation. However, it has not been mentioned how important skills development is in the industry, in light of the increased use of technologies as is portrayed on the global front. The demand of technologically inclined skills is anticipated to be on the rise.

The 7NDP highlights Zambia's vision for 2030 which emphasises on the development of quality human capital, including investment in quality education and skills development. Despite this premise, the difficulty in achieving this outcome has been attributed to low access to skills training, poor quality of skills training and skills mismatch caused by the peripheral role played by industry in the development and implementation of Technical Education Vocational and Entrepreneurship Training (TEVET) curricula (MoNDP, 2017) .

A variety of tertiary education institutions were designed to meet the special needs of various sectors of the economy this includes universities, colleges of education and TEVET institutions. The TEVET institutions were prioritized in light of Zambia labour market challenges. The Revised Sixth National Development (R-SNDP) highlighted that skills and development sub-sector faced some progression challenges in certain programmes, for which there were no institutions that offered higher level qualifications. This led to negative perception on the current quality of

graduates, and interested candidates had no means of upgrading their skill areas (MoFNP, 2014)

A Skills Improvement Programme (SKIP) implemented by Department for International Development Zambia (DFID) identified flaws in the TEVET system to produce the required skills to meet labour market needs. These were inadequate information on occupations in labour market demand and supply; insufficient links with employers, and rigid supply response (DFID, 2014)

A challenge faced in Zambian construction industry is that labour market information in the construction sector is either scarce or unavailable, which makes it difficult to plan labour resource allocation according to the needs of the industry (Muya, et al., 2003). Koyi et al (2012) found that there is no aggregated labour market information for the construction industry in Zambia and that it brought difficulty to gauging labour market conditions that determine the skills demand and supply cycle of labour

The NDPs which contain holistic overviews of future industry development plans are sources of information on strategic plans for economic development in Zambia. The 7NDP highlighted plans for major economic infrastructure projects across the transport, energy and communications sectors which signify a potential boom in the construction sector. One of the main development outcomes outlined was improved transport systems and infrastructure, elaborating on how a well-functioning transport system supports growth and creation of jobs which ultimately increases economic productive capacity. The government plans to invest in infrastructure development of railway, aviation, road and maritime and inland waterways (MoNDP, 2017).

Transportation infrastructure development activities are categorised under civil engineering works in construction according to ISIC as shown in table 2-3. The transportation development process involves stages such as planning, project development and environment, design and construction. For the coordination and transition into the various project phases there is a need for communication among personnel involved in each phase. It is Project Managers who are responsible for establishing, maintaining communication and coordination the project development

and delivery process to ensure successful completion (FDOT, 2017). The scarcity of literature on skills planning on a local scale signifies how poor skills development planning is in the Zambian construction industry.

There is a recognised skills shortage in transportation engineering, predominantly in railway systems. Kaewunruen et al (2016) discussed the need to train and improve research skills and capability for engineers and professionals. With transportation systems shifting towards environment-friendly means of transport (Maclean, et al., 2018), it is imperative that skills development in provision of sustainable, climate resilient transportation should be prioritised. Maclean et al (2018) listed some construction related skills development priorities in transportation to be green transport infrastructure labour, design and engineering as well as public transport network operation construction, operation and maintenance and management. Managers, professionals and technicians and associate professionals are pivotal in responding to technological changes. The focus on job creation and lack of concern about relative skills development in the 7NDP indicates a gap in literature.

Zambian transportation infrastructure is reported to be inadequate to sustain and does not reach desired growth levels because of weak structural and management capacity (ZDA, 2014). The road sector is dominant, but improvement is required in contracts execution and accountability which requires increase of institutional capacity of entities that supervise and coordinate the development of road infrastructure. Rail and air transport have lower traffic densities, with air traffic being handled by neighbouring countries and the bulk of rail cargo being transported by road. This is taking its toll on the roads (UNDP, 2016). The 7NDP plan to invest in transportation infrastructure is justified. This will require skills associated with transportation system development. There is more reporting on infrastructure needs than there is on the actual skills required to meet those needs.

It is evident that high level skills are pivotal in driving economic change. The challenge therefore lies in determining exactly what dimension of skill requires investment. This requires investigating what the industry occupational skills needs are in terms of required job skill level and the corresponding skills competencies. It is therefore imperative that skills mismatches should be identified and used for skills development and implementation.

2.4 Addressing skills challenges

2.4.1 Demand and supply of skills

Classification of the construction labour force profile is required in order to scrutinise particular skills deficiency areas. Reddy et al (2016) stated that a central source of labour market information is required and it can be used to identify measure and analyse the industrial skills requirements. This requires exploring the following inter-related areas: the economy, the profile of the labour force, the current demand and the future demand.

It is also important to consider the construction project lifecycle which has a number of stages, each requiring the input of different groups of individuals for the execution of the construction processes. Projects differ in size and complexity; however a more generic lifecycle structure includes initiation, planning, execution and closing of the project (PMI, 2013). It is important to note that construction activities not only include the physical works but also professional services. As mentioned by UKCES, high skills drive the development or use of technology and they are reported primarily at higher occupational levels. In ZQF, the higher education levels are from 7-10 (from table 2.1) (ZAQA, 2016).

In ILO's outlook of key challenges and policy responses in G20 countries, they mentioned that the availability of quality, relevant training for in-demand skills and occupations is a key factor, along with accessible and timely labour market information. They also illustrated how partnerships between education and training providers and firms, trade unions and civil society, including apprenticeship schemes, have proven useful in ensuring that training matches the needs of firms (ILO, et al., 2014) The identification of both cognitive and non-cognitive skills is required in construction by the investigation industrial needs and creating policy reforms and skills development initiatives to address those needs should be made a priority.

With the labour intensive nature of the construction industry, human resource is a key input. Neyestani (2014) articulated how Human Resource Development (HRD) plays a pivotal role in the advancement of personal and professional skills, knowledge and abilities of employees. Neyestani elaborated further that HRD

encompasses the training, career development, performance management and development, coaching, mentoring of employees to improve their knowledge and skills for individual and organizational development. It is not formal education alone that is required for skills advancement, and organisations have a role to play in continuous professional development as individuals' transition from school to industry.

Neyestami (2014) also mentioned how talent and skills development play a role in actually enhancing individual performance which ultimately benefits the organization in the long run. The combination of soft skills such as leadership, communication, time management as well as technical skills for performing specific tasks enhances individual strengths and addresses multiple aspects of productivity requirements.

Muya et al (2003) revealed that Zambian construction industry faces a challenge of skills shortage, which impedes productivity and in that order for the country to invest in the necessary education and training programmes; there must be an understanding of labour the resource issues that the industry is faced with. In a working paper by Moono and Rankin (2013), their research indicated that there was difficulty in sourcing and retaining skilled and experienced labour in construction. They identified that there is a limited quantity of graduates with industry relevant practical skills, and that theoretical knowledge was more profound.

Moono and Rankin's quantitative analysis on construction among other industries yielded a number of outstanding results. Firstly, industry players relayed that foreign labour was more productive and required less supervision compared to local labour. They also discovered that there was an evident gap between education providers and industry such that relevant skills needs that graduates were required to have, were not being addressed. Another key observation was the lack of apprenticeships that were offered in industry (Moono & Rankin, 2013).

The scarcity of labour market information is profound, with industry feedback stating the dire need for the establishment of active labour market information system for sector development. The current labour market statistics do not provide sufficient information on the broad range of skills competencies that are required

(Moono & Rankin, 2013). This has inhibited progress on skills development planning and implementation.

2.4.2 Skills measurement

Reddy et al (2016) identified that there are a large number of unpredictable variables which influence demand and supply and hence used selected indicators to provide signals on whether demand outstrips the supply for specific occupations at a particular point in time. In the OECD et al (2013) guide for a conceptual framework for skills development programmes for low income countries; it was recommended that information should be gathered by the use of indicators for employment and productivity. It emphasised the need to put in place a comprehensive system of information relating to skills in terms of their economic and social outcomes.

Indicators provide relevant data in order to monitor and assess organizational labour strategies. The ILO devised Key Indicators of the Labour Market (KILM) to improve dissemination of global labour market elements (ILO, 2016). OECD et al (2013) mentioned how indicators are required for the efficiency of matching skills that have been obtained through education and training with those required by employers and the self-employed. A profound weakness that is highlighted is that a more direct measure of skills rather than qualifications would be preferable but is not possible because of limited data availability.

Rasool (n.d.) conceptualised a national skills measurement mechanism to measure skills imbalances in the labour market. This proposed a framework for measuring skills imbalances. The framework included six categories with indicators measuring the state of the labour market, recruitment**,** education administrative data**,** labour market entry, employer responses**,** wage movements and migration patterns. The selection of indicators required the identification of valid, reliable and robust package indicators to measure skills shortages and surpluses that may exist in the labour market.

In Rasool's conceptualisation of setting up a national skills measurement mechanism to measure skills imbalances in the labour market, he indicates that a framework should be constructed to identify skills supply and demand mismatches at the detailed occupational level, according to standard occupation codes. ISCO-08

is an ideal tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job. The groups are based on their similarity in terms of the skill level and skill specialisation required for the jobs. (ILO, 2012). A shortfall of this method is that amount of information is voluminous and may be difficult to attain because lack of labour market information.

There are usually difficulties encountered in measuring mismatch. Obadic (2006) found that empirical results in previous studies indicated that the disaggregation of data was one of the problems. Another identified problem was that job vacancies which came from official statistics only included job searches of individuals whore registered at the employment offices. In addition, Labour Force Surveys do not include the data on labour demand. The task thereby lies in linking skill level and skill specialization as per job task.

In research conducted by Fichen & Pelizzari (2014), they identified that a key difficulty in formalizing the notion of skill mismatch was the identification of the job requirements. Their reasoning was that the data used for this type of analysis is normally collected through workers and that did not directly address the structure of production processes. They also identified the lack of information about the demand side as a difficulty.

Their research proposed a new measure of skills mismatch by developing a simple theoretical framework which formally defined job requirements with assumptions made for data estimation, and then carried out empirical analysis using in the OECD Survey of Adult Skills (PIAAC), which allowed comparisons to be made across skill domains, labor market statuses and countries (Fichen & Pellizaari, 2014).

Windapo (2016) used a mixed method research approach which involved collecting empirical data from contracting companies in the form of personal interviews and a questionnaire survey. The identifiable disadvantages from using such a method included low response rates and the potential to incorporate bias. The purpose was to examine the skilled labour supply in the South African construction industry and determine whether there was a relationship between trade certification, quality of

work output and scarce labour skills. The research demonstrated exactly which occupational shortages existed and the factors that attributed to level supply.

Castiglioni & Tijdens (2014) developed a forecasting system for occupational needs in Italy in order to increase information to all labour market stakeholders. Their main aim was to understand the nature and the evolution of the labour market trends which were involved in the definition of labour policies in relation to organisational development of human resources. They conducted surveys with the aid of questionnaires and face-to-face interviews with workers.

The observation made by Fichen & Pelizzari (2014) about workers not directly addressing the structure of production processes invokes the idea that the people who have more understanding of what work needs to be done are the ones who seek out for the particular skills in the labour market. The intent therefore of this research was to design a framework that would aggregate labour market skills information particularly for the construction industry to address the challenge of lack of or scarcity of such information.

2.5 Research Framework

2.5.1 Theoretical Framework

This study derived its concept from labour market theories. The labour market is described as the place where there is interaction between labour service provision (supply) and labour service requirement (demand) (CTD, 2004). Ideally, equilibrium in the labour market is the ultimate goal to achieve, but the cyclic nature of the labour market is bound to lead to mismatches. Labour market equilibrium occurs when supply equals demand, generating the competitive wage and employment. The wage used is the prevailing market rate to avoid the instance of fluctuating wage pressures that a randomly selected rate would induce. The outcome of such an occurrence would be excess jobs but minimal workers or excess workers vying for the few available jobs (Gasset, 2018).

One of the theories used in labour markets is the Classical Theory of Employment and Output. It assumes that the determination of output and employment is dependent on labour, goods and money markets in the economy. The belief of classical economists was that full employment existed in the economy. Classical

theory states that there is a relationship that can be established in which output and employment is a function of the stock of capital, technical knowledge, and the number of workers (Chand, 2018). The theory has been critiqued with the argument that full employment cannot not exist. The subject of mismatch arises on this premise. As mentioned by Obadic (2006), the concept of labour mismatch is the existence of disequilibrium or maladjustment between labour supply and demand.

Mismatch leads to the need to establish where the imbalance lies. This study uses theories that have been incorporated in the Programme for the International Assessment of Adult Competencies (PIAAC) conducted by OECD. The theoretical backgrounds involve firstly determining what key skills should be measured. The PIAAC framework recommends the identification of key skills (cognitive and n non-cognitive) and their required uses on the job. It also highlights the need to assess current investments in education and training. Binkley et al (2003) identified six core skill competencies to be communication, mathematical, problem solving, intrapersonal, interpersonal and technology application.

The PIAAC framework discusses the need to determine how acquired skills decline by investigating investment in education, the social environment, the amount of informal learning as well as institutional factors that have an effect on the performance of individuals. The ultimate goal is to map skills ability to required labour market outcomes (OECD, 2011). The explored theories led to the formulation of the conceptual framework for the research.

In the design of the skills measurement framework, an attempt on an effective method of attaining labour market equilibrium as close as possible was made. The variables explored were technical knowledge and the number of workers required. By understanding the causes of mismatch and carrying out a skills measurement, performance requirements were identified and presented for use is skills development planning

2.5.2 Conceptual Framework

In the design of the skills measurement framework, the study firstly acknowledged the cyclic nature of the construction industry (Agapiou, et al., 1995) that would

require an assessment of the current labour market environment. The next step involved determining what the prevalent factors that influenced skills demand and supply in the industry (CTD, 2004). Identifying those factors led to the identification of emerging skills requirements and the state of the current skills supply in the construction labour market (UKCES, 2013).

A skills competency analysis (Cappelli, 2015) was required to determine the nature of skills sets that were required and assessing where the deficiencies were in the available skill sets. The assessment was of knowledge, practicality and reflexivity (self-governance) of individuals (ZAQA, 2016), encompassing both cognitive and non-cognitive skills required in construction jobs. The result was the identification of prominent skills mismatches that required addressing. In Figure 2.1, the planned conceptual framework design for the study is outlined.

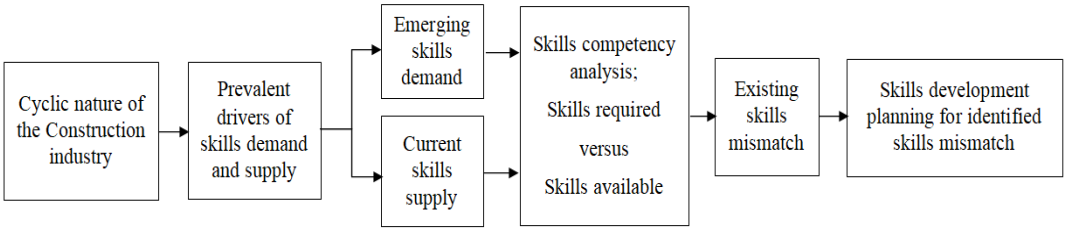


Figure 2.1: Conceptual framework design for research

The research followed the logical progression that is illustrated in Figure 2.1. The concept revolved around determining which skills mismatch exist in order for skills development planning that was responsive to emerging skills competency needs to be conducted.

A summary of key findings from literature which highlight underlying concepts in the study is shown in Table 2.7

Table 2.7: Summary of key findings from literature

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
Skills dimensions					
International labour Organisation (2012	Global	International Standard Classification of Occupations, Structure, group definitions and correspondence tables ISCO 08 Volume I.	Classification of occupations	Explanatory	Skill measurement should consider the nature of the work performed in relation to duty characteristics, level of formal education attained, amount of informal job training and previous experience required for task completion.
Zambia Qualifications Authority. (2016)	Zambia	Zambia Qualifications Framework Level Descriptors	Classification, accreditation and articulation of national qualifications for the purpose of linking education and training into a unified system	Explanatory	Depicts that qualification levels assess three competencies; knowledge of comprehension and assimilation, practical competence of developed skills and reflexive competence (ability to self-govern and career growth)
United Nations (2008)	Global	International Standard Industrial Classification (ISIC) Rev 4	Classification of productive activities To provide a set of activity categories for the collection and reporting of statistics according to such activities.	Explanatory	Construction sector consists of activities such as construction of buildings, civil engineering works, specialised construction activities and architectural and engineering activities. Understanding the nature of activities required enables planning for skills according to relative skills sets.

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
Jina, X., Zhangb, G., Liuc, J., Fenga, Y., & Zuod, J. (2017).	Australia	Major Participants in the Construction Industry and Their Approaches to Risks: A Theoretical Framework	To compare the major participants of client, design team, contractor and project manager involved in construction projects based upon their characteristics and the risk management approaches they implement.	Questionnaires	Stakeholder identification is important in skills planning because their involvement in the industry dictates what their interests are and their required outputs.
Factors influencing skills demand and supply					
Cambridge Training and Development Ltd (2004)	United Kingdom	LMI Matters! Understanding labour market information	To help develop awareness of labour market information (LMI) and to show how it can be used effectively	Explanatory	Key influences on the labour market include education and training, technological change, globalisation and government policies. The influences result in changes in opportunities, and knowing what they are can help individuals assess their situation.
Oseghale, B.O.; Dr Abiola-Falemu, J.O.; Oseghale G. (2015)	Nigeria	An Evaluation of Skilled Labour shortage in selected construction firms in Edo state, Nigeria	To assess the current state of the construction industry's skilled workforce, causes and prevalence of skilled labour shortage and the effect that the shortage has on construction project delivery.	Structured questionnaires and interviews	Prevailing factors responsible for labour shortage included; no clear career path, high mobility of construction workers and low wages, diminishing craftsperson training programmes, ageing workforce and high mobility of workforce
O. Windapo	South Africa	Skilled labour supply in the	To examine the skilled labour supply in	Mixed design	The level of supply of skilled tradesmen is

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
(2016)		South African construction industry: The nexus between certification, quality of work output and shortages	the South African construction industry and determine whether there is a relationship between trade certification, quality of work output and scarce labour skills.	approach: literature review, empirical data: interviews and questionnaires	attributed to the lack of high-quality basic education, the state of the economy and ageing workforce. The method is disadvantageous in that there is low response rate and it is subject to bias.
Citra Weddikkara; Kapila Devapriya (2011)	Sri Lanka	Demand and Supply Trends And Construction Industry Development (A Case Study in the Sri Lankan Construction Industry)	To identify and analyze the causal factors and their implication on supply characteristics in order to identify the industry developments required.	Literature review, interviews and statistical data gathered from government publications and other occasional papers.	Demand side factors: Government policies, economic condition, construction price/inflation, population growth/ urbanization, foreign aids/loan and grants. Supply side factors: project procurement, role of the contracting firms, project delivery process, technological application, usage of construction materials
Cappelli, P. H. (2015).	United States of America	Skills Gaps, Skills Shortages, and Skills Mismatches: Evidence and Arguments for the United States.	To assesses the range of concerns over the supply of skills in the U.S. labour force, in education-related skills.	Literature review	Employer job requirements are determined by labour market skills needs.
Skills issues					

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
Moono, H., & Rankin, N. (2013).	Zambia	Education and Employment in Zambia: Evidence from a Scoping Exercise.	To investigate the issue of education system not meeting the needs of the changing economy	Analysis of existing survey data and interviews	There is difficulty in sourcing and retaining local skilled and experienced labour in construction. Limited quantity of graduates with industry relevant practical skills.
Department for International Development Zambia. (2014).	Zambia.	Skills Improvement Programme (SKIP) in Zambia.	To propose an intervention programme to support the improvement of skills development in Zambia.	Descriptive	The TEVET system does not produce required skills to meet labour market needs. There is a disconnection between industry and education systems. Labour market information on demand and supply is inadequate for skills planning
Neyestani, B. (2014).	United States of America	Human Resource Development in Construction Industry.	To find and realize all factors which are caused by Human Resource Development on productivity and employee's performance in construction industry,	Explanatory	Organisations have a role to play in continuous professional development as graduates' transition from school to industry.
Koyi, G., Masumbu, G., & Halwampa, A. (2012).	Zambia	Understanding youth labour demand constraints in Zambia, The mining, manufacturing and construction sectors	To provide an analysis of youth unemployment and undertake a labour demand constraint analysis in order to understand key youth unemployment issues and factors influencing the demand for youth labour in Zambia	literature review; questionnaire; and interviews	Lack of aggregated labour market information specific to the construction sector makes determining the skills demand and supply cycle of labour difficult. There is need for more accessible local labour market information.

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
Emerging skills needs					
Ministry of National Development Planning. (2017).	Zambia	Seventh National Development Plan 2017-2021	To create a diversified and resilient economy for sustained growth and socio-economic transformation driven, among others, by agriculture.	Explanatory	Investment in construction activities are for development of transport systems and infrastructure. There is minimal focus on development of local skills in transportation systems development in light of technologically progressive methods of construction on the global front.
Kaewunruen, S., Sussman, J. M., & A, M. (2016).	Global	Grand Challenges in Transportation and Transit Systems.	To highlight grand challenges in transportation and transit Systems for collaborative research by industry and academia	Literature Review	There is a need to train and improve research skills and capability for engineers and professionals
Burcin Becerik-Gerber and Kensek, A.K. (2010)	United States of America	Building Information Modelling in Architecture, Engineering, and Construction: Emerging Research Directions and Trends	To formulate research ideas and methodologies to pursue them and to explore how an industry/academic partnership for exploring exciting research	Online surveys, research workshop, and student reports,	Emerging technology in construction. BIM uses information technology for project integration. It requires joint participation between architects, engineers and construction industry participants.
Tay, Y. W. D., Panda, B., Paul, S. C., Noor Mohamed, N.	United Kingdom	3D printing trends in building and construction industry: a review.	Review the latest research trends 3D Modelling by analysing publications from 1997 to 2016	Literature review	Emerging technology in construction. Requires skills in both robotics and civil work simultaneously. In low income countries, it is

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
A., Tan, M. J., & Leong, K. F. (2017).					not easily achievable.
R. Maclean, S. Jagannathan, & B. Panth, 2018).	Singapore	Education and Skills for Inclusive Growth, Green Jobs and the Greening of Economies in Asia.	To provide recommendations to help manage the transition toward green and inclusive growth and suggest a framework for implementation of potential strategies and policy initiatives, and examines areas for further research	Case Studies	Emerging technology in construction. A green economy is emerging requiring transitioning to green jobs and green skills. Construction skills development priorities in transportation are network operation labour, design and engineering and public transport construction, operation and maintenance.
Castiglioni, C.; Tijdens, K.G. (2014)	Italy	Skills and occupational needs: labour market forecasting systems in Italy	To give an overview of the initiatives carried out in Italy to collect information on skill projections and the needs of the labour market for occupational needs analysis and labour market forecasting	Questionnaires and interviews	Particular attention needs to be paid to understanding future labour market trends which is difficult in an unstable economy.
Skills measurement					
Anne Fichen and Michele Pellizzari (2014)	Geneva	A new measure of skills mismatch: theory and evidence from the Survey of Adult Skills (PIAAC)	To propose a new measure of skills mismatch that combines information about skill proficiency, self-reported mismatch and skill use.	Questionnaires and interviews	The method allows for the classification workers into under-skilled, well-matched and over-skilled in terms of literacy and numeracy. It is too generic.
Rasool, H. (n.d.).	Unknown	Conceptual Paper on setting up a Skills Measurement	To conceptualise the setting up of a national skills measurement mechanism	Descriptive	The framework incorporates the use of indicators that require voluminous amounts of

Author	Country/ Region	Title	Objectives	Methodology	Conclusions/Comments
		Mechanism	to measure skills imbalances in the labour market.		data input and will require frequent updating. Difficulty because of scarcity of labour market information.
Alka Obadic (2006)	Europe	Theoretical and empirical framework of measuring mismatch on a labour market	To measuring the structural unemployment caused by regional mismatch in selected transition countries by known theoretical methods of mismatch indicators	Empirical Analysis	The difficulty in measuring mismatch using empirical analysis is due to the disaggregation of data. The information from statistics mostly captures data of employed persons. Labour force surveys do not include demand and supply data.
OECD, World Bank, ETF, United Nations Educational Scientific and Cultural Organisation., (2013;	Global	Indicators of Skills for Employment and Productivity: A Conceptual Framework and Approach for Low Income Countries	To provide a framework for the collection of statistical indicators which can be used to guide skill development with a focus on low income countries	Database survey	Indicators did not efficiently match skills A more direct measure of skills rather than education and qualifications is preferable but not possible because of limited data availability
Reddy, V., Bhorat, H., Powell, M., Visser, M., & arends, A. (2016)	South Africa	Skills Supply and Demand in South Africa	To inform planning and provisioning of education and training, and assist individuals in making appropriate career and educational choices.	Analysis of surveys	Use of selected indicators to provide signals on what influences demand and supply. Difficulty was in accuracy of data from surveys.

2.6 Summary

This chapter reviewed literature that was pertinent to the study for the formulation of the research design. The next chapter details the methodology used to carry out the research.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The challenge of skills mismatches in the construction industry was discussed extensively in chapter two. This chapter outlines the most suitable methodology that was selected in relation to carrying out the research task. It also discusses the research design; population and sample; sampling technique; data collection methods that were used and the data analysis tools and techniques. Research ethical issues are discussed.

3.2 Research design

The preparation of the research design was a crucial aspect in this study. As defined by Sellitz et al (1959), a research design is the arrangement of data collection and analysis conditions in a matter that is relevant to the research purpose in the most economical way. The aim of the research was to recommend a skills measurement framework that will enable skills development planning and implementation that is responsive to industry needs.

The planned approach taken was, firstly the identification of factors that influenced the demand and supply of skills. In order to gauge the condition of the construction industry, an investigation on which of these factors prevailed was conducted. This enabled the determination of emerging skills needs as well as the current state of available skills.

A skills competency analysis in which available skills were assessed in comparison with required skills in the labour market was the next step. The nature of information sought, required the development of skills competency profiles. The competencies had to be derived from duty characteristics, education and training and organisational processes involved in construction activities and this required information to be gathered directly from industry participants.

The selection of the research method for data collection and analysis was formed on the need for primary data, given the scarcity of labour market information specifically in construction. There are two types of research methods that can be used in research namely quantitative methods and qualitative methods.

i. Quantitative methods

Quantitative methods aim at quantifying data and generalising results from a sample of the population of interest. They also may intend to measure the incidence of various views and opinions in a chosen sample or aggregate results. It is more objective because precision, measurement & analysis are the priority (MacDonald & Headlam, 2011). Some quantitative methodologies used include surveys and experimental designs. They are described in Table 3.1.

Table 3.1: Quantitative research methods

Quantitative research	Description
Surveys	A numeric description of trends, attitudes, or opinions of a population conducted by studying a sample of that population. e.g. with use of questionnaires or structured interviews (Fowler, 2009)
Experimental Designs	Determines whether a specific treatment influences an outcome. It is conducted by providing a specific treatment to one group and withholding it from another and then determining how both groups scored on an outcome. e.g. use of true experiments, with the random assignment of subjects to treatment conditions, and quasi-experiments that use non-randomized assignments (Keppel, 1991)

ii. Qualitative methods

Quantitative methods are used when there is a need to understand the underlying reasons and motivations for certain actions in order to determine how people interpret their experiences and the world around them. It is more subjective because the individuals' interpretation of events is what is most relevant (MacDonald & Headlam, 2011). Some qualitative methodologies used include narrative research, phenomenology, grounded theory, ethnographies and case studies. Table 3.2 describes these methods.

Table 3.2: Qualitative methods of research

Qualitative research	Description
Narrative Research	Studies the lives of individuals and may require certain individuals to provide stories about their lives (Riessman, 2008)
Phenomenology	Describes the lived experiences of individuals about a phenomenon as the participants describe it to be. It typically involves conducting of interviews (Giorgi, 2009; Moustakas, 1994)
Grounded Theory	Derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. (Charmaz, 2006; Corbin & Strauss, 2007)
Ethnographies	Studies the shared patterns of behaviors, language, and actions of an intact cultural group in a natural setting over a prolonged period of time. This usually involves the use of observations and conducting of interviews.
Case Study	An in-depth analysis of a case, often a program, event, activity, process, or one or more individuals. Involves the collection of detailed information using a variety of data collection procedures over a sustained period of time (Stake, 1995; Yin, 2009; 2012)

(Source: (Creswell, 2014))

The use of a survey to collect quantitative data was more appropriate for the study as compared to experimental design. This is because the core of the research was to identify skills mismatches, which required knowledge of trends, attitudes, or opinions relative to the construction industry. This is unlike experimental design which would involve controlled environment observations. Qualitative data was also required in order to develop the strategy to address the skills mismatches derived from practical experience of tried and tested methods that are used locally. The need to acquire adequate information that was more in depth was what prompted the use of interviews, which allowed for suitably specific questions to be formulated and asked more directly (Walliman, 2011). The comparison, correlation and interpretation of these combined data sets were what formulated the skills measurement framework. The research required generalising of results from a sample of the population of interest in the construction industry as well as a

subjective interpretation of methods of skills competency analysis carried out by academia. It is for this reason that the study adopted a mixed method approach to include both quantitative and qualitative data

3.3 Population and scope

Creswell (2003) defines research population to be a collective term used to describe the total quantity of things that have a similar characteristic and are subject of the study. The target population was contractors, consultants, government institutions and local authorities whose core of business was inclined towards construction and development of transportation infrastructure. These included rail, road and air infrastructure. Higher institutions of learning that offered construction related programmes were also part of the target population.

As reviewed from literature, technological advancements affecting the industry which require high skill level expertise are emerging. In response to this need, managers, professionals and technicians and associate professionals were the selected occupational groups for the study. The population in this study was composed of construction industry participants in Lusaka Province, Zambia. Lusaka was selected because it has the highest percentage distribution of employed persons under the construction industry compared to the other provinces as shown in Table 3.3. (CSO, 2015)

Table 3.3: Percentage distribution of employed persons (15 years or older)

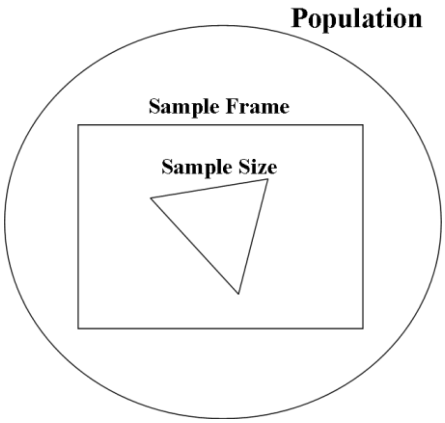
Province	Percentage distribution (%)
Central	1.9
Copperbelt	3.3
Eastern	1.8
Luapula	2.3
Lusaka	7.0
Muchinga	3.2
Northern	1.2
North-Western	1.9
Southern	2.3
Western	1.9

(Source: CSO Labour Force Survey Report, Zambia 2014)

In addition, a large proportion of construction companies, consultants and trade schools are registered and based in Lusaka compared to other parts of the country. From a total of 59 identified registered Consultants, 55 are based in Lusaka. According to the National Council for Construction annual registration figures of 2014, Lusaka accounted for 48 percent of the distribution of the contractors, with rest being distributed amoung the other nine provinces. The headquarters for TEVETA is also based in Lusaka and is the body that oversees all nationwide TEVET institutions.

3.4 Sampling techniques

Within the population, there may be a selected group that is of interest to a study. The selected category forms the sampling frame. The sample size is then selected from the sampling frame (Walliman, 2011). Figure 3.1 illustrates the relationship between population, sampling frame and sample size.



(Source: (Walliman, 2011))

Figure 3.1: Sampling technique relationship

i) Sample Frame

The sampling frame was formulated by selecting contractors from a published list of National Council for Construction (NCC) registered contractors. NCC has registration categories from Grade 1-6. The contractors were selected from companies registered in grades 1-4 who conduct civil engineering works and general roads and earthworks. A total of 20 Contractor firms from each grades (1-4) were randomly selected from the list to give a total of 80 Contractor firms.

Consultants included firms that were registered with Association of Consulting Engineers of Zambia (ACEZ) whose core of business is transportation infrastructure development. The respondents were randomly selected from a list of 59 registered ACEZ member firms. Government agencies and local authorities that conduct civil engineering works were aligned with infrastructure development formed part of the frame. Higher level institutions included were those that offer Science Technology Engineering and Mathematics (STEM) programmes. The particular selection of the institution was based on the identification of construction related programmes offered by institutions that were randomly selected from a list of Universities, Colleges and TEVET institutions in Lusaka. Following a review of the list of institutions and programmes, it was observed that there were outstanding bodies that encompassed the curricula of majority of other institutions. These included NCC, the statutory body responsible for the promotion, development, training and regulation of the construction industry in Zambia, and TEVETA the regulator of all institutions providing technical education, vocational and entrepreneurship training. These accounted for 9 randomly selected institutions. The University of Zambia was also one of the selected institutions.

ii) Population size

The population size was determined using stratified sampling. Sampling elements of the population were divided into four groups; consultants, contractors, higher education institutions and government agencies.

Consultants were 59 in number. The contractors were randomly sampled to select 20 contractors in each grade which totaled 80. The higher institutions were 13 in number and government agencies were 10. This brought the total population size to 162.

iii) Sample size

The sample size was calculated using equation (1) and (2)

$$N_0 = \frac{Z^2 P(1-P)}{(E)^2} \qquad \text{equation (1)}$$

Source: Sample size formula; (Rao, 2007)

Where:

N_0= required sample size E= marginal error

Z= standard normal deviation

P= Proportion of population

A marginal error of five percent with 95 percent confidence was used for the study. The standard deviation factor which responds to 95 percent confidence is 1.96. The response distribution to give the largest population proportion was estimated at 50. This gave a sample size of 384.

Equation 1 is used to calculate the sample size necessary for a large population. For smaller, finite populations, an adjustment needs to be made. (PSECS, 2018). Using the smaller population size of 162, the adjustment formula in equation (2) was used.

$$N_1 = \frac{N_0}{1 + ((N_0 - 1)/N)} \qquad \text{equation (2)}$$

Source: Sample size formula: (PSECS, 2018)

N_0= large population sample size N= Population size

N_1= small population sample size

The new sample calculation was size 115.

For this research, fifty (50) questionnaires were prepared for distribution. For each stratum, the sample size was calculated through proportional allocation based on its size relative to the population. Interviews were conducted in higher institutions of education as shown in Table 3.4.

Table 3.4: Sample frame and sample size of the research

Population Group (Stratum)	Population Sample	Proportional allocation	Sample Size
Consultants	59	0.396	20
Contractors	80	0.537	27
Higher education institutions	13 (for interview)	-	-
Government agencies	10	0.067	3
Total	162	1	50

The skills needs were correlated to skills acquisition to allow for skills matching with the use of indicators. These types of skills matches were determined following the results.

3.5 Data collection instruments

From literature, the most common research instruments used for data collection were questionnaires and interviews. The nature of data required was primary data and questionnaires were selected because they were the most cost effective means that could be used. Secondary data was in the form of labour force surveys, population surveys and reports were used to provide context for the design of the questionnaires. The questionnaire was also selected because of the ability to reach a wider audience and received structured responses for ease of analysis. A setback experienced was the slow response from participants as well as lack of enthusiasm to participate in the research. In some instances, respondents did not answer all the questions and this led to information gaps.

Interviews were also conducted with the aid of an interview guide. An interview guide was used to streamline the conversation in the interview and keep it in a similar context with the questionnaire. The interviews were selected because information that required elaboration by selected experts in skill development was important to the study. The interviews were used to validate the findings from primary data derived from questionnaires, as well as from secondary data and literature reviewed.

3.5.1 Design of research instruments

The questionnaire comprised of six sections. Section one requested for general information about the respondents in order to develop the industry profile characteristics of the target population. The demographics included gender, nationality, age, professional experience in the industry, academic qualifications, organizational roles as well as level of management in the organization.

The second section had questions to identify organization particulars such as organization types and the core of business. Section three investigated the factors of demand and supply. The aspects considered were government policies, technological needs, education and training and economic factors. Section four explored the organizational skills needs in terms of vacancies the difficulty in filling them and the frequency of conducting recruitment.

Section five was designed to gather information for skills competency assessment. It firstly inquired which tasks were frequently required in the construction projects. This was done in order to determine what the skills requirements to meet task objectives were. The second part of section five was an assessment of the ability of the workforce to carry out required tasks by gauging the skills and experience of the respondents. A rating scale was used to measure the capability levels.

Table 3.5 consists of a rating scale of 1-5 that was used to measure skills competencies with 1 being a very low score, indicating low competency, 3 being medium and indicating average competency, and 5 being very high indicating extremely competent.

Table 3.5: Skills Competency rating scale

Rating Scale	**Description of Level of skill competency**	**Competency ranking**
5	**Experienced:** Rich set of specialized skills allowing for knowledge transfer in training	**Very High (5)**
4	**Extensive Knowledge**: Regularly apply knowledge in accomplishing job	**High (4 > 5)**
3	**Moderate Knowledge**: Professional training received in area, occasionally applied	**Medium (3 > 4)**
2	**Limited Knowledge**: Knowledge from some formal training but rarely applied	**Low (2 > 3)**
1	**Passing knowledge**: knowledge from a few hours of training, but never applied	**Very Low (< 2)**

The definition of core competencies was conducted using ISC0-88. It took into consideration the stages in the transportation project life cycle, the job specific skills required for each occupational group and the skills dimensions i.e. knowledge, practical and reflexive. A description of skills associated with the skills dimensions that were used shown in Table 3.6

Table 3.6: Description of skills dimensions

Skill Dimension	Description of skills
Knowledge	General or specialized depth of knowledge
	Breadth of Knowledge in area of discipline
	Kind of knowledge ranging from concrete to abstract or fragmented to cumulative
	Complexity (combination of breadth
Practical	Creativity using logic and critical thinking
	Technical using methods materials, tools and instruments
	Communication involving written, oral, literacy and numeracy
	Interpersonal
Reflexive	Responsibility, self-governance, accountability, adaptability

(Source: ZAQA, 2016)

The skills dimensions in Table 3.6 were used in the development of skills competency profiles. The competencies adopted for the questionnaires are shown in Table 3.7.

Table 3.7: Developed skill competency profiles

Phase	Nature of Work	Associated skills	Occupational Group
Planning	Feasibility Studies	Planning and designing, civil engineering projects,	Professional
		Study facts to determine the need, like traffic volumes and growth, local development and safety factors	Professional
		Undertaking research and analysing functional, spatial, commercial, cultural, safety, environmental and aesthetic requirements	Professional
	Stakeholder identification	Determining the objectives and constraints of the design brief by consulting with clients and stakeholders	Professional
	Project Scope definition	Formulation of design concepts and plans that harmonize and aesthetic considerations with technical functional, ecological and production requirements	Professional
	Financial planning	Estimating total costs and preparing detailed cost plans and estimates as tools for budgetary control	Professional
Design	Project team assembly	Overseeing the selection, training and performance of staff and subcontractors	Manager
	Drawings, plans and specifications preparation	Preparing sketches, diagrams, plans, maps, charts, samples and models to communicate design concepts and other information	Professional
		Specifying and interpreting drawings and plans, and determining construction methods	Professional
		Resolving design and operational problems in the various fields of engineering through the application of engineering technology.	Professional

	stakeholder involvement	Determining the objectives and constraints of the design brief by consulting with clients and stakeholders	Professional
Construction	Construction delivery method	Operating and implementing coordinated work programmes for site	Manager
		Reading specifications to determine construction requirements and planning procedures	Associate Professional
	Project Scheduling	Coordinating labour resources and procurement and delivery of materials, plant and equipment	Manager
		Organizing and managing project labour and delivery of materials, plant and equipment	Professional
		Organizing and coordinating the material and human resources required to complete jobs	Associate Professional
	Work Supervision	Interpreting architectural drawings and specifications	Manager
		Supervising the construction of structures, water and gas supply and transportation systems	Professional
		Examining and inspecting work progress	Associate Professional
		Examining equipment and construction sites to ensure that health and safety requirements are met	Associate Professional
		Supervising construction sites and coordinating work and other construction projects	Associate Professional
		Supervising the activities of building trades, workers, labourers and other construction works	Associate Professional

	Stakeholder communication	Negotiating with building owners, property and subcontractors involved in the construction process to ensure projects are completed on time and within budget	Manager
	Project cost management	Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources	Manager
	Quality control	Ensuring adherence to building legislation and standards of performance, quality, cost and safety	Manager
	Reporting	Regularly review updated schedules and financial reports to gauge progress on completion dates and budget allocations.	Professional
Completion	Final Measurement	Wrap up final construction, address deficiencies, and close out contracts	Professional
	Defects liability	Ensuring adherence to standards of performance, quality, cost and safety	Manager
	Handover	Arranging submission of plans to local authorities	Manager
Operation and Maintenance	Performance assessment	Reviewing and resolving design and operational problems through the application of engineering technology.	Professional

(Sources: ISCO-88; TranBC (2018))

Section six of the questionnaire was designed for the purpose of determining whether organisations invested in skills development of their workforce. As found from literature, the organization has a role to play in skill development through the training of their workforce. The section was inserted to gain insight on the level of importance that organization place in training activities.

The interview was particularly directed at academic institutions. An interview guide was prepared in order to create a balance between open-ended questions and structured investigative questions relative to the quantitative data, which allowed for varying views on the same subject matter to be obtained in a fair manner. The interview guide had four sections. The first section was used to determine whether educational institutions identified industry needs. It had questions on how the institutions investigated skills competency needs and skills gaps and whether they established relationships with industry. Section two was designed to determine the institution's ability to regularly review curricula and finance the activity. The third section inquired the key skills elements around which the curricula were designed, and required explanations on the steps involved in obtaining information from industry for the use in curriculum design. The last section was used to determine whether are any existing educational institution - employer partnerships. It included open ended questions on the perceived shortfalls of the current methods used in the curriculum design process and suggestions on how to address them. The purpose of the interview was to gain insight on how industry and academia could partner for skills development planning. A sample of the interview guide is in Appendix B.

3.6 Pilot Study

It is always advisable to conduct 'pilot study' (Pilot Survey) for testing the questionnaires. A pilot survey is a replica and rehearsal of the main survey. Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaires and also of the survey techniques. (Kothar, 1990)

The research instruments were pilot tested to validate the effectiveness in yielding required results. For the questionnaires, the aspects taken into consideration were; the amount of time it took to complete, clarity of instructions, ambiguity of questions, objection to answering any of the questions, attractiveness of questionnaire layout

and most importantly the identification of items that did not yield useful data. The interview guide was pilot tested for the same reasons.

3.7 Administering the survey

A total of fifty (50) questionnaires were administered by hand delivery as well as electronic mail. Participants were allowed three weeks to complete the questionnaires and follow-ups were made as reminders. Three interviews were conducted face-to-face with curriculum development experts at TEVETA, the University of Zambia and NCC. Appointments were made beforehand, at a time most convenient to the interviewees.

The questionnaires were accompanied by a cover letter which explained what the purpose of the research was and assurance of confidentiality of responses. Similarly, the interviewees were informed orally prior to the commencement of the interview.

3.8 Data analysis and presentation

The data from the questionnaires was analysed using statistical software, namely Microsoft Excel and Statistical Package for the Social Sciences (SPSS). Statistical methods of analysis for the correlation of variables was conducted to produce tables, pie charts, bar charts, frequency tables, cross tabulation and mean response tables.

The data from interviews was analysed using content analysis which involved the categorising of verbal data that was used to classify and summarise the information into key words. The process of data analysis, as described by Bengston (2016) includes; the decontextualisation of data to identify meaning units, recontextualising the units to include relevant words, the categorizing of similar words and phrases and the compilation of realistic conclusions of condensed word units. The result was a set of codes that describe the findings according to set out themes of each section of the interview guide. The codes were used for the correlation of interview data to questionnaire data.

3.9 Ethical Considerations

The purpose and objectives of the research were disclosed to respondents before the research instruments were administered. Participation in the survey was on a voluntary basis and respondents were assured of their confidentiality and anonymity,

and as such, their names and organisations have not been included in the results presentation. The data was handled objectively by including all results regardless of the contradiction to any hypothesis made prior to carrying out the research, and the true findings of the research were disclosed. In order to ensure confidentiality and anonymity of the interviewees, their names, gender and job titles have not been disclosed.

3.10 Reliability of instrument

Research instruments were tested for consistency in different settings through the pilot study. Pilot subjects who were selected were involved in different stages in construction to represent the multiple facets of construction. These included individuals involved in planning, design, supervision, construction and service delivery. In addition, the participants used were of different occupational groups. They included an academician, an associate professional, a professional and a manager. The feedback received indicated how accurately the instruments answered the research questions.

3.11 Validity of instrument

In order to ensure that the design of the research would provide credible conclusions to address the research questions, two validation checks were carried out. Firstly, the questionnaire and interviews were tested in a pilot survey. The purpose of the pilot study was to ensure that the approach of data collection yielded necessary results pertinent to the study. It allowed for corrections to be made, such as the addition of relative questions and the removal of unnecessary questions.

Secondly, the aspect of the ability of the research to be generalised beyond the specific research context was explored. The use of ISCO-88 for detailed occupation classification of construction professions and the corresponding job descriptions, as well as ISIC Rev 4 for economic activity classification of types of construction was a way to structure the research such that it can be used for in depth skills analysis of all the different subsectors of the Construction industry. In addition, the participation of different stakeholder groups was incorporated into the research design in order to gain different perspectives in differing contexts.

3.12 Summary

This chapter presented the tools and techniques design to suit the nature of the research. It discussed the target population and the expected outputs of the data collection instruments. Chapter four analyses and discusses the collected results.

CHAPTER 4: ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

The previous chapter described the research methodology that was implemented in the study. In this chapter, the results obtained from the questionnaire survey administered to industry players in the transportation sub sector are analysed and discussed. In order to gain more insight on the skill development planning procedures in the industry, one-on-one interviews were conducted with curriculum development experts in construction-related learning institutions, and the analysis of the results are also included in this chapter.

4.2 Questionnaire survey

A total of fifty (50) self-administered questionnaires were distributed through electronic mail and hand delivery. Thirty eight (38) questionnaires were filled and returned, giving a 76 percent response rate.

4.3 Respondent Demographics

4.3.1 Gender of Respondents

Out of the 38 respondents, 29 were male, representing 76.3 percent and the remainder of 23.7 percent was female.

4.3.2 Nationality of Respondents

The respondents composed of 33 Zambians and 5 non Zambians representing 86.8 percent and 13.2 percent respectively.

4.3.3 Age of Respondents

The age range frequency distribution is shown in Table 4.1.

.

Table 4.1: Age of Respondents

Age Range	Frequency	Percentage
Less than 30 years	33	86.8
30-39 years	5	13.2
40-49 years	0	0
Total	38	100.0

4.3.4 Academic Qualification of Respondents

The majority of correspondents, which was 63.2 percent, had a Bachelor's Degree qualification. The remainder of the distribution is shown in Table 4.2.

Table 4.2: Academic qualifications of respondents

Academic qualification	Frequency	Percentage
Diploma	4	10.5
Bachelor's Degree	24	63.2
Master's Degree	10	26.3
Total	38	100.0

4.3.5 Working Experience of Respondents

In Table 4.3 the frequency of the number of years of work experience that respondents have is shown.

Table 4.3: Years of Work Experience in the Construction Industry

Years of experience	Frequency	Percentage
0-5 years	27	71.1
5-10 years	6	15.8
10-15 Years	2	5.3
More than 15 years	3	7.9
Total	38	100.0

4.3.6 Management Level of Respondents

Majority of the respondents held middle management positions (52.6 percent). Senior management positions were held by 34.2 percent of respondents and 13.2 percent held junior management positions.

4.3.7 Construction Occupational Titles of Respondents

The different occupational titles held by the respondents are shown in Table 4.4.

Table 4.4: Construction Occupational Titles of Respondents

Occupational title	ISCO-88 Group	Frequency	Percentage
Civil Engineer	Professional	26	68.4
Inspector of Works	Associate	3	7.9
Site Manager	Manager	2	5.3
Contract Manager	Manager	2	5.3
Project Manager	Manager	2	5.3
Chief Executive Officer	Manager	1	2.6
Environmental Officer	Professional	1	2.6
Surveyor	Professional	1	2.6
Totals		38	100.0

4.4 Organisation Particulars of Respondents

The target population of the study was construction industry participants whose core of business is transportation infrastructure development. Data was collection to determine the organization identification particulars.

4.4.1 Type of Organisation

The organisations of the respondents consisted of 17 consultants (34 percent), 12 contractors (24 percent), 7 government institutions (14 percent), one local authority and one parastatal. The distribution is shown in Figure 4.1.

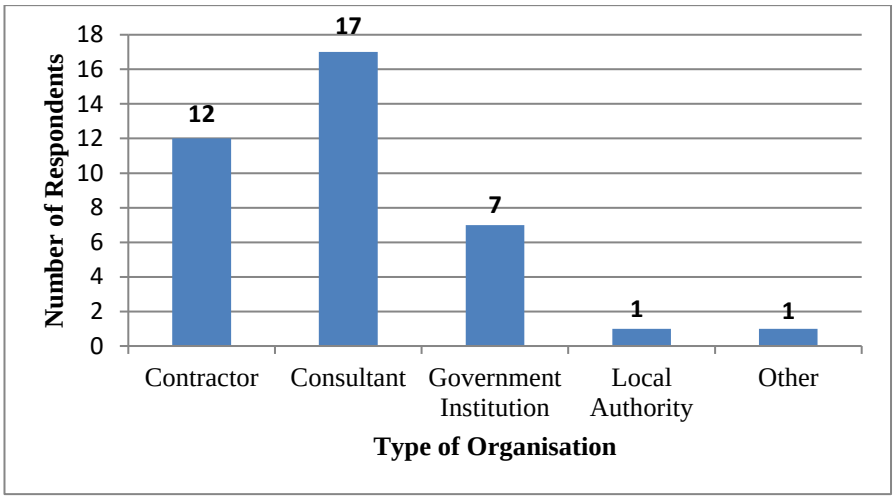


Figure 4.1: Type of organisations represented by respondents

Among the contractors, there were 6 that were Grade 1 registered contractors, 5 registered at Grade 2 and one registered at Grade 4. This is shown in Figure 4.2.

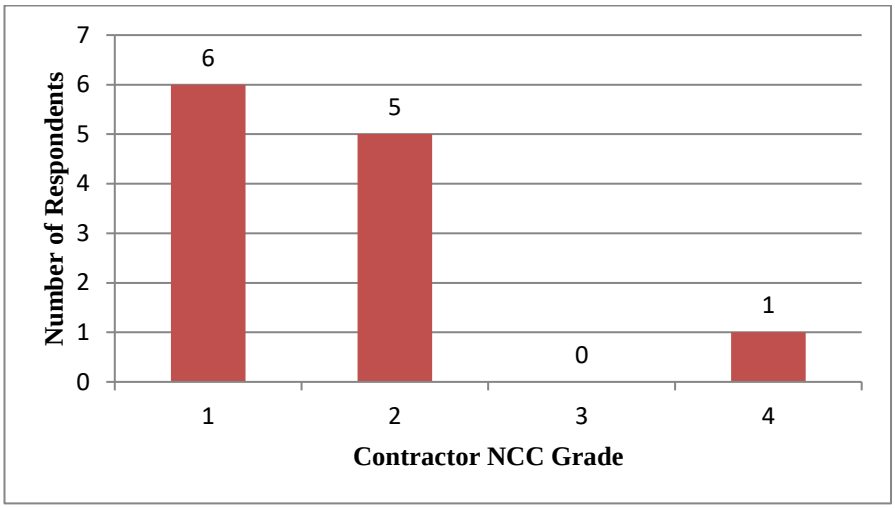


Figure 4.2: NCC Registration Category of contractors

4.4.2 Core of business of organisations

The number of respondents in organisations that conducted road construction activities was 33, this represented 86.8 percent. An illustration of the distribution of the remainder of the sectors is shown in Figure 4.3.

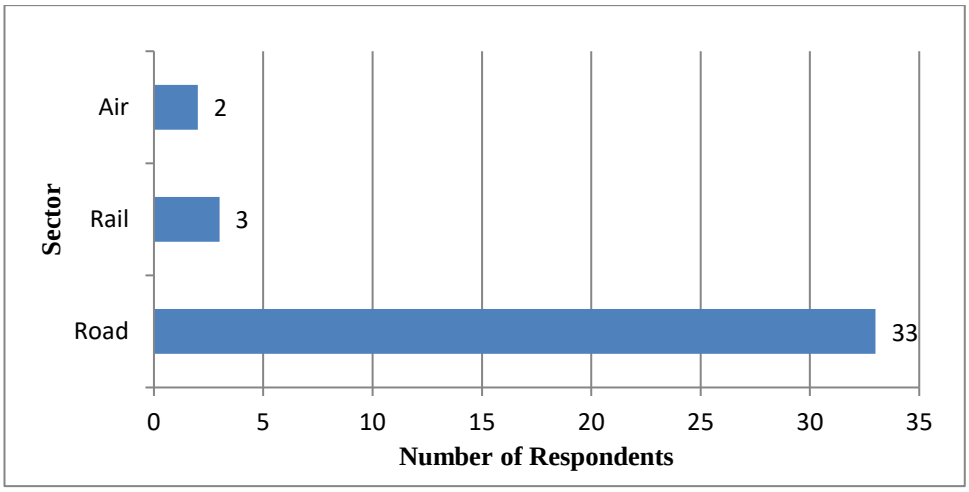


Figure 4.3: Transportation sub-sectors of firms

4.4.3 Female Participation in Construction firms

The respondents were asked to estimate the average percentage of female construction staff employed in their organisations. Results indicate that an average of 16.3 percent of construction staff were female, as shown in Table 4.5.

Table 4 - 5: Percentage of female staff employed in company

Description	Number
Mean	16.3
Median	11.0
Mode	2.0

The respondents were then asked if any of the females occupied senior positions in the company. Table 4.6 shows the responses.

Table 4.6: Availability of female employees who held Senior Positions

Response	Frequency	Percentage
Yes	11	28.9
No	26	68.4
I do not know	1	2.6
Total	38	100.0

4.5 Factors influencing skill demand and supply

The respondents were asked to rate the importance of certain factors in the selection of a construction job.

A five point likert scale was used for the assessment where respondents were rating the importance of certain factors in construction job selection. The mean scores on influential factors is shown in Table 4.7.

Table 4.7: Factors influencing skills demand and supply

No.	Factor description	Type of factor	Mean Score
1	Personal interest in doing this type of job	Social	4.66
2	Your attitude, motivation, or personality	Social	4.61
3	Personal technical and practical skills	Education and training	4.50
4	Salary scale	Economic	4.45
5	Relevant work experience	Education and training	4.24
6	Personal qualification level	Education and training	4.16
7	Ability to use emerging technological design software and tools	Technological	3.82
8	Company accreditation by national bodies affiliated to construction	Governmental	3.79
9	Personal professional accreditation by national bodies affiliated to construction	Governmental	3.66
10	Company participation in international construction projects	Globalisation	3.45
11	Personal mobility for job-related transfers	Demographic	3.39
12	Government plans to promote job creation through implementing the construction projects	Governmental	3.34
13	Favourable work hours	Economic	3.29
14	Government financing of the construction projects	Governmental	3.08
15	Government funding of construction education and training programmes for continuous professional development within projects	Governmental	2.89

(Scale parameters were; 1=Not important, 2=slightly important, 3=not sure, 4=important, 5= very important)

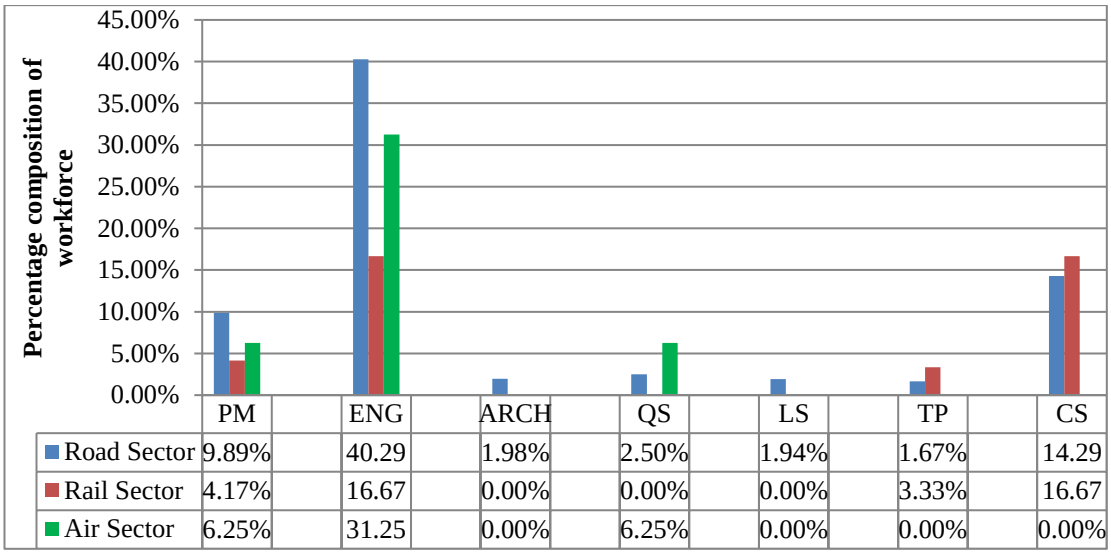
The responses indicated that reflexive skills were of importance, with the higher means scores being social factors relating to motivation, interest and attitude in carrying out a certain job. Education and training factors such as technical and practical skills, work experience and qualification levels followed suit with mean scores of 4.50, 4.24 and 4.16 respectively. The most common economic factor was salary scale with a mean score of 4.45. A technological factor of the ability to use emerging design software and tools had a mean score 3.82.

An observation from the results was that the government factors did not have as much influence compared to the other factors. The construction industry environment for high skill professionals is experiencing skills movement driven by clear career paths of individuals and the rate of pay for carrying out a job. The need to use design software and tools is important and corroborates literature.

4.6 Organisational skills needs

In the determination of skills needs, organisational requirements compliment industry needs and are aligned with the core of business. An investigation on skills needs of the organisation was conducted. Firstly, the employment by occupation of high skilled construction staff relative to overall number of construction employees was investigated.

The high skilled occupations that were investigated were, Project managers, Engineers, Architects, Quantity Surveyors, Land Surveyors, Traffic Planners and Construction Site supervisors. The analysis was done for each sector by calculating the percentage composition of high skilled construction occupations relative to total number of construction employees. Figure 4.4 shows the percentage composition of high skill construction occupations in organisations in the road, rail and air sectors.



	PM	ENG	ARCH	QS	LS	TP	CS
Road Sector	9.89%	40.29	1.98%	2.50%	1.94%	1.67%	14.29
Rail Sector	4.17%	16.67	0.00%	0.00%	0.00%	3.33%	16.67
Air Sector	6.25%	31.25	0.00%	6.25%	0.00%	0.00%	0.00%

ENG = Engineers

ARCH = Architects

QS = Quantity Surveyor

LS = Land Surveyor

TP = Traffic Planners

CS = Construction Supervisors

Figure 4-.4: Percentage composition of high skill construction professionals

The road sector had a high average percentage of Engineers and Construction Supervisors in the workforce with percentages of 40.29 and 14.29 percent respectively. Land Surveyors were least in number with a percentage of 1.94. The rail sector mostly had Engineers and Construction Supervisors with a composition of 16.67 each. It also had an average composition of 4.17 percent of Project Managers. There were no Architects, Quantity Surveyors and Land Surveyors. Traffic Planners were at 3.33 percent. The air sector had more Engineers than other occupations, with a percentage composition of 31.25. The air sector also had Project Managers consisting of 6.25 percent of the workforce.

4.6.1 Vacancies for high skill professions

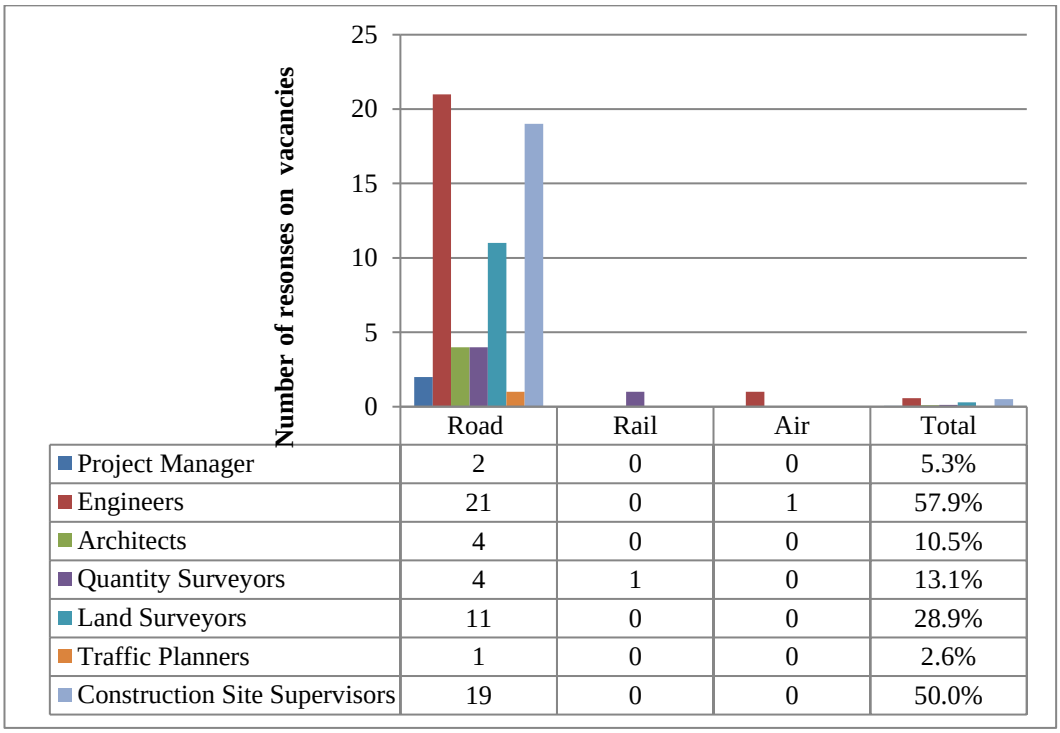
The study sought to determine which high skill occupations were in demand in occupations. The respondents were asked how frequent the recruitment of staff was carried out in the organization. The responses are shown in Table 4.8.

Table 4 - 8: Frequency of recruitment

Frequency of Recruitment	No. of Responses	Percentage Response
Not Frequent	18	47.4
Moderately Frequent	16	42.1
I Do Not Know	2	5.3
Frequent	1	2.6
Very Frequent	1	2.6
Total	38	100.0

The results indicate that organisations did not conduct recruitment very frequent. This is shown by the 47.4 percent of respondents that indicated how recruitment was not frequent, closely followed by 42.1 percent of respondents that indicated moderately frequent recruitment activity.

In the instances where organisations carried out recruitment, the study sought to determine which occupations had vacancies. Figure 4.5 summarises which occupations were most sought for.



	Road	Rail	Air	Total
Project Manager	2	0	0	5.3%
Engineers	21	0	1	57.9%
Architects	4	0	0	10.5%
Quantity Surveyors	4	1	0	13.1%
Land Surveyors	11	0	0	28.9%
Traffic Planners	1	0	0	2.6%
Construction Site Supervisors	19	0	0	50.0%

Figure 4.5: Responses on vacancies for high skilled occupations

The results indicate the most sought after occupations in the road sector were Engineers, Construction Site Supervisors and Land Surveyors with 21, 19 and 11 confirmed responses respectively. In the rail sector, there were only vacancies for Quantity Surveyors. The air sector only had vacancies for Engineers. Across the sectors combined, the most vacancies were for Engineers at 57.9 percent, Construction Supervisors at 50.0 percent and Land Surveyors at 28.9 percent.

4.6.2 Difficulty in filling Vacancies

The respondents were asked whether the organisations experienced difficulties in filling vacancies and the underlying reasons that may contribute to it. In Table 4.9, the responses are shown.

Table 4.9: Difficulty in recruitment experienced

Response	Frequency	Percentage
Yes	16	42.1
No	15	39.5
I do not Know	5	13.2
Unresponsive	2	5.3
Total	38	100.0

This indicates that there are instances where there is difficulty in recruitment and other instances where it is not so challenging. Although yes and no responses were almost at par, the higher percentage of respondents, at 42.1 percent indicated that there was difficulty in recruitment. The reasons as to why recruitment was experienced were explored and are shown in Table 4.10.

Table 4.10: Extent to which reason contributes to inability to fill vacancies

Reason	Mean Response	Percentage
Company is unable to pay market rate	3.94	23.7
Lack of relevant work experience	3.72	23.7
Lack of the qualifications needed	3.56	10.5
Not enough people with job-specific skills in the industry	3.44	10.5
Lack of technical or practical skills	3.28	7.9
Poor attitude/motivation or personality	2.33	5.3
Not enough people interested in doing this kind of job	2.28	5.3

Low number of applicants	2.28	2.6
Job requires unsociable work hours	1.78	2.6
Unknown reasons	-	7.9
Total		100.0

(Scale parameters were 1= none, 2= low, 3= I do not know, 4= medium, 5=high)

The results indicate that the company's inability to pay market rates was the highest contributing reason as to why vacancies could not be filled. The lack of relevant work experience and qualifications for the job were other contributing reasons. An observation is that having a low number of applicants does not significantly affect the ability to fill vacancies.

4.7 Skills competency assessment

The overall outcome of the study is to provide a means of measuring skills competencies. From literature, key labour market indicators have been used to gauge labour market conditions. It has also been identified that the indicators focus more on education and qualifications and that a more in depth analysis would be ideal for skills competency assessment. In the study, respondents were asked what tasks they frequently had to carry out on a daily basis in their jobs. This was conducted to determine the nature of skills that are required in order to meet task objectives.

4.7.1 Skills requirements

The frequency of carrying out in all the sectors combined is shown in Table 4.11.

Table 4.11: On-job-skills requirements

No	Skills requirement	Phase	Mean Response	Std. dev.
1	Supervising and coordinating construction works on site	Construction	4.11	1.203
2	Examining and inspecting work progress	Construction	4.08	1.239
3	Ensuring adherence to construction legislation and standards of performance	Construction	3.68	1.435
4	Ensuring that construction workers follow established occupational health and safety policies and procedures	Construction	3.63	1.303
5	Addressing work defects, and close out of contracts	Project Completion	3.55	1.606

6	Consulting with clients and stakeholders for design purposes	Planning	3.34	1.438
7	Preparation of technical reports	Planning	3.26	1.703
8	Preparing construction drawings using engineering software	Design	3.18	1.658
9	Reviewing updated activity schedules and financial reports to gauge progress	Construction	3.11	1.673
10	Reviewing and resolving design and operational problems through the application of engineering technology	Operation & Maintenance	3.08	1.600
11	Estimating project costs and preparing detailed cost plans	Planning	3.05	1.659
12	Negotiating with building owners, property owners and other stakeholders affected by construction works	Construction	2.95	1.666
13	Conduct surveys to establish baselines, elevations and other geodetic measurements	Planning	2.84	1.853
14	Managing budgets and controlling project expenses	Design	2.76	1.567
15	Preparing technical specifications	Design	2.68	1.694
16	Organizing and managing project labour and delivery of materials, plant and equipment	Construction	2.58	1.426
17	Preparation of financial reports	Construction	2.58	1.671
18	Conflict resolution when working with others	All Stages	2.55	1.465
19	Undertaking research to analyse functional, economic, environmental, social requirements for design	Planning	2.55	1.639
20	Organising and selecting project staff	Design	2.53	1.466
21	Preparing construction method statements	Design	2.50	1.351
22	Training and mentoring of apprentices	All Stages	2.51	1.359

(Scale parameters were 1=I do not know, 2=not frequent, 3=moderately frequent, 4= frequent, 5=very frequent)

From the results it can be seen that most skills are required in the construction phases. The most required skill is the supervision of coordination of construction works on site with a mean response of 4.11. The examining and inspecting of works progress is also an essential skill that is required. The least required skill set is that of knowledge transfer in the form of training and mentoring of apprentices. This is a form of on-the job training that is not considered as a priority.

In literature, the issue of use of modern technologies was discussed. It was established that the use of technological methods and tools is a factor influencing skills demand and supply. The respondents were asked if there were any emerging technologies that were impacting the way their organisations were conducting the construction works. The response is shown in Table 4.12.

Table 4.12: Responses on the influence of technology

Technology needed	**Frequency**	**Percentage**
Yes	33	86.8
No	4	10.5
I do Not Know	1	2.6
Total	38	100.0

The responses indicated by 86.8 percent of the sample size indicated that there were emerging technologies that were impacting the way the organisations were conducting construction works. Out of the total respondents, 42.1 percent indicated that their companies sourced for or provided training to promote the skills development for the use of the emerging technologies as shown in Table 4.13.

Table 4.13: Provision of technological training programmes in organisations.

Training Provided	**Frequency**	**Percentage**
Yes	16	42.1
No	3	34.2
I do Not Know	6	15.8
Unresponsive	3	7.9
Total	38	100.0

Respondents were also asked what level of computer use was and its level of importance in task completion. In Table 4.14, the required level of computer use is shown.

Table 4.14: Level of importance of computers in task completion

Rank No.	Level of Computer Use	Mean Response
1	Basic(e.g. data entry, sending and receiving e-mails or printing)	4.76
2	Moderate (e.g. word processing or spread sheets)	4.61
3	Complex (e.g. analysing information or design, including computer aided design)	3.95
4	Advanced (e.g. software programming; managing computer networks)	2.37

(Scale parameters were 1= not important, 2= slightly important, 3= not sure, 4= important, 5=very important)

The results indicate that basic knowledge in computing such as data entry and receiving emails and printing is required to a higher degree. The complex level, which requires the use of Computer Aided Design (CAD), is also of importance but it ranked after moderate use which had a mean response of 4.61.

4.7.2 Skills competency of available workforce

For the assessment of skills competency to be conducted in this research, the respondents were gauged on their ability to carry out the tasks that were required of them. The respondents were asked to rate their skill level proficiency and experience in performing task on a scale of 1-5. The overall skills competency of the available workforce is shown in Table 4.15.

Table 4.15: Overall skills competency of available workforce

Rank No.	Skills Ability	Rating Average*	Std. dev.	Phase
1	Examining and inspecting work progress	4.05	1.012	Construction
2	Supervising and coordinating construction works on site	3.92	1.148	Construction
3	Addressing construction defects,	3.82	1.312	Project Completion
4	Ensuring adherence to construction legislation and standards of performance	3.63	1.239	Construction
5	Stakeholder engagement	3.62	1.233	All phases
6	Ensuring that construction workers follow established occupational health and safety	3.53	1.268	Construction

	policies and procedures			
7	Preparing construction drawings using engineering software	3.53	1.370	Design
8	Analysing functional, economic, environmental, social requirements for design	3.42	1.287	Planning
9	Organizing and managing project labour and delivery of materials, plant and equipment	3.37	1.441	Construction
10	Reviewing and resolving design and operational problems through the application of engineering technology	3.37	1.364	Operation &Maintenance
11	Preparation of technical reports	3.34	1.512	Construction
12	Closing out of contracts	3.32	1.435	Project Completion
13	Preparing technical specifications	3.26	1.427	Design
14	Conducting surveys to establish baselines, elevations and other geodetic measurements	3.26	1.537	Planning
15	Conflict resolution when working with others	3.24	1.234	All stages
16	Estimating total costs and preparing detailed cost plans and estimates	3.24	1.480	Planning
17	Organising and selecting project staff	3.13	1.436	Design
18	Preparing construction method statements	3.13	1.379	Design
19	Determining needs, like traffic volumes and growth, local development and safety factors	3.08	1.323	Planning
20	Training and mentoring of apprentices	3.05	1.432	All phases
21	Preparation of financial reports	2.89	1.410	Construction

(*Rating interpretation: (< 2) =very low, (2>3) = low, (3>4) = medium, 4>5= high and 5= very high)

An overall indication is that respondents were least capable of financial reporting. The training and mentoring of apprenticeship was an aspect in which respondents lacked capabilities. The strengths were in examining and inspecting works progress and construction works supervision. An important phase in transportation planning had low skill sets. Determining needs like traffic volumes and growth, local development and safety factors was one of low scoring skills with a rating of 3.08. Another planning skill which is the estimating of total costs and preparing detailed cost plans was on the lower side of the scores with a mean response of 3.24.

4.7.3 Skills mismatches

From the research, results indicated the dominant high skill level occupations were Engineers and Construction Site Supervisors. Despite this, the vacancies were highest for these occupations. An indication is that the demand for Engineers and Construction Supervisors is exceeding the current supply. An important aspect to note is that one of the influential factors of demand and supply was salary scale. According to the results, the organisations' inability to pay market rates for skills was the most common reason why vacancies are hard to fill. There is a skills shortage of Engineers and Construction Supervisors within organisations.

Education and training was another influential factor as seen from literature. One of the other reasons why vacancies were hard to fill was the lack of relevant work experience and qualification. From the results, it was seen that majority of respondents had less than 5 years of work experience in the sector. This difficulty in finding individuals with 'relevant' work experience and qualifications implies that the type of skills attained are different from what is required to perform the job adequately. This is an indication of a skills gap.

It was identified from literature that construction plans include development of transportation infrastructure. From results it is seen that the skills strengths in the sector lie in the supervision, examining and inspecting of construction works. The planning and design processes showed fewer skills capabilities. Skill proficiency ratings ranged between moderate knowledge in which professional training was received in area and occasionally applied, and extensive knowledge in which knowledge was regularly applied in accomplishing job. An illustration of what was shown in Table 4.9 is shown in Figure 4.6.

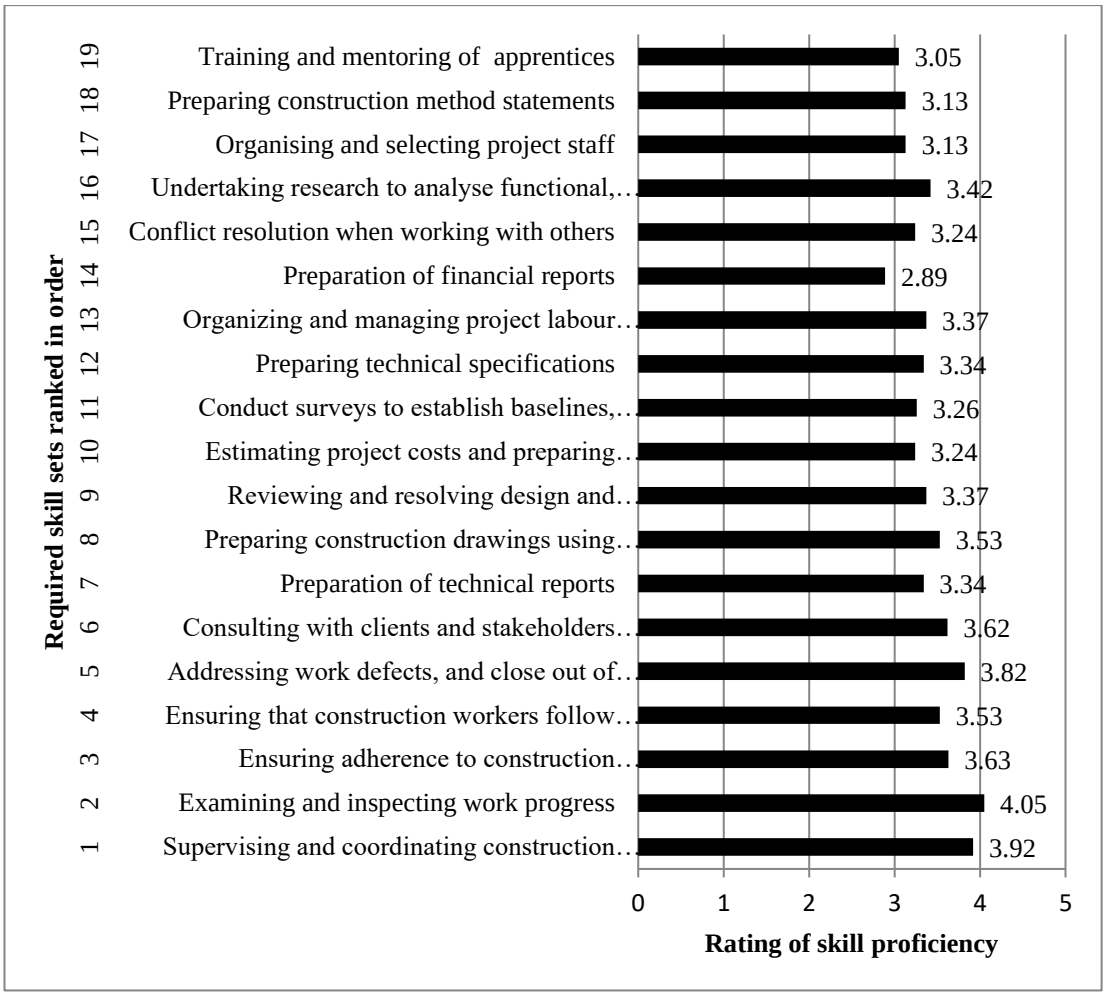


Figure 4- 6: Skills proficiency ratings of respondents

Financial reporting had the lowest mean rating of 2.89. The preparation of construction method statements and organizing project staff also had lower ratings of 3.13 each. The design aspects of transportation infrastructure experience larger skills gaps than the construction phases. Additional response from the air sector was that staff was outsourced for new construction works due to lack of local qualified staff. The sector normally sourced engineers to carry out supervisory and maintenance works.

The financial and functional design aspects exhibited lower skills competency efficiencies. Estimation of project costs and and preparing detailed cost plans and estimates had an indication of being a subject of difficulty for participants. Technical report writing and preparation of technical specifications proficiencies also lagged in comparison with supervisory works. The up-skilling of staff would be required in these skill gap areas.

4.7.4 Skills development planning capacity of organisations

A recurring subject in this research is skills development planning. Results have indicated that knowledge transfer is not of importance in most organisations. In literature it states that organisations play a major role in the development of skills of the workforce. Respondents were asked if skills and training needs of individual staff were reviewed at their organisations. 50 percent of the response was that organisations carried out skills reviews as shown in Figure 4.7.

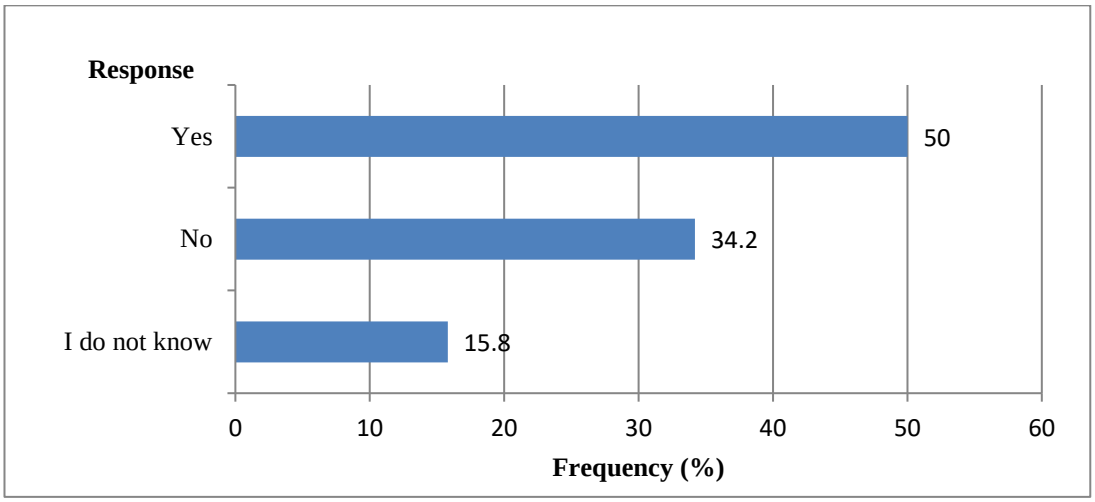


Figure 4.7: Response on whether skills reviews are conducted in organisations

The indication is that organisations assess skills needs. The frequency of the reviews in the organization is shown in Figure 4.8

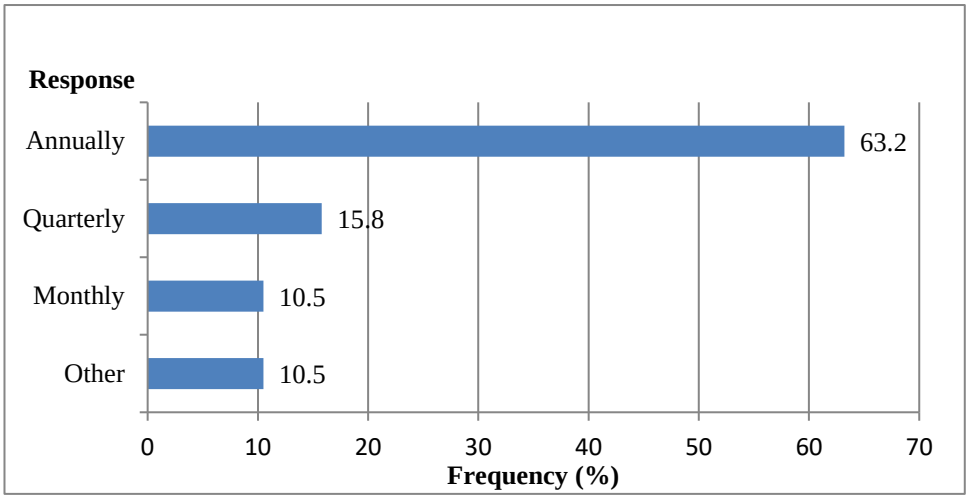


Figure 4- 8: Frequency of workforce performance reviews in organisations

Annual skills reviews were common in organisations, with 63.2 percent of the respondents indicating that reviews were conducted annually. Other periods when skills were reviewed were at the start of a new project.

Respondents were asked if their organisations offered or organised other forms of training, such as on-the-job training or workshops for the construction staff to participate in and the results are in Figure 4.9.

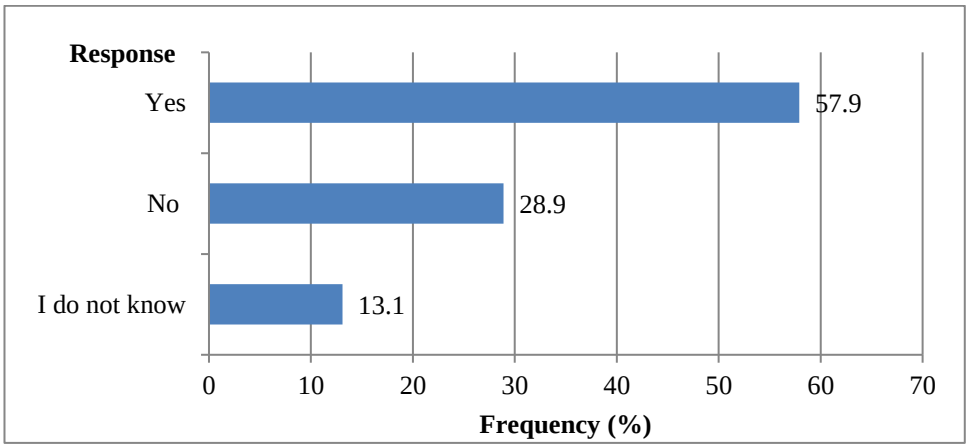


Figure 4.9: Organisations that offer staff training

Out of the 28.9 percent who responded no, an inquiry was made on what the possible reasons why the orgainisations did not offer training could be. Table 4.16 shows the responses.

Table 4.16: Reasons for no training

	Reason why training is not offered	Percentage
1	There is no budget for training	82.8
2	Low quality of courses offered	0.0
3	There are no trainers available	0.0
4	There is no need for training	18.2
5	I do not know	0.0
	Total	100.0

4.8 Interview Analysis

A major problem identified from literature was that training institutions do not respond directly to industry demands, leading to a rigid market supply. The purpose

of the interviews was to identify how training institutions carry out skills labour market assessments for the identification of skills mismatches in order to formulate skills development programmes. This would then establish the extent of the gap between industry and educational institutions in relation to skills planning.

The result of content analysis conducted on the interview responses was a set of codes that describe key processes in curricula development. The final Coding framework is demonstrated in Table 4.17.

Table 4.17: Final coding framework for content

Theme		Final Code
1	Skills Needs Identification	1. Stakeholder Consultation
		2. Labour Market Evaluation
		3. Job Profile Definition
		4. Skills Mismatch Analysis
		5. Training Needs Analysis
2	Internal Capacity for Review	
a	Financial Capacity	1. Government
		2. Self-funded
		3. Private Sector
b	Human Resource	1. Government
		2. Teaching/Institutional Experts
		3. Industry Representatives
3	Curriculum Design	1. Curriculum Review
		2. Job Profile Development
		3. Curriculum Design Validation
		4. Updating of Curriculum
4	Partnerships	1. Statutory Bodies
		2. Industry
5	Shortfalls	1. No enforcement polices
		2. No programme evaluations
		3. Lack of focus on industrial training

4.8.1 Industry needs assessment procedures

Interviewees were asked questions on how their institutions identified skills needs, the capacity that the institutions had to review curricula, the curriculum design process and if their institutions had any links with industry. The tabulated results for the initial coding framework used in the content analysis are included in Appendix C.

The interview findings suggested that the initial stage in curriculum development was conducting a skills needs assessment, as expressed by all the interviewees. The definition of the process differed from institution to institution with some calling it training needs analysis, labour market evaluation and needs assessment but the outcomes were similar. The process involved engaging stakeholders in the industry on emerging skills needs, as well determining the state of the labour market environment. The state of the labour market was assessed using labour market signals or indicators to determine which factors influenced the skills demand and supply.

Inquiries made were on persistent skills gaps, skills challenges and skills competency requirements. The information gathered was then used for the creation of job profiles which aligned skills competency requirements to occupational job roles. This enabled the assessment of exact skill sets that were required for the planning of the development of those skills.

4.8.2 Structural Capacity to conduct skills audits

An investigation on the financial and human capacity of institutions to carry out curriculum was conducted. The results from the interviews indicated that most of them did not have a budget allocation for curricula development. The industry and the government occasionally assisted financially. The human resource consisted of industry representatives, internal representatives and occasionally the government.

4.8.3 Designing Curricula

According to the results, the design of curriculum primarily involves stakeholder and industry input on emerging skills needs and review of current curricula and training programmes. This leads to the formation of job profiles and level descriptors for skills level assessments. The internal curriculum boards of the institutions then design the curricula and validation and review of the updated curricula is conducted by boards which have members who are industry representatives. This indicates that the industry plays a role in curriculum and training programme development.

4.8.4 Workforce partnerships

All the interviewees' response was that their institutions had workforce partnerships with industry. They also had partnerships with NCC.

4.8.5 Shortfalls

One of the shortfalls of the curriculum design process was the absence of programme effectiveness assessments. There is a need for monitoring and evaluation to ensure that the newly formed strategies of skills development yielded outputs of increased productivity of the workforce after up-skilling. The institutions did not have a programme evaluation process to determine whether the newly introduced programmes yielded the required outputs in industry in terms of meeting required skills competency needs.

Another shortfall highlighted was the intense focus on improving learning programmes with minimal attention given to the improvement practical skills training that would allow scholars to have hands-on training direct in industrial projects. A matter of concern was also the absence of enforcement policies with regards to industrial training which would link the knowledge and practical competencies to meet industry requirements.

4.8.6 Interview Results Discussion

In literature, a skill issue highlighted was that curricula in educational institutions were either outdated or irrelevant to industry (Moono & Rankin, 2013). Results however, indicated that the training institutions conduct assessments of skills needs by directly involving the industry. Furthermore, industry representatives give input to the curriculum design and validation process. The question that arises is whether the institutions incorporate the information obtained from stakeholder consultations, and labour market assessment into the design of updated curricula.

By taking the shortfalls of the curriculum design process, it can be deduced that there is more focus on improving on knowledge skill competency compared to practical skill competency. This entails that graduates may gain the knowledge but not necessarily know how to apply it in industry. Considering the available workforce partnerships that the institutions have with government and the statutory bodies, the ability to develop industrial training programmes on a wide scale to allow students enrolled to have practical experience. The questionnaire findings indicated that knowledge transfer was not of importance and mentorship had a low competency rating compared to other skills proficiencies. This indicates that even if industrial

training programmes were formulated, the trainees still would acquire adequate training if sent out to industry.

The results indicated that the institutions have the human capacity to carry out skills audits but are lagging when it came to financial capacity. In relation to the results of the survey carried out, 82.8 percent of the response indicated that there was no budget allocation for on the job training for skill improvement. The lack of enforcement policies on the skills development in organisations contributes to industry not realizing the importance of the role that they play in skills development.

The study was limited in that it did not probe further into the nature of training programmes that organisations consider to be of importance and areas of skill development that require improvement. Findings however indicate the ability to conduct relative skills audits but that there is a requirement for structural reform of policies to cater to the need for industrial training to compliment the improvement of knowledge competencies.

4.9 Key findings from results

The survey was conducted to firstly identify which factors are influencing the construction labour market and then identify which essential skills mismatches were existent and needed addressing. The interview results provided insight that would allow a skills measurement framework to be tailor designed to suit the local setting.

In the literature review, it was discussed how construction plans for Zambia included the diversification of transportation infrastructure development for economic growth (MoNDP, 2017). Research findings indicate that transportation infrastructure development in Zambia is dominated by the road sector with 86.8 percent of the respondents' organization having road construction projects. There was a challenge in finding respondents to participate from the rail and air sectors. Additional feedback from the survey indicated that the air sector specifically outsourced staff for new construction projects and employed local staff for supervisory and maintenance works. This indicates a need for skills development of local staff for the air sector.

The cyclic nature of the construction industry's influence on the fluctuations in skills demand and supply was discussed extensively in literature review (Agapiou, et al., 1995). It was further highlighted that there are different drivers of skills demand and supply as the fluctuation occurs. The technological progression influencing the global construction market was one of the subjects that were discussed. In the survey, 86.8% respondents stated that there were emerging technologies impacting the conducting of construction works. The workforce is expected to have basic knowledge in computing such as data entry and receiving emails and printing as well as knowledge of word processing or spread sheets. On a complex level, which requires the use of computer aided design is also of importance but to a lower extent.

From the results it was identified that the most influential factors of skills supply were a defined career path which involved personal interest in the job and attitude, motivation and personality towards it. This was followed by the demand factor of education and training requirements such as technical and practical skills and relative work experience. An economic factor, the salary scale was also a major contributing factor of influence in skills demand and supply. The aforementioned factors all had an average score of above 4, corresponding with the scale parameter of being important.

The importance of meeting education and training requirements is demonstrated in the investigation on the reasons for the inability of companies to fill vacancies. The highest mean response for this factor accounting for 23.7 percent of respondents was the lack of relevant work experience. It corresponds with the fact that a large number of them had less than five years of work experience. With the market saturated with graduates and the need for relative work experience in construction, the logical option would be to invest more in on the job training and industrial training programmes.

The economic factor of salary scale is matter that requires investigating as is it is a key influential factor and the companies' inability to pay market rates is the highest contributing factor to the inability to fill vacancies. Results indicated the highest mean response of 3.94 out of a scale of 5, representing 23.7 percent of the respondents. Further research on construction skills market rates and how they affect

the demand and supply of skills should be conducted and added to the labour market information body for labour market environment analysis.

The subject of skills mismatch required an investigation of skills competency needs in comparison with skills competency availability. The measurement of skills proficiencies was observed to be more detailed and direct as pointed out in literature review, in comparison with the use of key labour market indicators (OECD, et al., 2013). For this reason, skills competency analysis was adopted for the study.

The frequency of task execution was used as a means of identifying what the skills requirements were. This was investigated according to the phases in construction of transportation infrastructure, namely planning, design, construction, completion and operation and maintenance (TranBC, 2018). The responses indicated the most frequent skills requirements were in the construction phase. Tasks of importance were supervising and coordinating construction works on site and examining and inspecting works progress. The both had mean responses of above 4 on a scale of 5, corresponding to the scale parameter of "frequent"

Moderately frequent tasks included ensuring occupational health and safety policy adherence, stakeholder consultation, technical report writing, project cost estimation and cost planning, financial progress gauging and the preparation of construction drawings. The activities averaged a score of between 3 and 4 on a scale of 5, corresponding to the scale parameter of "moderately frequent." The least required tasks were a majority in the planning and design phases with activities such as stakeholder engagement, conducting baseline surveys for design, preparing construction method statements and technical specifications, organising and selecting project staff and managing and controlling budget expenses.

The highest skills competency ratings were in examining and inspecting works progress as well as the supervising and coordinating of construction works on site. Respondents exhibited medium skills proficiencies of between 3 and 4 on the rating scale, with the lower of the proficiencies being in preparing construction method statements, project cost estimation and cost planning,, organising and selecting project staff, conducting baseline surveys for design, preparing technical specifications and preparing of technical reports, all scoring below 3.5. Financial

reporting had the lowest proficiency rating of 2.89 which is a low proficiency ranking.

The evident skills gaps were reported in financial and technical aspects in the planning and design of transportation projects which are project planning of staff, works execution and design specification and the costs associated with conducting those activities. Communication skills in the form of written and numeracy were areas which needed addressing. This was shown from lower proficiency ratings in estimation of project costs and and preparing detailed cost plans and financial and technical report writing. Practical skills gaps were lacking in creativity using logic and critical thinking as was shown in low proficiencies in preparing construction method statements and technical specifications, as well as organizing project staff.

It can be argued that the fact that majority of the tasks were applied moderately frequent, that would be an indication that the skills are not really needed. This could be why the proficiency ratings were low. However, as observed in the air industry, this leads to outsourcing, indicating that there are some skills needs required that are requested for at low frequencies from local staff. In the literature review, it was mentioned that the road sector needed improvement in contracts execution and accountability. The focus seems to be more on supervision of works and less on planning and design, which considering the qualifications of respondents is an under utilisation of knowledge skill competency.

Reflexive skill gaps in terms of responsibility and accountability were exhibited the inability to train and mentor apprentices. There was also an indication that knowledge transfer on the job was not prioritised in organization, as it was ranked the least required task. It would not be possible to adequately provide mentorship considering the low number of years of relative experience of most respondents.

In terms of occupational role requirements, findings indicate that Engineers and Construction Supervisors constituted the higher percentage compositions of construction staff and yet they were the most sought after occupations. This is an indication of a skills shortage of such occupations. The diversity of the workforce in terms of female participation was also a moderately investigated. This arose from the realisation that women in the construction industry had the highest underemployment by occupation of 35.7 percent in relation to other industries according to the Labour

force Survey of 2014 (CSO, 2015) . With skills shortage being a matter of concern as seen from literature, maximisation of available skills in the labour market should be considered.

The skills mismatch in the construction industry can be attributed to more focus on skills development of the knowledge skill competency in comparison with practical skill competency development. The absence of enforcement policies for industrial training accompanied by the manner in which industry does not priorities mentorship and knowledge transfer is a hindrance to skills development. Another aspect of concern is industry focus on construction execution and less attention on planning and design. This leads to outsourcing of skills for major phases in construction and both the under-utilisation of available knowledge skill competencies as well as reducing of opportunities to increase on practical skills competencies that will be beneficial to the industry.

4.10 Summary

The chapter presented and discussed the data obtained from the questionnaire survey and interviews. Findings from qualitative and quantitative data were compared and interpreted to form the skills measurement framework. The next chapter presents the development of skills measurement framework that was a result of the analysis of collected data

CHAPTER 5: SKILLS MEASUREMENT FRAMEWORK

5.1 Introduction

Chapter four analysed and discussed the results obtained from data collection. This chapter presents the skill measurement framework that was devised for skills development planning. A detailed explanation of conceptualisation of the framework, its components, its interpretation and validation are elaborated in this chapter.

5.2 Framework development

The main function of the framework is to align skills competencies with changes in the internal and external environment of the industry. The framework was developed by using the results obtained from the semi-structured interviews and the questionnaire survey. The information collated from the interviews provided insight on how higher educational institutions conduct skills audits for curriculum development. This led to the formulation of a sequential five-stage framework structure, indicating the required input and the corresponding output of each progressive stage. The stages involved in skills assessment in the framework was derived using common principles applied in local skills audits identified from the interviews.

The questionnaire surveys provided data sets for the input into the framework. The questions investigated skill competency requirements in construction and assessed the ability of the workforce meet the required skills competencies. The framework that was developed is presented in Figure 5.1.

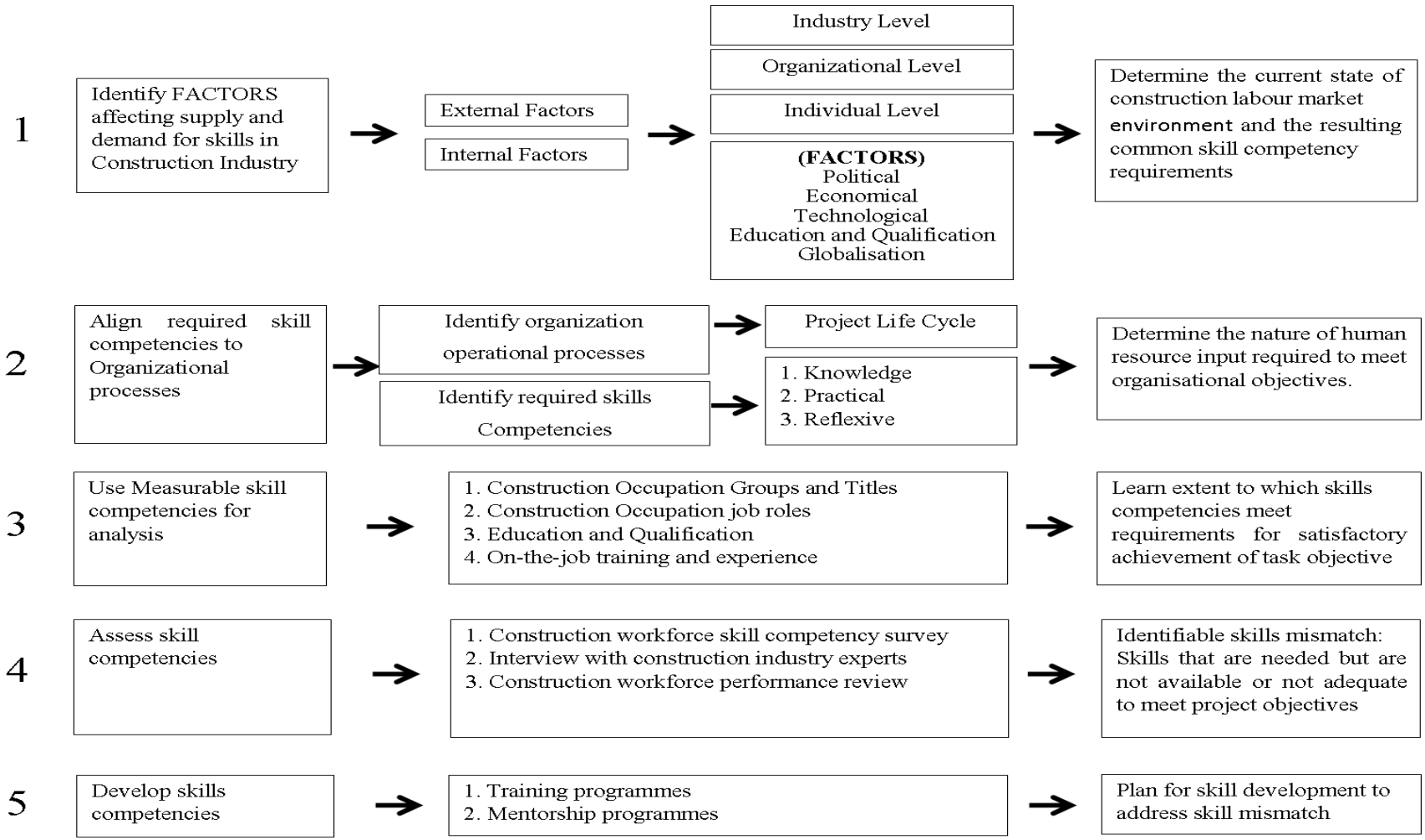


Figure 5.1 Skills Measurement Framework

5.3 Framework composition and interpretation

The Skills Measurement Framework consists of activities in five stages. Each stage has a specific input and aspects to consider which leads to a desired output which is required in the process of skills competency analysis. The stages are discussed successively.

5.3.1 Stage 1: Assessing the current state of the Construction labour market

The first stage in skills analysis involves gauging the current state of the construction labour market. This will require the identification of factors that are influencing skills demand and skills supply. Internal factors pivotal in achieving organisational objectives that are reliant on human resource, as well external factors relating to the construction business cycle should be assessed conjointly. This should be done holistically at industry level, then narrowed down to organisational level and finally at individual level, that is, of the workforce. The resulting output is a depiction of the current state of the construction labour market environment in which common, standard skills competencies that are required can be outlined.

5.3.2 Stage 2: Determining the nature of human resource input required

Gauging the construction industry environment provides insight on which type of construction activity is viable and predominant. The construction activity has a particular nature of work which requires specific skill sets to meet task objectives. The second stage of the framework is the process of aligning the skill competency requirements outlined in stage one with the organizational needs and processes. In construction projects, most of the organizational processes follow a generic project life cycle that includes initiation, planning, execution and closing of the project (PMI, 2013). The required skills sets for effective project performance need to be identified. This framework requires the defining of skills competencies in three dimensions; knowledge, practical and reflexive. The desired output is an overview of the nature of human resource input that is necessary to meet organisational objectives.

5.3.3 Stage 3: Selecting measurable skills competencies

The most crucial part of the skills measurement framework is the actual 'measurement' of skills. This requires selection of criteria upon which to assess the performance of the workforce. Stage three of the framework is where the organization has to define what constitutes the ability of the workforce to effectively and adequately perform tasks. A selection of measurable skills competencies have to be singled out. The framework firstly selects construction occupation groups. Each occupation group has job titles associated with it and outlines main tasks and duties that are carried out by individuals in that particular group. ISCO-08 was the main source of information on occupational classifications that was used in the development of the framework.

The level of formal education and qualification attained are also measurable aspects that were incorporated into the framework. The ZAQA level descriptors were used to associate the level of education attained to the subsequent qualification awarded. Another measurable competency used in the framework is on-the-job training and experience. The output is a list of measurable competencies for analysis which allow for the extent to which the skills competencies meet the requirements for satisfactory achievement of task objectives to be learned.

5.3.4 Stage 4: Identifying the skills mismatch

The fourth stage is the data collection and analysis stage. The previous stages were conducted to outline the facets that skills competency requirements consist of for competency analysis within the organisation. The framework uses two techniques to collect information, namely construction workforce skill competency surveys and interviews with construction industry experts. The workforce surveys investigate the nature of tasks that need to be carried out; the ability of the workforce to carry out the tasks and level of qualification and experience that is required of them. Current vacancies and their difficulty in filling them are also investigated to get an overview of prevailing labour market needs.

Interviews with construction industry players are used in the framework in order to learn how to incorporate skills requirements of the industry into training programmes that can be implemented in the organisation for the up-skilling of the workforce. The different perspectives of the people interviewed give a variety of ideas on how to

address deficiencies in skills competencies through experience on the job. By outlining the nature of tasks required on a frequent basis and comparing it to the ability of the workforce to effectively and efficiently perform tasks, the underlying mismatch can be identified. This is evident where necessary skills that are needed but inadequately meet project objectives are more apparent, based on the feedback given by the workforce. The result is a list of identifiable skills mismatches, whether a skills shortage or a skills gap.

5.3.5 Stage 5: Developing skills competencies

The final stage of the framework is the planning for the development of skills competencies. Stage four highlights skills mismatches that are prominent following the skills competency analysis. The identified mismatches are incorporated into training programmes that address the skills needs. The strengths of the workforce are also identified in stage four and that allows for planning for mentorship programmes within the organisation. The framework merely suggests these two forms of addressing mismatch, but ultimately, the selection of a skills development tactic is the decision of the organization. The essence of the framework is providing a method of identifying skills mismatch.

5.4 Skills Measurement Framework Validation

The extent to which the data collected for use in the framework was examined for validity. According to Bell and Waters (2014) most definitions of validity are inclined towards the ability of an item or instrument to measure and describe what it is supposed to measure. They elaborate on how Sapsford and Jupp (2006) further alluded to the fact that the structure of a piece of research determines what the conclusions can and should not be drawn from it. (Bell & Waters, 2014)

The information used to develop the framework was validated. For the research, the population sample consisted of respondents in industry and respondents in academia. The questionnaire survey constituted participants in senior, middle and lower management positions in construction. The nature of companies they represented were consultants, contractors, government institutions and local authorities. The interviews had participants with backgrounds in education and engineering. This provided a wide range of information with different aspects of construction that were considered.

5.4.1 Addressing skills mismatch in the Zambian construction industry

The progression of addressing the skills mismatch in this study began with the realisation of current construction plans in Zambia include transportation infrastructure development i.e. railway, aviation, road and maritime and inland (MoNDP, 2017). Further investigation presented information that, the construction projects which require large numbers of manual labour will be the focus, for job creation. On the global front, at industry level however, technology use however, is on the rise, of which the majority requires high level skills (UKCES, 2013).

The main factors affecting skills demand and supply were social factors such as personal interest, motivation and attitude towards certain construction jobs. The clearly dominant economic factor was salary scale. Education and Training requirements such as work experience, qualification, technical and practical skill requirements influenced the labour market immensely. Emerging technologies also affected the way in which construction works are carried out, and the required skill sets associated with it.

In stage two, the transportation infrastructure development project life cycle was determined to include planning, design, construction, close-out and operation and maintenance. The skills requirements associated with each of these phases of the lifecycle were derived from ISCO-08. In stage three, occupational groups required were identified as managers, professionals and associate professionals, which are high level skilled occupations. The associated job roles were also derived from ISCO-08. In stage four, inquiries were made about job vacancies that existed and their difficulty to be filled. The occupations were listed as Engineers, Architects, Project Managers, Quantity Surveyor, Land Surveyors, Traffic Planners and Construction Supervisors. The occupations in highest demand were Engineers and Construction Supervisors.

The predominantly active sector was the road sector. The skills gaps identified were in technical report writing and preparation of construction drawings using engineering software in the road sector. In the rail sector managing budgets, expense control, schedule and financial progress monitoring as well as skills stakeholder consultation for design purposes were the skills gap. The air sector had the overall problem of having to outsource foreign staff for new construction works due to

shortage of local staff. The skills gaps were identified in technical and financial report writing and estimating project costs and preparing detailed cost plans.

In stage five of the framework, the study identified that knowledge transfer capability is not a skills requirement and it was not considered as a key task. In organisations where on the job training was not offered, the main reason stated as to why there was no training was that there was no budget allocation for training. This indicated that addressing skills competency mismatches was not common at organization level.

The framework enabled the underlying skills competency issues to be highlighted, as well as analysed the skills development capacity of organisations. The overall result was that areas of skills competency that need addressing are financial management, technical report writing and preparation of construction drawings using engineering software.

5.4.2 Beneficiaries of the framework

The skills measurement framework can be used by different stakeholders in the construction industry. Employers can use the framework to identify the emerging skills demand and supply in the industry, as well the type of construction works that are rising on the market. Education and training institutes can use the framework to investigate what the industry skills needs are and develop job profiles for review for the use in curriculum development. Government and policy makes can use information from the framework to identify which skills are required in specific areas of Construction, and thereafter influence the decisions on the subsequent education and training programmes that can be planned for and implemented.

5.4.3 Framework significance to construction industry

The skills measurement framework will provide an aggregated source of construction industry specific data which can be used for skills development planning. It is not exclusive to a specific level of skill in that, it merely responds to the construction labour market environment, with the first stage being the identification of prevalent influential factors of skills demand and supply. The focus has primarily been on identifying cognitive skills and yet there is a need to determine

both cognitive skills non-cognitive skills. This framework makes both sets of skills a priority.

The framework enables the formulation of job profile descriptions in a manner that allows for an in depth audit of skills requirements to be conducted. This is beneficial at organizational level and industrial level. With Government's historically, low commitment in adequately funding TEVET and skills development. (DFID, 2014), organisations can decide to fund in-house skills development of their workforce, using the framework for skills competency analysis.

5.5 Summary

This chapter demonstrated what the skills measurement framework consists of. The development, composition and interpretation of the framework were also demonstrated. In the next chapter, the conclusions and recommendations for further research are discussed. It also mentions what the limitations to the study were.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter presents the skill measurement framework that developed that can be used for skills development planning in the construction industry. This chapter summarises the key research findings and conclusions drawn from it. The limitations of the study are also discussed, along with recommendations for future research studies.

6.2. Conclusions made from research findings

The overall purpose of the study was to develop a skills measurement framework for the construction industry in Zambia. The specific objectives of the study were to: identify factors that influence skills demand and supply in the transportation sector of the Construction industry, to determine high level skills mismatches that exist in the transportation subsector of the Construction industry and to develop a skills measurement framework. Qualitative and quantitative methods of data collection were used, in the form of literature review, structured questionnaires and interviews.

6.2.1 Factors influencing skills demand and supply

The factors influencing construction skills demand and supply included defined career paths, education, qualification and relative experience requirements, salary scale, and emerging technologies affecting the way construction is being carried out. Transportation infrastructure development activities have been prioritised by the government of Zambia and thus skills demand and supply will be centered on jobs of that nature.

6.2.2 Prominent skills mismatches in the construction industry

A skills shortage was identified in the transportation sub sector. There was a shortage of Engineers and Construction Supervisors. Difficulty in recruitment was mainly due to the inability for companies to pay market rates for skills. Another issue was the lack of relevant work experience and qualification of applicants.

Skills gaps were identified in practical and reflexive dimensions. The practical aspects included communication skills and creativity. Low skills proficiencies were exhibited in written and numeric communication skills. This was in activities

included in the financial and technical aspects of planning and design of transportation projects. This included project planning of staff, preparation of design specifications and the costs associated with conducting those activities, estimation of project costs and preparing detailed cost plans. Skills in preparing construction method statements and technical specifications, as well technical and financial reporting also had low proficiency ratings. These are creative skills with the use of logic and critical thinking. Reflexive skill gaps in terms of responsibility and accountability were identified from the inability to train and mentor apprentices. There was however, an indication that knowledge transfer was not prioritised in organizations, as it was ranked the least required task in projects.

6.2.3 Skills measurement framework for competency analysis

From the findings of the study, a procedure was formulated how to identify skills mismatches and plan for skills development. This was in the form of a five stage skills measurement framework. The framework was designed to align construction skills needs with changes in the internal and external environment of the construction industry for skill development in organisations. The stages include the following activities;

Stage 1: Assessing the current state of the Construction labour market

This requires the identification of factors that are influencing skills demand and skills supply in the current stage of the construction market business cycle

Stage 2: Determining the nature of human resource input required.

Based on prevailing labour market factors, stage two determines organizational needs and processes are required to meet organizational goals and the required skills competencies of the human resource.

Stage 3: Selecting measurable skills competencies

After identifying the nature of human resource required in the construction phases, defining competencies to be measured is the next step. It requires determining what constitutes ability of the workforce to effectively and adequately perform tasks. The first measurable is the construction occupation titles. The next measurable is main tasks and duties associated with the occupational titles. Education and training level

descriptors relative to occupational titles follow the associated with occupational titles form the final measurable competency.

Stage 4: Identifying the skills mismatch

The next stage involves comparing the nature of tasks that need to be carried out to the ability of the workforce to carry out the tasks and level of qualification and experience that is required of them. The extent to which skills needs meet skills availability determines which skills match exists. In this framework two techniques are used to collect information, namely construction workforce skill competency surveys and interviews with construction industry experts.

Stage 5: Developing skills competencies

Finally, stage five highlights skills mismatches that are prominent following the skills competency analysis in stage four. The identified mismatches are incorporated into training programmes that address the skills needs.

6.3 Contribution to the body of knowledge

The skills measurement framework provides an aggregated source of construction industry specific data in Zambia, which is scarce. It addresses skills mismatches which are some of the key industry issues given its cyclic nature. It also ensures that the skills development planning process includes direct input from industry input in the form of primary data to address industry relevant practical skills needs. This then results in a direct response to the Zambian construction labour market environment needs, the ability to assess both cognitive and non-cognitive skills and the capacity to conduct in-depth skills audits based on job profile descriptions.

6.4 Limitations of the Study

One of the main limitations of the study was the lack of enthusiasm of individuals to participate in research. This led to a lower response rate than was initially planned for. In addition, there was difficulty in finding labour market information that is specific to the construction sector for literature review on a local context. There was also the probability of potential bias of skills proficiency rating by respondents.

6.5 Recommendations for further study

A key skills issue that should be addressed are the disregard that organisations have for knowledge transfer, in light of the fact that graduates are not meeting the needs of the industry. A recommendation is that organisations should investment in on-the-job training programs in construction organisations in response to labour market changes in the industry. These are more rapid responses, as most education institutions review curricula every five years.

Another recommendation would be to formulate and enforce policies to entice organisations to offer industrial training to allow for graduates and students to have practical experience to compliment knowledge competencies. This could be in the form of internship and mentorship programmes.

For further study, an investigation on the nature of training courses that organisations in industry require to meet the needs of the rapidly changing construction labour market environment should be conducted.

In future research, the skills measurements framework could be used on a narrower scale to conduct sub-sector specific skills needs assessments for all construction subsectors.

REFERENCES

Agapiou, A., Price, A. & McCaffer, R. (1995) Planning future construction skill requirements: Understanding labour resources. *Construction Management and Economics,,* 13(2), pp. 149-161.

Bell, J. & Waters, S. (2014) *Doing Your Research Project: A guide for first-time researchers.* Berkshire: Open University Press.

Bengtsson, M. (2016) How to plan and performa qualitative study using content analysis. *Elsevier,* pp. 8-14.

Binkley, M. R., R. Sternberg, S., Jones, D. & Murray T. S & Clermont, Y. (2003) *Moving Towards Measurement: the Overarching Conceptual Framework for the ALLStudy, In: Measuring Adult Literacy and Life Skills: New Frameworks for Assessment,,* Canada: Statistics Canada.

Burcin Becerik-Gerber, A. & Kensek, A. K. (2010) Building Information Modeling in Architecture, Engineering,and Construction: Emerging Research Directions and Trends. *Journal of Professional Issues in Engineering Education and Practice,* pp. 139-147.

Cappelli, P. H. (2015) Skills Gaps, Skills Shortages, and Skills Mismatches: Evidence and Arguments for the United States. *Industrial and Labour Relations Review: SAGE Journals,* 68(2), pp. 251-290.

Castiglioni, C. & Tijdens, K. (2014) *Skills and occupational needs: labour market forecasting systems in Italy.(AIAS working paper; No. 142).,* Amsterdam: Amsterdam Institute for Advanced labour Studies, University of Amsterdam..

Chand, S. (2018) *the-classical-theory-of-employment-assumption-and-criticism-2.* [Online] Available at: http://www.yourarticlelibrary.com/macro-economics/theories-macro-economics/the-classical-theory-of-employment-assumption-and-criticism-2/30882k [Accessed 21 November 2018].

Charmaz, K. (2006) *Constructing grounded theory.*. Thousand Oaks, CA: : Sage..

Construction Industry Training Board (2010) *Sector Skills Assessment forthe Construction Sector,* Norfolk: Construction Industry Training Board: Construction Skills.

Clarke, L. & Wall, C. (1998) *A blueprint for change: Construction skills training in Britain.,* Bristol: Policy Press..

Corbin, J. M. & Strauss, J. M. (2007) *Basics of qualitative research: Techniques and procedures for developing grounded theory (3rd ed.).*. Thousand Oaks, CA : Sage..

Creswell, J. (2003) *Qualitative and quantitative and mixed method approach.2nd edition ISBN: 0-7619-2441-8.,*. London: SAGE.

Creswell, J. D. & Miller, D. L. (2000) Determining Validity in Qualitative Inquiry. *Theory Into Practice,* pp. 124-130.

Creswell, J. W. (2014) *Research Design: Qualitative, Quantitative and Mixed Method Approaches (4th Ed.).* Thousand Oaks, California: Sage.

Central Statistical Office, (2015) *2014 Labour Fource Survey Report,* Lusaka: Central Statistical Office.

Cambridge Training and Development Ltd (20040 *LMI Matters! Understanding labour market information.* Notingham: Crown Copyright.

Department for Education and Employment (2000) *An Assessment of Skill Needs in Construction and Related Industries,* London: Crown.

Department for International Development Zambia (2014) *Skills Improvement Programme (SKIP) in Zambia,* Lusaka: Department for International Development Zambia.

Drucker, J. & White, G. (1996) *Research methods for construction.* 2nd ed. Oxford: Blackwell Science Ltd..

Florida Department of Transportation. (2017) *Project Development and Environmental Manual Part 1.* Florida: Florida Department of Transportation.

Fichen, A. & Pellizaari, M. (2014) *A new measure of skills mismatch:theory and evidence from the Survey of Adult Skills (PIAAC).* Geneva: OECD Publishing.

Foulkes, A. & Ruddock, L. (2007) *Defining the Scope of the Construction Sector.* Salford, Proceedings of the 8th IPGR Conference, pp 89-98.

Fowler, F. J., 2009. *Survey research methods (4th ed.).*. California: Sage.

Global Agenda Council on Employment, Quintini, G. & Pouliakas, K. (2014) *Matching Skills and Labour Market Needs: Building Social Partnerships for Better Skills and Better Jobs,* Davos-Klosters: World Economic Forum.

Gasset, J. O. Y., (2018) *Labour Market equilibrium.* [Online] Available at: https://sites.hks.harvard.edu/fs/gborjas/publications/books/LE/LEChapter4.pdf [Accessed 15 October 2018].

Giorgi, A. (2009) *The descriptive phenomenological method in psychology: A modified Husserlian approach.*. Pittsburgh, PA: Duquesne University Press..

Greene, M. T. & Papalambros, P. Y. (2016) *A cognitive framework for engineering systems thinking.* Ann Arbor, Greene and Papalambros.

Gruneberg, S., 1997. In: *Construction economics:An introduction.* London: Macmillan, p. 21–36..

Gutman, L. M. & Schoon, I. (2013) *The impact of non-cognitive skills on outcomes for young people: Literature review,* London: Education Endowment Foundation.

International Labour Office (2012) *International Standard Classification of Occupations: ISCO-08 Volume I.* Geneva: International Labour Organisation.

International Labour Office (2016) *Key Indicators of the Labour Market.* 9 ed. Geneva: International Labour Organisation.

International Labour Office (2016) *Using Labour Market Information.* Geneva: International Labour Office.

International Labour Office, Organisation for Economic Co-operation and Development,UNESCO & World Bank Group (2014) *G20 labour markets: outlook, key challenges and policy responses,* Melbourne: International Labour Organization.

Jalava, J., (2006) *Production, Primary, Secondary,and Tertiary: Finnish Growth and Structural Change, 1860-2004.* Helinski: Pellervo Economic Research Institute and Helsinki School of Economics .

Jina, X., Zhang G., Liuc, J., Fenga, Y., Zuod, J., (2017) Major Participants in the Construction Industry and Their Approaches to Risks: a Theoretical Framework. *Procedia Engineering,* Volume 182, pp. 314-320.

Kaewunruen, S., Sussman, J. M. & A, M. (2016) Grand Challenges in Transportation and Transit Systems. *Frontiers in Built Environment, Volume 2* , p. Article 4.

Keppel, G. (1991) *Design and analysis: A researcher's handbook (3rd ed.).* New Jersey: Prentice Hall..

Kothar, C. R. (1990) *Research Methodology: Method and Techniques, Second Revised Edition.* Jaipur: New Age International (P) Ltd., Publishers.

Koyi, G., Masumbu, G. & Halwampa, A. (2012) *Understanding youth labour demand constraints in Zambia, The mining, manufacturing and construction sectors,* Lusaka: Zambia Institute for Policy Analysis & Research (ZIPAR).

Lorenz, L. (2012) *Anticipating and Matching Skills Demand and Supply: Synthesis of National Reports,* Vienna: European Training Foundation.

MacDonald, S. & Headlam, N. (2011) *Research Methods Handbook: Introductory guide to research methods for social research.* Manchester: Centre for Local Economic Strategies.

Maclean, R., Jagannathan, S. & Panth, B. (2018) In: *Overview. In: Education and Skills for Inclusive Growth, Green Jobs and the Greening of Economies in Asia. Technical and Vocational Education and raining: Issues, Concerns and Prospects.* Singapore: Springer, pp. 1-18.

Methodological Centre for Vocational Education and Training (2008) *Study of the Construction Sector: Research report on skill needs,* Vilnius: Methodological Centre for Vocational Education and Training.

Ministry of National Development Planning (2014) *Revised Sixth National Development Plan 2013-2016,* Lusaka: Ministry of Finance and National Planning.

Ministry of National Development Planning (2017) *Seventh National Development Plan 2017-2021,* Lusaka: Ministry of National Development Planning.

Moono, H. & Rankin, N. (2013) *Education and Employment in Zambia: Evidence from a Scoping Exercise,* London: International GrowthCentre.

Moustakas, C. (1994) *Phenomenological research methods.*. Thousand Oaks, CA:: Sage..

Mukora, J.(2008) *Scarce and critical skills research report,,* Pretoria: Department of Labour.

Muya, M., Mulenga M.N., Bwalya C.D., Edum-Fotwe, T.F., Price, A.D. (2003) Construction skills requirements issues. *Department of Civil and Environmental Engineering, University of Zambia and Department of Civil and Building Engineering*, September, Volume 1, pp. 69-76.

National Council for Construction (2003) *The National Council for Construction Act.* Lusaka: National Council for Construction.

Neyestani, B. (20140 *Human Resource Development in Construction Industry,* Berkeley: University of California.

Obadic, A.(2006) Theoretical and Empirical Framework of Measuring Mismatch on a Labour Market. *Journal of Economics and Business, Vol. 24, No. 1,* pp. 55-80.

Organisation for Economic Development and Coorperation (2011) *PIAAC Conceptual Framework of the Background Questionnaire Main Survey,* s.l.: Organisation for Economic Co-operation and Development.

Organisation for Economic Development and Coorperation (2017) *Getting Skills Right: Skills for Jobs Indicators.* Paris: OECD Publishing.

Organisation for Economic Development and Coorperation, World Bank, European Training Foundation, & International Labour Organisation (2013) *Indicators of Skills for Employment and Productivity: A Conceptual Framework and Approach for Low Income Countries; United Nations Educational, Scientific and Cultural Organisation,* s.l.: Organisation for Economic Development and Coorperation.

Oseghale, B., Dr Abiola-Falemu, J. & Oseghale, G. (2015) An Evaluation of Skilled Labour shortage in selected construction firms in Edo state, Nigeria. *American Journal of Engineering Research,* 4(1), pp. 156-167.

Pearce, D. (20030 *The Social and Economic Value of Construction: The Construction Industry's Contribution to Sustainable Development.* s.l., nCRISP: The Construction Industry Research and Innovation Strategy Panel.

Project Management Institute (20130 *A guide to the project management body of knowledge, PMBOK Guide Fifth Edition.* Pennsylvania: Project Management Institute, Inc..

Penn State Eberly College of Science (2018) *STAT 414/415 Probability Theory and Mathematical Statistics. Lesson 34: Sample Size: Estimating a Proportion for a Small, Finite Population.* [Online] Available at: https://newonlinecourses.science.psu.edu/stat414/node/264/ [Accessed 24th May 2018].

Rao, V. K. (2007) *Bio-statistics: A manual of methods for use in nutrition and anthroppology.* New Delhi: Jaypee Brothers.

Rasool, H., (n.d.) *www.* [Online] Available at: www.unevoc.unesco.org/e-forum/Conceptual_Paper_Skills_Measurement_FR Research.pdf
[Accessed 04 June 2017].

Reddy, V., Bhorat H., Powell, M., Visser, M. and Arens, A. (2016) *Skills Supply and Demand in South Africa,,* Pretoria: LMIP Publication,Human Sciences Research Council.

Riessman, C. K.(2008) *Narrative methods for the human sciences.*. Thousand Oaks, CA:: Sage..

Selltiz, C., Jahoda, M., Deutsch, M. & Cook, S. W. (1959) *Research Methods in Social Relations, Rev. Ed.* New York: Holt, Rinehart and Winston, Inc..

Stake, R. E. (19950 *The art of case study research.*. Thousand Oaks, CA: Sage..

Tay, Y. W. D, Panda B, Paul S.C., NoorMohammed N.A., Tan M.J (2017) 3D printing trends in building and construction industry: a review.. *Virtual and Physical Prototyping,* pp. 261-276.

TranBC (2018) *TranBC (British Columbia) Ministry of Transportation and Infrastructure. Four Stages of a Mega Project-An Insider Perspective.* [Online] Available at: https://www.tranbc.ca/2016/11/02/four-stages-of-a-mega-project-an-insider-perspective/
[Accessed 12 July 2018].

UK Commision for Employment and Skills (2013) *Technology and Skills in the Construction Industry,* London: UK Commision for Employment and Skills.

United Nations Development Programme (2016) *Zambian Human Development Report 2016, Industrialisation and Human Development,* Lusaka: United Nations Development Programme.

United Nations (2008) *International Standard Industrial Classification of All Economic Activities (ISIC) Rev 4,* New York: United Nations.

Walliman, N. (2011) *Research Methods, the basics.* New York: Routledge, Taylor & Francis Group.

Weddikara, C. & Devapriya, K. (2011) Demand and Supply Trends and Constuction Industry Development: A Case Study in the Sri Lankan Construction Industry. *Australasian Journal of Construction Economics and Building,* I(1), pp. 91-105.

Windapo, A. O. (20160 Skilled labour supply in the South African construction industry: The nexus between certification, quality of work output and shortages. *SA Journal of Human Resource Management*, 14(1), p. a750.http://dx.doi.org/10.4102/sajhrm.v14i1.750.

Yin, R. K. (2009) *Case study research: Design and methods (4th ed.).* Thousand Oaks, CA: Sage.

Yin, R. K. (2012) *Applications of case study research (3rd ed.).*. Thousand Oaks, CA:: Sage..

Zambia Qualifications Authority (2016) *Guidelines for Determining National Occupational Standards,* Lusaka: Zambia Qualifications Authority.

Zambia Development Agency (2016) *Zambia Qualifications Framework Level Descriptors,* Lusaka: Zambia Qualifications Authority.

Zambia Development Agency (2014) *Infrastructure Sector Report,* Lusaka: Zambia Development Agency.

APPENDICES

APPENDIX A: QUESTIONNAIRE

Instructions: Please respond to the following questions by using a tick [√] in the appropriate box or answering in the space which is provided.

Section 1: General Information

1.1 Gender: Male ☐ Female ☐

1.2 Nationality: Zambian ☐ Non-Zambian ☐

1.3 What is your age?

Less than 30years ☐ 30-39 years ☐ 40- 49 years ☐

50+ years ☐

1.4 How many years of work experience do you have in the construction industry?

0 - 5 years ☐ 5 -10 years ☐ 10- 15 years ☐

More than 15 years ☐

1.5 What is your highest academic qualification?

O'Level ☐ Master's Degree ☐

Diploma ☐ Doctorate ☐

Bachelor's Degree ☐ Other (specify) _____

1.6 What is your position in the organisation?

Senior management [ ] Middle management [ ] Junior management [ ]

1.7 What construction occupational role do you play in the organisation? (e.g. Civil Engineer, Surveyor, Architect, Planner etc.)

_____

Section 2: Organisation Identification Particulars

2.1 Type of Organisation: (Please Tick appropriate)

Contractor ( ) Government Institution ( ) Other (specify)____

Consultant ( ) Local Authority( )

2.2 If you selected Contractor in 2.1, State the NCC Registration Category that your company is in. If else, proceed to 2.3.
Grade (i.e. 1, 2,3,4,5 or 6): _____

2.3In which of these **transportation** sub-sectors do majority of your construction projects fall under currently?

Road Rail Air Other(Specify):_____

2.4What is the estimated percentage of female construction staff who are employed in your company?

_____

2.5Do any of the female construction staff occupy any senior positions in your company?
Yes [ ] No [ ] I do not know [ ]

2.6 If your answer to **2.5** was yes, how many are they? If else proceed to Section 3.
No. of female construction staff _____

Section 3: Skill demand and supply factors

3.1 How important are the following factors to you when you are selecting a construction job?

	Factor	Not Important	Slightly Important	Not sure	Important	Very Important
1	Government plans to promote job creation through implementing the construction projects					
2	Government funding of construction education and training programmes for continuous professional development within projects					
3	Government financing of the construction projects					
4	Company participation in international construction projects					
5	Company accreditation by national bodies affiliated to construction					
6	Personal professional accreditation by national bodies affiliated to construction					
7	Salary scale					
8	Favourable work hours					
9	Personal mobility for job-related transfers					
10	Your attitude, motivation, or personality					
11	Personal interest in doing this type of job					

12	Relevant work experience					
13	Personal qualification level					
14	Personal technical and practical skills					
15	Ability to use emerging technological design software and tools					

Section 4: Organisational needs

4.1 How many construction employees are there in your company? _____

4.2 How many people at your company are employed in the following positions?

	Position	Number Employed
1	**Managers**	
(a)	Project Managers	
2	**Professional Occupations**	
(a)	Engineers	
(b)	Architects	
(c)	Quantity Surveyors	
(d)	Land Surveyors	
(e)	Traffic Planners	
3	**Associate Professionals**	
(a)	Construction Site Supervisors	

4.3 Are there any vacancies at your company for the following positions?

		Any vacancies available		
	Position	Yes	No	I do not know
1	Project Managers			
2	Engineers			
3	Architects			
4	Quantity Surveyors			
5	Land Surveyors			
6	Traffic Planners			
7	Construction Site Supervisors			

4.4 Does your company face any challenges in filling these vacancies?

Yes [ ] No [ ] I do not know [ ]

4.5 If yes, to what extent do the following reasons contribute to the inability to fill vacancies? If else, proceed to 4.6

	Reasons	None	Low	Medium	High	Don't Know
1	Low number of applicants					
2	Not enough people interested in doing this kind of job					
3	Not enough people with job-specific skills in the industry					
4	Lack of relevant work experience					
5	Lack of the qualifications needed					
6	Poor attitude/motivation or personality					

7	Lack of technical or practical skills					
8	Company is unable to pay market rate					
9	Job requires unsociable work hours					

Other; specify:_____

4.6 How often does your company conduct recruitment of construction staff?

Not Frequent [ ] Moderately Frequent [ ] Frequent [ ] Very Frequent [ ] Don't Know [ ]

Section 5: Skill Competency Assessment

5.1 How often are you required to carry out the following tasks in construction projects?

	Task Performed	Not Frequent	Moderately Frequent	Don't Know	Frequent	Very Frequent
1	Undertaking research to analyse functional, economic, environmental, social requirements for design					
2	Conduct surveys to establish baselines, elevations and other geodetic measurements					
3	Consulting with clients and stakeholders for design purposes					
4	Estimating project costs and preparing detailed cost plans					
5	Organising and selecting project staff					
6	Preparing construction drawings using engineering					

	software					
7	Preparing technical specifications					
8	Preparing construction method statements					
9	Organizing and managing project labour and delivery of materials, plant and equipment					
10	Supervising and coordinating construction works on site					
11	Examining and inspecting work progress					
12	Ensuring that construction workers follow established occupational health and safety policies and procedures					
13	Negotiating with building owners, property owners and other stakeholders affected by construction works					
14	Managing budgets and controlling project expenses					
15	Ensuring adherence to construction legislation and standards of performance					
16	Reviewing updated activity schedules and financial reports to gauge progress					
17	Preparation of technical reports					

18	Preparation of financial reports					
19	Addressing work defects, and close out of contracts					
20	Reviewing and resolving design and operational problems through the application of engineering technology					
21	Training and mentoring of apprentices					
22	Conflict resolution when working with others					

5.2 On a scale of 1 to 5 how would you rate your skills and experience in performing the following tasks on a construction project:

Rating Scale

Rating	**Description**
1	**Passing knowledge**: knowledge from a few hours of training, but never applied
2	**Limited Knowledge**: Knowledge from some formal training but rarely applied
3	**Moderate Knowledge**: Professional training received in area, occasionally applied
4	**Extensive Knowledge**: Regularly apply knowledge in accomplishing job
5	**Experience:** Rich set of specialized skills allowing for knowledge transfer in training

		Rating Scale (Tick)				
	Skill applied in different construction phases	1	2	3	4	5
1	**Planning**					
	Determining needs, like traffic volumes and growth, local development and safety factors					
	Analysing functional, economic, environmental, social requirements for design					
	Conducting surveys to establish baselines, elevations and other geodetic measurements					
	Estimating total costs and preparing detailed cost plans and estimates					
2	**Design**					
	Organising and selecting project staff					
	Preparing construction drawings using engineering software					
	Preparing technical specifications					
	Preparing construction method statements					
3	**Construction**					
	Organizing and managing project labour and delivery of materials, plant and equipment					
	Supervising and coordinating construction works on site					
	Examining and inspecting work progress					
	Ensuring that construction workers follow established occupational health and safety policies and procedures					
	Ensuring adherence to construction legislation and standards of performance					
	Preparation of technical reports					

	Preparation of financial reports					
4	**Project Completion**					
	Addressing construction defects					
	Closing out of contracts					
5	**Operation and Maintenance**					
	Reviewing and resolving design and operational problems through the application of engineering technology					
6	**Interpersonal**					
	Training and mentoring of apprentices					
	Conflict resolution when working with others					
	Stakeholder engagement					

5.3 Are there any emerging technologies impacting the way you/your company conduct the construction works?

Yes [ ] No [ ] I do not Know [ ]

5.4 If YES, does your company source for/ provide training to promote skills development for the use of these emerging technologies? If else, proceed to 5.5.

Yes [ ] No [ ] I do not Know [ ]

5.5How important are the following levels of computer skills in completing project tasks?

	Level of Computer skill	Not Important	Slightly Important	Not sure	Important	Very Important
1	Basic(e.g. data entry, sending and receiving e-mails or printing)					
2	Moderate (e.g. word processing or spread sheets)					

3	Complex (e.g. analysing information or design, including computer aided design)					
4	Advanced (e.g. software programming; managing computer networks)					

Section 6: Workforce skill assessment

6.1 Are skill and training needs of individual construction staff regularly reviewed at your organisation?

Yes [ ] No [ ] I Don't know [ ]

6.2 If Yes, How often? If else, proceed to 6.3.

Monthly [ ] Quarterly [ ] Annually [ ] Other (specify)_____

6.3 Does your organization offer or organize other forms of training, such as on-the-job training or workshops for construction staff to participate in?

Yes [ ] No [ ] I Don't know [ ]

6.4 If your answer to 6.3 was **NO**, what is the reason why other forms of training are not offered?

	Reason why training is not offered	**(Tick appropriate)**
1	There is no budget for training	
2	Low quality of courses offered	
3	There are no trainers available	
4	There is no need for training	
5	I do not know	

Other (Specify):

End of Questionnaire

APPENDIX B: INTERVIEW GUIDE

Interview Serial No.

Institution Identification Particulars

Name of Academic Institution: _____

Personal Information

Name of Interviewee (Confidential): _____

Gender: Male ☐ Female ☐

Field of Specialisation _____

Level of qualification _____

Number of Years of work experience in field _____

Job title in organisation _____

Section 1: Industry Needs Assessment

Purpose: To determine whether educational institutions identify industry needs.

1.1 Does your institution consult employers in the industry about their hiring needs, skills competencies and tasks required for specific occupational roles?

1.2 Do you inquire what the persistent skill gaps are and why? How do you do so?

Section 2: Educational Capacity

Purpose: To determine the institution's ability to regularly review curricula to meet industry needs.

2.1 Is there a budget allocation or initiative in place for the regular reviewing of curricula?

2.2 Do you engage industry representatives to advise on, loan, or even donate technology to support hands-on learning?

2.3 Are there any government initiatives in place that support collaborative skills development between the industry and your institution?

2.4 Do employers assist in the assessment of project-based assignments; provide placements, and train or mentor students?

Section 3: Designing Curricula

Purpose: To identify the key elements around which curricula are designed.

3.1Do you receive feedback from industry representatives about their expectations to design the curriculum?

3.2 Do you collaborate with industry representatives to review and update existing curricula or develop new curricula that are in line with technical and professional skills needs? If yes, how is it conducted?

3.3 Do industry representatives play a role in setting standards for programs of study that support career advancement?

3.4 Does your institution regularly evaluate training programs to ensure they are relevant to employers and aligned with current changes in the industry?

Section 4: Workforce Partnerships

Purpose: To determine whether there are existing educational institution-employer sectoral partnerships

4.1 Is there a direct link between educational institutions and industry practitioners to facilitate skills development planning?

4.2 Does the industry support and sustain collaboration partnerships in skills development with your institution?

4.3 What are the shortfalls of the curriculum design process?

APPENDIX C: CONTENT ANALYSIS FROM INTERVIEWS

Content Analysis of Expert 1

	Field of Specialisation	Education		
	Level of Qualification	Bachelor's Degree		
	No. of Years of Experience in particular position	2 Years		
Theme 1	How educational institutions identify skills needs			
	Meaning unit	Condensed Meaning unit	Initial Code	Final Code
a	Method of Identification			
	A labour market evaluation is carried out to determine industry skills needs. Labour market signals are used in the period of the reviewing of curriculum	conduct labour market evaluation using indicators to identify skills needs	labour market evaluation	2
b	Questions asked			
	Job profile reviews are carried out by a panel of experts who are performing the targeted job in industry. The job profiles are validated by industry and instructional/teaching parts	create job profiles that are validated by industry experts	job profile definition	3
Theme 2	Internal Capacity to Review Curriculum			
a	Financial			

	The government has a budget allocated to carry out research and review curriculum. Trade and craft certificates are reviewed every 4 years, advanced certificate and diploma every 5 years	government budget allocation for curriculum development and curriculum review every 4-5 years	government financial support, every 4-5 years	1
b	Initially the government would finance skill development programmes but it became too expensive to maintain. A skill development levy was introduced to companies. Memorandums of understanding are between companies and specific schools in which they take on students.	skills development levy for companies	financial support from companies	3
	Human Resource			
	Mostly government provides support. Learner ship programmes are established with companies to support hands on learning.	government engages companies to have learner ship programmes	government	1
	TEVETA recently (2017) started to engage employers in the placement and training of students by putting out Call for proposals to offer training services.	employers are engaged to offer training services	employers	3
	Development of syllabus is done by teaching/instructional expert panels that are complimented by a few industry experts.	teaching and instructional expert panels	teaching/ instructional experts	2

Theme 3	Curriculum Design			
	Industry representatives provide information on changes in job requirements that should be put under consideration of planning of curriculum. NCC has a representative on the curriculum development board. ZAQA is consulted to approve syllabus in line with occupational standards and descriptor levels	Industry representatives provide information on job requirements. Some of them include NCC and ZAQA	consultation from industry	1
	Stakeholders approach TEVETA to inform them of new methodologies and technologies used which they should consider incorporating into curricula-.	stakeholders provide input on emerging skills needs	stakeholder consultation	1
	Job profiles and syllabi are validated by industry and instructional/teaching parts	develop job profiles and syllabi then industry and teaching parts validate curriculum design	validation of curriculum design	3
	Curriculum development unit then develops qualification descriptors after consulting ZAQA	ZAQA develops qualification descriptors	qualification level descriptors	2
Theme 4	Workforce Partnerships			
	The industry is informative when it comes to providing feedback of industry needs and it is handled by the research unit.	research unit collaborates with industry	partnership with industry	2

	The TEVETA Board Sub-Committee on Occupational Standards, Curriculum and Training Systems approves syllabus. TEVETA has a relationship with NCC. They have a place on the board	partnership between institution and NCC	partnership with NCC	1
Theme 5	Shortfalls			
	Industry has the capacity to provide attachments on project based assignments in order to provide practical experience but that avenue is rarely explored	need to explore other channels of providing on the job training like project based assignments	project based assignments	3

Content Analysis Expert 2

	Field of Specialisation	Engineering		
	Level of Qualification	Doctorate		
Theme 1	How educational institutions identify skills needs			
	Meaning unit	Condensed Meaning unit	Initial Code	Final Code
a	Method of Identification			
	A needs assessment is carried out in which stakeholders are consulted. Stakeholders include the university staff and students itself, government, the industry, secondary schools	consult stakeholders when conducting a skills needs assessment	skills needs assessment	1
	Needs anticipations are also made based on factors influencing the job market	identify factors influencing the job market	labour market signals	3
b	Questions asked/Matters investigated			
	Skills gap in terms of knowledge and practical	skills dimensions assessment	identify skill gaps	5
	How excessive the skills gap is		extent of skills gap	5
	Particular skill sets that are required	skills needed to meet task objectives	skills competencies	5
	other available sources of skill sets and their level of knowledge impartation	what skills are available	skills inventory	5
	Factors influencing skills- the job market ecosystem. This is in terms of needs, supply, migration patterns, lay-offs	what is influencing skills demand and supply	labour market environment	3

	sponsorship for education	any sponsorship for upgrading skills	funding of skills development	3
Theme 2	Internal Capacity to Review Curriculum			
a	Financial			
	The private sector is normally the source of funding. There is no specific budget allocation, it is rare to have funds sourced internally within the institution	no budget, mostly outsourced from private sector	private sector	3
b	Human Resource			
	companies offer assistance in training staff and providing training manuals on emerging skills needs	companies up-skill training staff for new curriculum	companies in industry	3
	reviews are conducted internally by lecturers, department representatives of the different schools	internal reviews of curriculum	lecturers, school department representatives	2
	industry practitioners approach the institutions to inform them about emerging skills needs	industry input on curriculum design	industry practitioners	3
Theme 3	Curriculum Design			
	feedback is received from industry on skills needs	skills needs requiring addressing are identified	industry input	1
	a workshop is called to discuss skills needs	stakeholders discuss skills issues that require addressing	stakeholder input	1

	updating of existing curricula is a collaborative effort between industry representatives and the institution	curriculum is updated to reflect skills needs	updating of curricula	4
	Quality Assurance(QA) unit stipulate what curriculum should have based on skills triggers from industry	QA unit structures curriculum after consultations	validation by QA unit	3
Theme 4	Workforce Partnerships			
	Each discipline has an industry representative and major employers	collaboration with industry practitioners and employers	major employers	2
	industry representatives with influential positions sit on the advisory board	collaboration with influential industry participants	industry representatives	2
Theme 5	Shortfalls			
	there is need for policies to facilitate the ease of collaboration	improvement required in collaboration of curriculum design	policy formulation required	1

Table 4 - 18: Content Analysis of Expert 3-NCC Interviewee

	Field of Specialisation	Engineering		
	Level of Qualification	Master's Degree		
	No. of Years of Experience in particular position	3 Years		
Theme 1	How educational institutions identify skills needs			
	Meaning unit	Condensed Meaning unit	Initial Code	Final Code
a	Method of Identification			
	Stakeholder consultation workshops are arranged. Key stake holders in the construction industry are invited. Some of the stakeholders include Road Development agency, Ministry of Works and Supply, Road Traffic and Safety Agency and Local Authorities.	stakeholder consultation workshops arranged for skills needs identification	stakeholder consultation	1
	Radio programmes are aired in which industry stakeholders are encouraged to call in and express their sentiments on skills issues affecting the Construction industry	radio programmes on discussions about skills issues affecting construction	stakeholder consultation	1
	Training needs analyses are conducted in which the institution goes to construction sites and engages with construction site personnel to gather information on emerging workmanship and technological skill needs in the industry	training needs analysis on emerging workmanship and technological skills needs	training needs analysis	5

b	Skills gap analysis is conducted.		Skills gap analysis	4
	Questions asked			
	What are the existing skills gaps	investigating skills gaps, skills challenges, skills competencies requiring development	skills mismatch identification	4
	What skills challenges are experienced			
	Which skills competencies are lacking and require more training in			
Theme 2	Internal Capacity to Review Curriculum			
a	Financial			
	The Government and TEVETA sometimes assist with funding for curriculum development activities. The exercise is included in the annual work plan but occasionally allocates funds towards. Usually, funds are secured when there is money to spare after carrying out other activities.	Government and TEVETA occasionally assist. Occasionally, the institute allocates funds	Occasional assistance by Government, TEVETA and NCC	1 2
b	Human Resource			
	Industry representatives provide expertise when consulted on training needs	Industry representatives give input	industry representatives	3
	Collaborative skills development programmes between government and institution are carried out sometimes. An example is sensitisation programmes like career talks. These are carried out in different provinces to create awareness about skill development planning and implementation needs	government and NCC collaborate in skills development programmes	government and NCC	1

	Training programmes are developed for re-skilling of training officers once the curriculum is updated	training officer capacity building	training officers	2
Theme 3	Curriculum Design			
	Industry representatives collaborate in the review and development of new curricula.	review and development of new curricula in line with skills gap	review and development of curricula	1
	Job profiles are developed internally as a guide in which skill sets are evaluated to determine what kind of positions that individuals can take up in companies and the salary scales	developing of job profiles to match qualification levels of curricula	job profile development	2
	Feedback about industry expectations in curriculum design is received from required technical institutions and organisations. TEVETA is also informed	technical institutions and organisations give input on proposed curricula	validation of curriculum design	3
	Review of training programmes is carried out annually, especially due to the dynamic nature of technology in the industry. Capacity building training is carried out in which trainers are retrained first then the new courses are incorporated into the curriculum	review of training programmes, updating of training programmes then capacity building of training providers	retraining of training providers	4
Theme 4	Workforce Partnerships			
	Direct links between the institution and industry practitioners exist to facilitate skills development planning.	direct links with industry for skills development	link with industry practitioners	2

Theme 5	Shortfalls			
	Inability to determine whether the training that is received plays an impact on effectively carrying out job related tasks once it is introduced.	need to check if training leads to meeting task objectives	effectiveness of training programmes not checked	2
	Need to ensure that the new type of training is equivalent to the work output of trained individuals	need to check if training increases output	output increase not checked	2
	Performance assessment of training programmes needs to be done	need to check outcome of training programmes	no evaluation of training programmes	2

APPENDIX D: PUBLICATIONS

A research article from this dissertation was submitted to a journal for publication.

Phiri P., Mwiya B. and Mwanaumo E. (2019) A Skills Measurement Framework for the Construction Industry: A Case of Lusaka Province, *The University of Zambia Journal of Natural and Applied Sciences (UNZA JONAS)*