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

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ABSTRACT

Construction is characterised as being labour intensive and thus the continuous skills development will always be 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 59 contractors, 80 consultants, 23 higher education institutions and 10 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 fifty (50) structured questionnaires and the conducting of three (03) 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. A sequential five-stage skills measurement framework structure was designed that investigated important aspects for skills development which are responsive to industry needs. The stages yield outputs which identify factors influencing skills demand and supply and skill competency requirements in construction, and assess the ability of the workforce meet the required skills competencies.

Key words: skills mismatch, construction, skill competency

INTRODUCTION

The construction 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). A result is that training institutions are insufficiently responsive to market demands which make the labour supply rigid. (DFID, 2014).

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. (MoNDP, 2017). This signifies a focus on transportation infrastructure development in the Zambian construction sector.

Zambian transportation infrastructure has been unsustainable and exhibited slow growth due to weak structural and management capacity (ZDA, 2014). 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) A working paper by Moono and Rankin (2013) indicated that there was difficulty in sourcing and retaining skilled and experienced labour in construction. In addition, they discovered an evident gap between education providers and industry such that relevant skills needs were not being addressed. 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. 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 (UKCES, 2013).

MATERIALS AND METHODS

Research Design

The research examined the state of the Zambian construction industry labour market environment of the transportation sub sector in Lusaka Province. It investigated which factors were influencing the demand and supply of skills, the on-the job skills requirements for the different phases of construction, the skills competencies of the existing workforce and the strategies implemented by training institutions when conducting skills audits for curriculum review and design. A mixed method approach to include both quantitative and qualitative primary data was employed to collect data.

Research Instruments

Data was collected through self-administered questionnaires and by the conducting of semi-structured interviews with the aid of an interview guide. The questionnaires were design to collect information about skills competency needs and aptitudes of managers, professionals and associate professional occupations. The choice of these occupations was the premise that technological progression was identified as a prevailing influential factor of skills demand and supply, and the skills associated with it are 'primarily' reported at these skill levels. The interviews targeted curriculum development experts in higher education institutions.

Stratified random sampling was conducted from a sampling frame consisting of 80 contractor firms selected from a published list of National Council for Construction (NCC) registered contractors (Grades 1-4), 59 consultancy firms that were registered with Association of Consulting Engineers of Zambia (ACEZ), 10 government agencies and local authorities that conduct civil engineering works and 13 higher level institutions that offered Science Technology Engineering and Mathematics (STEM) programmes. A total of 162 firms and organisations conducting transportation infrastructure development were identified and used as the sampling frame. For each stratum, the sample size was calculated through proportional allocation based on its size relative to the population.

Data collected from the questionnaires was analysed using statistical techniques and presented as percentages, frequencies and mean scores for various competency items. Factors influencing skills demand and supply were ranked using mean scores with a scale parameter ranging from 1-5, where 5 was the highest possible mean score. Skills measurement was conducted using a

rating scale of 1-5 with 1 being low competency and 5, high competency.

Data from the interviews was analysed using content analysis. The process involved categorisation of verbal data by collecting similar words and phrases to draw realistic conclusions of condensed word units. The end result was a set of codes that described the findings according to set out themes of each section of the interview guide.

RESULTS

Questionnaire Findings

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. Findings depicted the investigated construction skills market to consist of a younger workforce with the whole sample size consisting of individuals less than 40 years old. The educational and professional qualifications were characterised by 89.5 percent of respondents having a Bachelor's Degree or higher. A total of 71.1 percent of respondents had less than five years of work experience. 15.8 percent had 5-10 years of experience, 5.3 percent had 10-15 years of experience and 7.9 percent had more than 15 years of work experience in the industry. 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. There was a challenge in identifying respondents to participate from the rail and air sectors.

In the construction skills market environment, 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 main reasons that companies were unable to fill vacancies were: company is unable to pay market rate (23.7%), lack of relevant work experience (23.7%), lack of the qualifications needed (10.5%), not enough people with job-specific skills in the industry (10.5%), lack of technical or practical skills (7.9%), poor attitude/motivation or personality (5.3%), not enough people interested in doing this kind of job (5.3%), low number of applicants (2.6%), job requires unsociable work hours (2.6%) and unknown reasons (7.9%). The lack of relevant work experience was a key reason

The frequency of task execution in the form of mean responses on a scale of 1-5 was used as a means of identifying what the skills requirements were. Tasks of importance were supervising and coordinating construction works on site (4.11) and examining and inspecting works progress (4.08). Moderately frequent tasks included ensuring occupational health and safety policy adherence (3.63), stakeholder consultation for design (3.34), technical report writing (3.26), financial progress gauging (3.11), the preparation of construction drawings (3.18), project cost estimation and cost planning (3.05). Least required tasks were in the planning and design phases with activities such as stakeholder engagement, conducting baseline surveys for design (2.84), preparing technical specifications (2.68), managing and controlling budget expenses (2.76), organising and selecting project staff (2.53), training and mentoring of apprentices (2.51) and preparing construction method statements (2.50).

Using a skills proficiency scale of 1-5 with 5 being highly competent, results indicated that skills strengths in the sector lie in the supervision, examining and inspecting of construction works (4.05). The planning and design processes showed fewer skills capabilities. The preparation of construction method statements and organizing project staff had lower ratings of 3.13 each Financial reporting had the lowest mean rating of 2.89. 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. Technical report writing (3.34) and estimation of project costs and preparing detailed cost plans and estimates (3.24) had an indication of being a subject of difficulty for participants.

In terms of occupational role requirements, response rates from the results indicated the

required high skilled occupations to be: Engineers (57.9%), Construction Site Supervisors (50%), Land Surveyors (28.9%), Quantity Surveyors (13.1%), Architects (10.5%), Project Managers (5.3%) and Traffic Planners (2.6%)

Interview Findings

Content analysis revealed that the initial stage in curriculum development was conducting a skill 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 state of the labour market was assessed using labour market signals or indicators to determine which factors influenced the skills demand and supply.

According to the results, the actual design of curriculum primarily involves stakeholder and industry input on emerging skills needs and review of current curricula and training programmes. 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 led to the formation of job profiles and level descriptors for skills level assessments

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. 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.

Results indicated a shortfall of the curriculum design process to be the lack of 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 as wells as the absence of enforcement policies with regards to industrial training which would link the knowledge and practical competencies to meet industry requirements.

Skills Measurement Framework

The framework was designed to consist of five consecutive stages of skills needs investigation as is carried out by curriculum development institutions as determined from interviews. The first stage involves gauging the current state of the construction labour market by identifying factors that are influencing skills demand and skills supply. The second stage of the framework is the process of aligning the skill competency requirements outlined in stage one with the organisational needs and processes. Skills competencies dimensions were defined according to occupation and in each construction stage. 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. Measurable aspects from the study were construction occupation groups and their associated job tasks and duties as well as education and qualification attained. Stage four is identifying skills mismatch 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 with the use of a rating scale. Stage five is developing skills competency strategies.

DISCUSSION

The importance of meeting education and training requirements is demonstrated in the investigation conducted 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 corresponded with the fact that 71.1 percent of respondents 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.

Gauging the construction industry environment provides insight on which type of construction activity is viable and predominant. The processes in transportation infrastructure development were identified as planning, design, construction, close out and operation and maintenance (TranBC, 2018). The subject of skills mismatch required an investigation of skills competency needs in comparison with skills competency availability. High response rates were inclined towards skills in the construction phase. 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. 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 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 in low frequencies from local staff. The focus seemed 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. There was also an indication that knowledge transfer on the job was not prioritised in organisations, as it was ranked the least required task. There was also a shortage of Engineers and Construction Supervisors. They 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 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. 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. 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. The lack of enforcement policies on the skills development in organisations contributes to industry not realising the importance of the role that they play in skills development.

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 are 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.

CONCLUSION

The factors influencing construction skills demand and supply included; defined career paths, education, qualification and relative work experience requirements, salary scale and emerging technologies affecting the way construction is being carried out. Prominent skills mismatches in the construction industry included; (1) a shortage of Engineers and Construction Supervisors and (2) a skills gaps in financial and technical aspects of planning and design of transportation projects for skills such as planning and selecting of project staff, preparation of design specifications, estimation of project costs and preparing detailed cost plans, preparing construction method statements and technical specifications and technical and financial reporting

A five-stage skills measurement framework for competency analysis was designed with activities such as (1) assessing the current state of the Construction labour market, (2) determining the nature of human resource input required, (3) selecting measurable skills competencies, (45) identifying the skills mismatch and (5) developing skills competency strategies.

A limitation to the study was the high probability of potential bias of skills proficiency rating by respondents. Difficulty in finding labour market information that is specific to the construction sector for literature review on a local context was also a limitation. 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. Another recommendation would be to formulate and enforce policies that 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.

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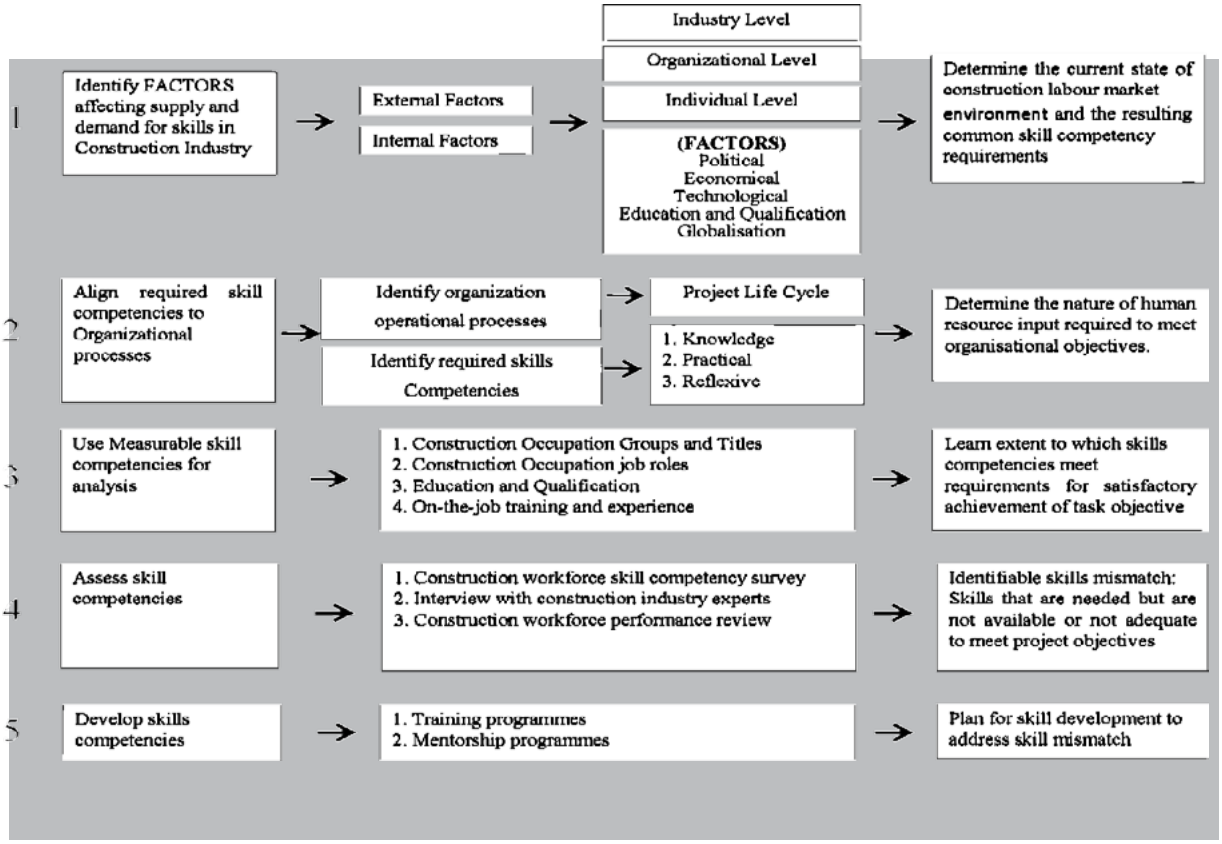

Figure 1: Skills measurement framework

TABLES

Table 1: Rating scale for skills competency ranking

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)**

Table 2: Skills competency ratings of 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 policies and procedures	3.53	1.268	Construction
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