ESTATE MANAGEMENT

Assessment of the Levels of Manpower Demand and Supply among Skilled Trades in Construction Firms in Port Harcourt Metropolis, Rivers State

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Published November 2026

Abstract

The availability of competent skilled trades people is central to the delivery of construction project. The continuous shortage of skilled manpower is complicated by occupational differences in labour requirements and the time needed to develop trade competence. This study assesses the levels of manpower demand and supply among skilled trades in construction firms in Port Harcourt Metropolis, Rivers State, and tests whether the demand supply gap differs across occupations. A quantitative cross sectional analysis was conducted using 1,000 respondent records contained in the supplied questionnaire dataset. Demand and supply were measured separately on five-point ordinal scales for eleven trades. Respondent level demand–supply differences were calculated, compared using Wilcoxon signed-rank tests with Holm adjustment, and examined through a repeated observation regression. The overall mean demand score was 3.943, compared with a mean supply score of 2.922, producing a mean demand gap of 1.022 scale points (95% CI: 0.998–1.045). Demand ratings exceeded supply in all eleven trades, with all skilled trade specific paired test remaining significant after multiplicity adjustment (adjusted $p < .001$). Electricians recorded the highest mean gap (1.574), followed by scaffolders (1.352), plumbers/pipefitters (1.302) and masons/bricklayers (1.222). The adjusted regression confirmed that gap magnitude varied significantly by trade (Wald $\chi^2(10) = 765.85$, $p < .001$). The study concludes that there is more demand for skilled trades than the availability of manpower across construction firms.

Keywords: Construction Manpower; skilled trade; labour demand and supply; skills shortage; Port Harcourt

1 Introduction

Construction is labour intensive and depends on the timely availability of workers whose competencies match technical requirements of each project stage. Skilled trade people translate design information and construction specifications into physical work through activities such as masonry, carpentry, electrical, installation, plumbing, welding, tiling, scaffolding, steel fixing, glazing and heating, ventilation and air conditioning installation. A shortage in one occupation may disrupt the sequence of dependent activities even where the overall number of workers available to a firm appears adequate. Manpower planning in construction therefore requires attention not only to the aggregate size of the workforce but also to its occupational composition, competence and availability when required.

Demand for construction labour is influenced by the volume, type, cost, complexity and timing of projects. Chan et al. (2006) demonstrated how occupational labour requirements can be estimated using project expenditure and trade specific labour multipliers. Wong et al. (2007) further showed that

construction output and labour productivity are important determinants of aggregate manpower demand. These studies indicate that labour requirements fluctuate with the construction cycle and differ across project types. A firm undertaking residential construction may require a different mix of trades from one executing industrial, infrastructure or oil and gas projects. The supply side is equally complex The number of people available to work in a trade is not identical to the number of competent workers that employers can recruit. Effective supply depends on practical skills, experience, certification where applicable, geographical availability, willingness to accept prevailing wages and working conditions, and the ability to mobilize workers within project schedules. Training and apprenticeship systems may take years to produce fully competent workers, while retirement, migration, occupational mobility and weak retention can reduce the available workforce. Consequently, demand may rise more quickly than the supply of competent workers can adjust.

Nigeria specific studies have identified concerns about artisan shortages and the institutional conditions that shape skills development. Idris et al. (2024) examined the severity of skill shortages among Nigerian building construction artisans and highlighted competency, safety and training issues. Elegbede and Akinbile (2024), using responses from 121 construction professionals in Oyo State, grouped shortage related influences around governmental inefficiencies, stakeholders engagement, resources, changing construction practices, labour market organization and wages. Tope (2024) also examined factors associated with shortages of skilled artisans and highlighted the importance of investment in manpower development and interest in skills acquisition. These studies provide relevant national context, but their findings do not substitute for an occupational assessment specific to Port Harcourt.

Port Harcourt is an important centre of construction activity in Rivers State, demand arising from residential, commercial, industrial, infrastructure and oil and gas related development. For firms operating in this environment, the practical question is whether the competent workers required for particular trades are available in sufficient measure. General statements about labour shortages do not reveal which occupations experience the greatest imbalance or whether observed differences are statistically meaningful. This study addresses that problem by comparing the demand and supply ratings reported by the same respondents across eleven skilled trades and by estimating an adjusted model of trade specific gap differences.

1.1 Aim and objectives

The aim is to assess the levels of manpower demand and supply among skilled trades in construction firms in Port Harcourt Metropolis, Rivers State.

The specific objectives are to:

1. determine the level of demand for each selected skilled trades;
2. determine the level of supply or availability of competent workers in each trade;
3. measure and test the demand and supply differences within each trade; and
4. establish whether the magnitude of the demand-supply gap differ significantly across trades.

1.2 Research questions

1. What is the level of demand of manpower for each selected skilled trades?
2. What is the level of supply of competent manpower for each selected skilled trades?
3. Is the level of demand significantly different from supply within each trade?

4. Does the magnitude of the demand-supply gap for differ significantly across trades after adjustment for respondent and project characteristics?

2 Literature review

2.1 Manpower demand and supply in construction

Manpower demand refers to the quantity and occupational mix of labour that employers require to execute planned and ongoing work. It is derived from project workload, construction methods, productivity expectations, project duration, technology and the sequence of operations. In construction, labour demand is not constant; it changes with the business cycle and may rise sharply during periods of high project activity. Wong et al. (2007) modelled construction manpower demand as a function of economic and industry variables, while Chan et al. (2006) developed a trade based forecasting approach that links labour requirements to project expenditure and project duration. The implication is that workforce planning should be linked to the actual project portfolio rather than relying on a static estimate of total employees.

2.2 Occupational and skilled trade imbalance

Construction occupations are not interchangeable. Masonry, carpentry, electrical installation, plumbing, welding, scaffolding, steel fixing and finishing trades require different combinations of technical knowledge, practical experience and safety competence. A shortage in a critical trade can constrain project progress even if other trades are adequately supplied. Chan et al. (2006) emphasized the importance of estimating requirements by trade, while Wong et al. (2010) examined occupational demand as a distinct component of construction manpower forecasting. These approaches support the use occupation-level rather than aggregate workforce measures.

Evidence from Nigeria points to shortages across several artisan occupations. Idris et al. (2024) reported relatively high shortage scores for plumbing, installation and tiling/decorative stone work, followed by masonry, carpentry, electrical installation, painting and welding/fabrication. Their study also identified concerns about safety related competence and delays in project delivery. The rankings provide a useful national comparator, although the study respondents and geographical coverage differ from the present dataset.

2.3 Factors shaping the supply of skilled trades

The supply of competent artisan depends on the attractiveness and accessibility of training, the quality of instruction, the strength of apprenticeship and mentorship, the cost of acquiring skills, the availability of tools and equipment, and the employment conditions offered by firms. Tope (2024) examined shortage factors in the Nigerian construction industry and reported the importance of investment in manpower development and interest in skill acquisition. Elegbede and Akinbile (2024) identified systematic influences that weak stakeholders engagement, inadequate resources, changing construction practices, disorganized labour markets and substandard wages. Together, these studies suggest that labour supply cannot be improved solely by increasing enrollment in training institutions; it also requires employer participation, credible competency assessment, attractive employment conditions and clearer occupational pathways.

Apprenticeship is particularly relevant because construction competence is acquired through supervised practice as well as classroom instruction. Ebekozien et al. (2024) discuss apprenticeship

as a mechanism for developing construction artisans and connecting skills formation with decent work. Akomolafe et al. (2022) similarly emphasize the importance of human resource development and continuous training in improving the productivity of building trades. These arguments inform the policy implications of the present study, especially where large gaps are observed in trades that require specialist practical competence.

2.4 The Port Harcourt construction context

Port Harcourt is the capital of Rivers State and the major city of the Niger Delta, the heartland of Nigeria's oil and gas industry. Construction demand in the metropolis is shaped by both public and industrial investment. The Rivers State Government signed a N195.3 billion contract with Julius Berger Nigeria Plc for the Port Harcourt Ring Road in July 2023. The rehabilitation of the Port Harcourt refinery complex was designed to restore it to at least 90% of nameplate capacity, and the wider Onne-Eleme corridor concentrates refineries, a port complex and petrochemical plants. Gas distribution infrastructure has also been expanded in industrial areas such as Trans-Amadi under agreements between the Rivers State Government and private operators. This mix of civil, industrial and energy-related work plausibly places heavy demand on electrical, piping, scaffolding and masonry trades, although this study does not test that link directly.

Reports on the local labour market point in the same direction. National press coverage notes that state-run housing schemes in Lagos, Rivers and Kano have reported delays attributed partly to artisan shortages. Port Harcourt residents have also complained of poor workmanship by local artisans, and a local trade-school director has observed that, although certification bodies exist, no dedicated regulator oversees artisans. These sources are journalistic and indicative rather than systematic, which reinforces the need for a structured local assessment.

2.5 Research gap

Existing literature provides useful evidence on construction manpower forecasting and the causes or severity of artisan shortages. However, much of the Nigerian evidence is based on broad shortage ratings, selected regions or lists of influencing factors. A local assessment that compares demand and supply ratings within the same respondent across a defined set of trades, and then tests whether gap magnitude differs by trade after adjustment for respondent and project characteristics, adds a more focused empirical contribution. The present study adopts a demand–supply gap. Framework for each respondent and trade, the difference between demand and supply ratings represents the direction and relative intensity of the reported imbalance. A positive score indicates that demand exceeds availability (supply); a zero score indicates parity; and a negative score indicates that availability (supply) exceeds demand. The measure is not treated as a headcount deficit.

3 Research methodology

3.1 Research design and instrument

The analysis is based on 1000 completed questionnaire records in the final response dataset. Each respondent rated the level of demand and supply for eleven skilled trades on separate five point Likert-type scales. Only the final 1,000 response, eleven trades dataset was analyzed. The questionnaire asked respondents to answer with reference to their firm's operations during the preceding twelve months.

The eleven skilled trades were mason/bricklayer, carpenter, electrician, plumber/pipefitters, welder/fabricator, painter/decorator, tiler, scaffolder, steel fixer, aluminum/glazing worker and HVAC installer/technician. Demand anchors were 1= Very Low Demand, 2 = Low Demand, 3 = Moderate Demand, 4 = High Demand and 5 = Very High Demand. Supply anchors were 1= Very Low Supply, 2 = Low Supply, 3 = Moderate Supply, 4 = High Supply and 5 = Very High Supply. N/A was offered in the questionnaire but was not present as a missing or coded response in the analyzed rating fields..

3.2 Data screening

The response sheet contained 1,000 unique respondents and no missing values in the analysed demand and supply fields. Each respondent contributed eleven demand ratings and eleven corresponding supply ratings, resulting in 11,000 respondent trade pairs. The demand–supply gap was computed as

$$\text{Gap}_{ij} = \text{Demand}_{ij} - \text{Supply}_{ij} \tag{1}$$

where *i* denotes the respondent and *j* denotes the trade. Positive values indicate that demand ratings exceed supply ratings. Since the scores are ordinal Likert-type responses, mean scores are used as descriptive summaries of the scale, while paired non-parametric tests provide the principal inferential comparison. The dataset also contains vacancy, vacancy count and recruitment difficulty fields.

3.3 Statistical analysis

Descriptive statistics were computed for demand, supply and the paired gap for each trade and for the overall respondent-level average across trades. Trade specific demand–supply differences were tested using two-sided Wilcoxon signed-rank tests. Holm's step-down procedure was applied to control the family wise error rate across the eleven trade tests. Paired mean differences and 95% confidence intervals are reported as interpretable scale-point summaries.

To test whether the gap differed across trades after adjustment, the data were reshaped into long format, producing 11,000 respondents trade observations. A linear repeated observation regression was estimated with the gap as the dependent variable, trade as categorical predictor and aluminium/glazing worker as the reference category. Gender, age bracket, education, job designation, years of experience and project type were included as covariates. Standard errors were clustered by respondent to account for the eleven observations contributed by each person. A joint Wald test assessed whether the trade indicators were collectively associated with gap magnitude. The model is interpreted as associational, not causal.

The response file contained 1,000 unique respondent identifiers and complete paired demand and supply ratings for all eleven trades. Internal consistency coefficients were not used to validate the eleven trade ratings because the trades are distinct occupational categories rather than interchangeable indicators of a single unidimensional scale. The primary inferential approach therefore uses paired trade-level comparisons.

4 Results

4.1 Respondent profile

The sample comprised 826 men (82.6%) and 174 women (17.4%). The largest age group was 35-44 years (308; 30.8%), followed by 25-34 years (277; 27.7%). Technical/vocational certificate holders formed the largest education group (296; 29.6%), skilled artisans the largest designation group (264; 26.4%), 5-10 years the most common experience band (289; 28.9%), and residential building the most common project type (358; 35.8%)

4.2 Overall demand and supply

Across the eleven trades, the overall mean demand rating was 3.943, while the overall mean supply rating was 2.922; the resulting mean paired gap was 1.022 points (95% CI: 0.998–1.045). The overall paired t-test was statistically significant, $t(999) = 85.49$, $p < .001$; the corresponding Wilcoxon signed-rank test was also significant ($p < .001$). The direction and magnitude of the difference indicate that respondents generally rated demand above the availability of competent workers. These results are summarised in Table 1.

Table 1. Overall demand and supply of skilled trades.

Measure	Mean	Interpretation
Demand across 11 trades	3.943	Between moderate and high; closer to high
Supply across 11 trades	2.922	Approximately moderate
Mean paired gap	1.022	Demand ratings exceed supply ratings
95% CI for mean gap	0.998-1.045	Interval excludes zero

4.3 Trade-specific demand, supply and gaps

The trade-specific demand and supply ratings and gaps are presented in Table 2.

Table 2. Trade-specific demand, supply and gaps.

Trade	Demand M	Supply M	Mean gap	95% CI for gap	Demand > supply
Electrician	4.256	2.682	1.574	1.500-1.648	81.8%
Scaffolder	4.068	2.716	1.352	1.275-1.429	75.7%
Plumber/pipefitter	4.089	2.787	1.302	1.225-1.379	74.7%
Mason/bricklayer	4.177	2.955	1.222	1.145-1.299	73.2%
Welder/fabricator	4.006	2.893	1.113	1.036-1.190	71.6%
Carpenter/joiner	4.072	3.067	1.005	0.928-1.082	68.0%
Tiler	3.917	2.974	0.943	0.863-1.023	63.5%
Steel fixer	3.668	2.773	0.895	0.813-0.977	62.3%
HVAC installer/technician	3.765	2.889	0.876	0.795-0.957	62.8%
Painter/decorator	3.782	3.293	0.489	0.406-0.572	48.4%
Aluminium/glazing worker	3.578	3.109	0.469	0.391-0.547	50.1%

Electricians recorded the largest mean gap (1.574), followed by scaffolders (1.352), plumbers/pipefitters (1.302) and masons/bricklayers (1.222). The smallest mean gaps were observed for aluminum/glazing workers (0.469) and painters/decorators (0.489). The proportion of respondents whose demand rating exceeded their supply rating was highest for electrician (81.8%), scaffolders (75.7%) and plumbers/pipefitters (74.7%). This ranking indicates that the imbalance is not evenly distributed across trades.

4.4 Paired significance tests

The Wilcoxon signed-rank test showed that demand ratings were significantly higher than supply ratings in all eleven trades. After Holm adjustment for multiple testing, every trade specific comparison remained statistically significant (all adjusted $p < .001$). Thus, the null hypothesis of no paired demand and supply difference was rejected for each trade. The 95% confidence interval for every mean gap was also entirely above zero.

4.5 Adjusted regression of trade specific gap differences

The repeated observation regression was statistically significant overall ($F = 22.13$, $p < .001$), with $R^2 = 0.065$ and adjusted $R^2 = 0.062$. The joint Wald test indicated that the trade indicators were collectively significant (Wald $\chi^2(10) = 765.85$, $p < .001$). The magnitude of the demand–supply gap therefore differed significantly across trades after controlling for gender, age bracket, education, job designation, experience and project type.

Table 3 presents the adjusted trade-specific gap contrasts.

Table 3. Adjusted regression: trade-specific gap contrasts (reference: aluminium/glazing worker).

Trade contrast	B	Cluster SE	95% CI	p
Carpenter/joiner	0.536	0.056	0.425-0.647	<.001
Electrician	1.105	0.054	1.000-1.210	<.001
HVAC installer/technician	0.407	0.057	0.295-0.519	<.001
Mason/bricklayer	0.753	0.057	0.642-0.864	<.001
Painter/decorator	0.020	0.058	-0.093-0.133	.729
Plumber/pipefitter	0.833	0.056	0.723-0.943	<.001
Scaffolder	0.883	0.055	0.775-0.991	<.001
Steel fixer	0.426	0.057	0.314-0.538	<.001
Tiler	0.474	0.056	0.364-0.584	<.001
Welder/fabricator	0.644	0.055	0.536-0.752	<.001

5 Discussion

From the data results it can be seen that there is a greater demand for skilled workers within all 11 occupations than there is supply. The average overall gap of 1.022 is a large difference on a scale of 5. When looking at the individual trades, it can be seen that there is a consistent pattern for all occupations, showing there is a local issue with demand and supply of skilled workers.Electricians, scaffolders, plumbers/pipefitters and mason/bricklayers had the largest gap. These occupations are

vital to various stages of construction and often have technical, safety related or sequential elements. Electricians and plumbers require specialist technical knowledge and need to work with other building systems to install. Scaffolders and masons are vital to building access and operations. Therefore if there is a signal of a shortage within these trades, there could be a bottleneck even though there maybe a greater availability in other occupations. This shows that there should be an understanding of shortages within the construction industry on a per-trade basis.There is some inconsistency between the findings of this study and the nationally comparative study. Idris et al. (2024) found that there was the highest trade shortage scores within plumbing and tiling/decorative stone works. This study shows a higher gap for electricians and scaffolders, whilst tilers had a more moderate gap. This could be due to a variety of factors including geographical location, types of projects within the data set, definition of occupations, make-up of the respondents and how they were measured. This should not be considered contradictory as there is no harmonisation between the studies. However, it shows the importance of a localised approach.

The findings are consistent with other studies in the manpower forecasting area. Chan et al. (2006) and Wong et al. (2007) argue that demand for labour will vary depending on the type of project, output and make up of occupations. This has been shown with the significant trade effect in the regression. However, the R squared value of the model (0.065) shows that the variation in the gap can only be explained to a small extent by the trade and respondent/project controls. Additional factors such as firm size, project size, contract workload, pay offered, recruitment methods, certification requirements, workforce mobility and timing of demand may have caused additional variation, but were not well represented in the model.The results show that painters/decorators and aluminium/glazing had a relatively small gap. This does not necessarily mean there is a surplus in these trades and that there are no issues with recruitment. It just means there was less of a difference in demand and supply in this sample. The fact that all trades had a positive gap does not indicate how many workers are not in the labour market, this would require headcount data.Policy recommendations would include focusing on particular occupations. Training providers, vocational institutions and contractors should work with each other to identify the trades with the largest gap and implement competency based training, on the job learning and trade certification. Firms should look to improve retention of staff by ensuring predictable pay, competitive pay, safe working and progression. This is consistent with studies from Nigeria which identified a lack of investment in training, collaboration between stakeholders, resources and labour market as causes of shortages (Elegbede & Akinbile, 2024; Tope, 2024).

6 Conclusion

This study looked at the demand and supply of manpower within 11 skilled occupations in construction firms in Port Harcourt Metropolis. There was an overall average demand score (3.943) which was higher than supply/availability score (2.922) giving an average gap of 1.022. All occupations had a significantly higher demand score. After Holm correction, all paired tests were significant. Electricians had the highest average gap, followed by scaffolders, plumbers/pipefitters and mason/bricklayers. The repeated observation regression showed that after adjusting for some respondent and project characteristics, there was a significant difference in the magnitude of the gap between trades.

Overall, this shows that there is a general issue with demand and supply but it varies by occupation. Therefore, construction firms, vocational institutions and policymakers should consider trade

specific manpower planning. This shows there are perceived issues with demand and supply based on scale, but does not show how many workers are actually in deficit.

7 Recommendations

The study recommends the following:

- Construction firms should produce manpower forecasts for each project. This should identify when and how many competent workers are needed per trade, especially electricians, scaffolders, plumbers/pipefitters and mason/bricklayers.
- Technical/vocational institutions should ensure they have the correct amount of students enrolled, equipment, teachers and practical assessments for each occupation as defined by employers.
- Contractors should look to increase structured apprenticeship and mentoring schemes to provide a blend of classroom learning and on the job learning.
- Industry associations and relevant public agencies should support a trade specific register of competent artisans. This should identify their skills, certification, experience, location and availability.
- Firms should look to improve recruitment and retention by offering timely payments, fair pay, safe working and predictable working.
- Future studies should collect accurate headcount data from firms. This should include current vacancies, how many workers are needed, how long they have been recruiting for, pay and how many training have been completed per year. This will allow an estimation of actual shortages and future workforce needs.

8 Limitations

This study uses questionnaire to determine the demand and supply rather than verified payroll, headcount, vacancy, or certification data. The cross-sectional design prevents causal inference, and the modest R^2 indicates that important firm-level and project-level factors were not fully captured. The findings are specific to the analysed sample and should be generalised with caution.

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