Labour–Specific Factors Influencing the Volume of Construction Waste Generation in The Construction Industry

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The construction industry generates a large volume of waste which distorts the aesthetics of the environment and contributes to the impediments to achieving social, economic and environmental dimensions of sustainability. Construction waste impacts project schedule, cost, and derails contractor's profit, leading to claims and disputes. Construction tradespeople who are the frontline workers have a role to play in the waste generation of construction projects irrespective of the level of development of a nation. This study assessed the labour-specific factors influencing construction wastes generation on construction projects in Nigeria. The well-structured questionnaire conveniently administered to construction tradespeople in active construction sites in Port Harcourt was used to gather data. Garnered data were analysed using the mean item score and Kruskal-Wallis H tests. The study found that the most significant labour-specific factor that influence construction waste generation are workers' mistakes/errors leading to rework, poor attitudes of workers, shortage of skilled workers/use of unskilled, poor workmanship, and lack of experience. The study recommended the organisation of adequate training to improve worker's knowledge and skills needed to execute projects tasks.

***Keywords**: construction waste, labour-specific factors, trades people, Nigeria*

1. INTRODUCTION

Globally, the construction sector is responsible for building and infrastructure provision to support the ever-growing population in cities (Luangcharoenrat et al., 2019). In response to the construction industry to the rapid population growth, its activities are scaled up at a proportional rate, leading to the use of a large volume of materials and the engagement of more labour; the consequence is the generation of a large quantity of construction waste. The large mass of waste generated contributes to distortion in the aesthetics of the environment and environmental degradation. Furthermore, construction waste impacts project cost, duration, and contractor's profit and disputes and claims (Tongo et al., 2020). Construction wastes have an impact on the social, economic and environmental dimensions of sustainability (Ortiz et al., 2010), and this has led to the increasing interest in construction waste-based studies globally (Yuan and Shen, 2011).

Construction waste in the UK in 2014 was 59% of a total of 202.8 million tonnes of waste generated (Sharman, 2018). Construction waste by the proportion of total wastes generated by countries shows that in the USA, it is 20-29% (Bossink and Brouwers, 1996); 27% in Canada (Yeheyis et al., 2013); 20% in Japan (Yonetani, 2017); 50% in Brazil (Contreras et al., 2016); and 32% in England (Sharman, 2017). With these statistics, the construction sector is adjudged to be among the largest contributor to waste (Sharman, 2018). In Nigeria, the situation is no different. It was reported that for every 100 houses built, the materials waste would be enough to build another 10 houses (Ameh and Itodo, 2013).

Outside the boundaries of Nigeria, a lot of construction waste-related studies exist in the literature. Similarly, in Nigeria, there are a lot of studies exist on construction waste; for instance, factors influencing waste generation in buildings project in the six states of Southwest (Tongo et al., 2020a,b), the effectiveness of construction waste minimization in Bauchi State (Baba and Suratkon, 2017), Waste control measures (Wahab and Lawal, 2011), Sources and causes of material waste and effects (Whyte et al., 2018), Professionals; view of materials wastages (Ameh and Itodo, 2013), and Quantitative Assessment of Construction Materials Wastage (Babatunde, 2012). While these studies identified various causes of waste on a construction project, labour-specific causes of construction waste were barely discussed. This is in spite of the fact that construction is labour dependant. The construction industry is a labour-intensive sector; thus, minimisation of waste generation is dependent on the understanding, cooperation, attitudes and behaviours of the workers (Luangcharoenrat et al., 2019), most especially the site operatives (tradespeople) who are majorly the frontline workers on the construction project. According to Eze et al. (2017), the construction tradespeople are the category of workers that are physically and directly involved in the execution of the works and production of the finished buildings and other construction-related structures. Site operatives (tradespeople) are the people directly involved in the art of putting raw materials to form the building envelope (Adewuyi and Otali, 2013). The Project Management Body of Knowledge (PMBOK) (2013) refers to tradespeople as members of the project team involved in the creation of deliverables. Thus, their actions and inaction could directly or indirectly contribute to waste generation on a project. Also, construction tradespeople are vital stakeholders on every project that may help to improve the performance of construction activities and reduce waste production and other related losses during the construction stage of the projects (Eze et al., 2017).

While the majority of the studies have blamed construction waste generation on design-related changes at the upstream stage of construction projects (Sweis et al., 2021), few studies have been explored regarding waste generation at the downstream stage of construction projects, especially the role of construction tradespeople

(artisan, craftsmen and operatives). Although, Faniran and Caban (1998) blamed downstream waste on material cutting, Tam et al. (2015) blamed downstream construction waste on workers' belief and the absence of effective supervision. The report of Skoyles (1976) showed that construction waste generation is dependent on labour and personnel-related factors other than other causes. It is based on this knowledge that this study assesses the labour-specific factors influencing construction waste generation on construction projects in Nigeria. The objectives of this study are; (i) to assess labour-specific factors influencing construction waste generation on construction projects (ii) to identify the labour-specific factors in which the views of the target participants vary. A poorly skilled worker, ill-trained worker, and have bad attitude will impact negatively on the quality of work and this could lead to multiple reworks and repairs during construction. Owing to the critical role of tradespeople on construction projects, Eze et al. (2017) recommends that site operatives and craftsmen should be carried along in waste management plans and decisions by management. Similarly, Tongo et al. (2020) recommend that experienced site operatives and craftsmen should be engaged and trained on ways of minimising building construction waste. Thus, construction tradespeople would form the primary basis for data collection for the study.

A critical step toward waste minimisation is the identification, and since construction tradespeople form the bulk of the category of workers on every construction project. The identification of the labour-centred causes of construction waste will help in devising strategies toward improving their experiences and knowledge to curtail waste generation on construction projects. Since, the tradespeople play a critical role in the delivery of construction project, especially as it has to do with the triple bottom line of time, cost and quality, and client satisfaction; the management of this category of stakeholder in the delivery of projects will bring a more sustainable way of delivering a project with lesser construction waste. Hence, the need for labour-specific factors influencing construction wastes generation on construction projects.

2 REVIEW OF LITERATURE

2.1 Construction waste

Construction waste which commonly included physical and non-physical wastes have a significant impact on construction projects cost, time, quality and sustainability aspects (Nagapan et al., 2012a; Saidu et al., 2017; Saidu and Shankantu, 2016a, 2016b). In many developing countries of the world, construction wastes have become a persistent matter because of their adverse effect on the attainment of economic, environmental and social aspects of sustainability (Nagapan et al., 2012b). In the same vein, Adewuyi and Otali (2013) posit that materials waste is a serious problem requiring crucial attention in the construction industry. This is because most of the waste is poorly managed which ends in a substantial distortion of the environmental and health problems, degradation of project performance (Imam et al., 2008; Saidu and Shakantu, 2016b).

On a construction project, Eze et al. (2017) found that the most waste generated is formwork from wood/timber, Mortar from Rendering/plastering, Blockwork and Brickwork and concrete. Concrete, Mortar from plastering/rendering, and concrete blocks are the most wasteful building materials during construction work (Ameh and Itodo, 2013). Babatunde (2012) found that the most wasteful material on construction sites are reinforcement, wires and cables, roofing sheets and pipes. These wastages were caused by poor materials handling of tools, and inadequate training of the construction workers to handle sophisticated equipment. Labour-only subcontracting options of project delivery contribute most to construction materials wastes (Ameh and Itodo, 2013). It follows that the construction tradespeople who are the frontline workers in the delivery of construction projects have a vital role to play in the generation of waste on projects.

2.2 Labour–specific factors influencing a waste generation

There are a lot of studies in existence in both developed and developing economies on construction waste generation factors. In the construction industry of Jordan, Al-Rifai and Amoudi (2016) investigated the major factors and causes contributing to construction material wastes, and found that management-related and workforce-related factors are the two most significant factors contributing to construction waste. Non-use of skilled labour and subcontractors, and workers' errors leading to rework were found to have the highest impact on construction waste generation. Al-Rifai and Amoudi (2016) attributed these to the casualization of labour and neglect of training by contractors and subcontractors. In a similar but separate study in Jordan, Bekr (2014) found Materials wastes range from 15% to 21% in values on construction sites, and these are caused frequently by changes occasioned by design and clients, workers mistakes leading to rework, poorly drafted contract documents, poor materials storage, deficiency in strategy for waste reduction, shortage and lack of experience of skilled workers, poor worksite conditions, transportation damages, theft and vandalism, and quantity surveyors' mistakes. In the Sri Lanka construction industry, Jayamathan and Rameezdeen (2014) through direct observation in six case studies carried out a study aimed at determining the influence of labour arrangements on construction waste generation. The study found that subtracted labour contributes to waste generation than direct labour. Similarly, in Hong Kong, Tam et al. (2007) found that labour-only subcontracting generated more waste than direct labour. Furthermore, labour and material subcontracting were found to contribute the lowest to construction waste generation. This shows according to Jayamathan and Rameezdeen (2014) that subcontractors will be more careful in terms of supervision and creating awareness amongst the workers on the consequences of wastage. Errors by workers were found among the contribution of the factors to variations, changed orders and rework in electrical and mechanical engineering projects in Hong Kong (Wan et al., 2009).

In the UK, last-minute changes were rated highest by architects and contractors as the main cause of waste in the UK construction industry (Osmani et al., 2006). In a different study by Fadiya et al. (2014), it was found that handling and operations, vandalism was among the sources of construction wastes. A survey of homeowners in Istanbul in Turkey by Esin and Cosgun (2007) showed that waste generation downstream of construction projects are caused mainly due to poor workmanship resulting from the use of unskilled labour, insufficient tools and poor workplace conditions. In Australia, Ajzen's 'theory of planned behaviour' was adopted by Teo and Loosemore (2001) to investigate the attitudinal forces that influence behaviour at the operative level. The study found that construction operatives believe that waste is inevitable. Management places less priority on waste management, lack of appropriate resources and incentive to support waste management informed the negative attitudes of operatives towards waste. Thus, Al-Sari et al. (2012) posit that people are critical in the waste management equation if downstream wastes are to be minimised. In the Palestinian construction industry, Al-sari et al. (2012) found that downstream of building construction, about 17 to 81kg of construction-related wastes are generated per area of the building floor. This situation is attributed to the use of labour-intensive techniques bordering on contractor's attitudes and behaviour towards the management of wastes. It was further reported that the use of higher numbers of unskilled workers has a negative influence on the attitudes of contractors towards waste reduction and behaviours towards the sorting and disposal of wastes. Unskilled workers are less aware of the impact of construction; misconceive the quality of recycled products, receive low wages, lacks sufficient motivation with less supervision effectiveness. Ekanayake and Ofori (2004) in Singapore found that design, operation and materials handling were the main sources of waste. In the Indonesian construction industry, Alwi et al.'s (2002) study found that the main

variables to waste generation on construction projects are repair works, time spent waiting for materials, delay in schedule, use of non-skilled workers, on-site waste from raw materials and poor supervision.

Khaleel and Al-Zubaidy (2018) in Iraq, found that materials damage on-site, poor handling of materials, incompetent technical staff of contractors are the critical contributors to waste generation on building projects. Sakunde and Valunjkar (2017) used six sigma principles and found that unfriendly behaviour and attitude of labour and project team members are among the factors influencing a waste generation and management on construction project sites. Asgari et al. (2017) reported that inadequate skilled and experienced personnel to implement effective management programs; has an impact on the quantity and quality of construction and demolition waste generated. Haruna et al. (2017) reported that besides materials planning and management problems, poor workmanship, materials theft and pilferage by workers, overestimation of materials, poor labour supervision, and wrong drawings interpretations top the list of waste factors on construction sites. Popoola et al (2018) reported that operational factor such as poor workmanship tops the list of contributors to on-site waster generation, especially on building construction projects.

Tongo et al. (2020a, b) found that the most influential factors to waste generation during building construction are regular changes in designs, non-involvement of contractors at the early stage of the project, client late request, inexperienced designers, poorly defined project brief, poor quality of design. Equipping site operatives with the necessary waste minimisation knowledge and their involvement in decision making were suggested as a way of reducing wastages on construction sites. Owing to the labour-intensive nature of construction work in a developing country like Nigeria, Adewuyi (2020) suggest the entrenchment of an incentive scheme to help check materials wastes on-site. It was suggested that regular payment of salary, provision of medical facilities, salary increase, giving of bonus, and proper supervision by experts, among others. Aboginije et al. (2021) suggested the use of experts and professionals who can help drive a sustainable waste management approach in supervision of tradespeople and training and provision of sound information on waste reduction practices.

Nagapan et al. (2011) carried out a study aimed at reviewing factors responsible for construction waste and found 63 waste factors that exist in construction activities. The study categorized these waste factors into seven groups, which are; design, handling, worker, management, site condition, procurement and external. The major factors under the worker-related factors are; workers' mistakes, incompetent workers, poor attitudes of workers, damage caused by workers, and insufficient training for workers. In a different similar but related in Malaysia, Nagapan et al. (2012a) found that site management and supervision, absence of work experiences, inadequate planning and scheduling, mistake and errors in design, and work execution mistakes, are the five major factors responsible for waste generation. Also, in the Malaysian construction sector, Ikau et al. (2016) carried out a study aimed to determine the various factors responsible for construction waste generation and found that design causes, procurement causes, materials handling causes, and construction causes; are the major factors that can guide waste reduction on construction sites. The major labour-specific factor was found under the construction causes, and they are; rework due to the use of wrong materials, rework related to poor workmanship, mistakes during the execution of work, damage caused by subsequent trades, over mixing of materials for wet trades, poor installation or errors, and vandalism and /or theft.

Luangcharoenrat et al. (2019) carried out a study aimed at identifying the contributing factors of construction waste in Thailand's construction industry and found that; design changes, inattentive working attitudes and behaviours, improper material storage, use of inexperienced designers', incompetent workers, the complexity of design, errors in design errors, poor planning

and scheduling, control and supervision, poor waste management attitudes, and wrong subcontractor's/teams selection. In Uganda, Muhwezi et al. (2012) found that design changes, lack of skilled workers, non-compliant materials, poor materials storage, are the causes of construction waste. Inefficient Job control, re-work and bad management of materials were the vital factors having a high impact on materials waste (John and Itodo, 2013). Dania et al. (2007) found that poor supervision and poor workmanship have a high influence on on-site material wastage. Table 1 shows the summary of selected labour-specific causes of construction waste generation on construction projects.

Table 1: Labour specific factors influencing construction wastes

S/N	Factors	Source(s)
1	Worker's no enthusiasm	Nagapan et al. (2012b); Nagapan et al. (2011); Teo and Loosemore (2001)
2	damages caused by labour engaged by third parties	Nagapan et al. (2011); Nagapan et al. (2012b); Ikau et al. (2016)
3	Ignorance of specifications	Nagapan et al. (2011); Muhwezi et al. (2012)
4	abuse of tools/Abnormal wear of equipment	Nagapan et al. (2012b); Nagapan et al. (2011); Esin and Cosgun (2007)
5	Over mixing of materials for wet trades	Ikau et al. (2016); Haruna et al. (2017)
6	Errors in the request of materials from the store	Nagapan et al. (2011)
7	Poor labour supervision	Haruna et al. (2017); Nagapan et al. (2011); Nagapan et al. (2012a); Teo and Loosemore (2001); Esin and Cosgun (2007); Ikau et al. (2016); Ameh and Itodo (2013); Alwi et al. (2002); Luangcharoenrat et al. (2019); Dania et al. (2007)
8	Poor documentation of requested materials	Haruna et al. (2017); Nagapan et al. (2012b)
9	vandalism and pilferage by workers	Haruna et al. (2017); Nagapan et al. (2011); Ikau et al. (2016); Berk (2014); Wan et al. (2009); Fadiya et al. (2014)
10	Too much overtime for workers	Nagapan et al. (2011); Nagapan et al. (2012b)
11	Poor workmanship	Popoola et al. (2018); Haruna et al. (2017); Nagapan et al. (2012b); Esin and Cosgun (2007); Ikau et al. (2016); Luangcharoenrat et al. (2019); Dania et al. (2007)
12	Poor material handling y workers	Khaleel and Al-Zubaidy (2018); Nagapan et al. (2011); Nagapan et al. (2012b); Berk (2014); Ekanayake and Ofori (2004); Luangcharoenrat et al. (2019)
13	Workers' mistakes/errors leading to rework	Nagapan et al. (2011); Nagapan et al. (2012a); Nagapan et al. (2012b); Al-Rifai and Amoudi (2016); Ikau et al. (2016); Berk (2014); Wan et al. (2009); Luangcharoenrat et al. (2019)
14	Inappropriate use of materials	Nagapan et al. (2012b); Nagapan et al. (2011.);
15	Lack of experience	Khaleel and Al-Zubaidy (2018); Asgari et al. (2017); Tongo et al. (2020a,b) ;Nagapan et al. (2011); Nagapan et al. (2012a); Nagapan et al. (2012b); Berk (2014); Alwi et al. (2002); Luangcharoenrat et al. (2019)
16	Poor attitudes of workers	Sakunde and Valunjkar (2017); Nagapan et al. (2012b); Nagapan et al. (2011); Teo and Loosemore (2001); Al-sari et al. (2012); Luangcharoenrat et al. (2019)
17	Incompetent worker	Tongo et al. (2020a,b); Khaleel and Al-Zubaidy (2018); Asgari et al. (2017); Nagapan et al. (2011); Nagapan et al. (2012b); Al-Rifai and Amoudi (2016); Berk (2014); Alwi et al.(2002); Luangcharoenrat et al. (2019)
18	Insufficient training for workers	Nagapan et al. (2012b); Nagapan et al. (2011); Al-Rifai and Amoudi (2016)
19	Damage caused by workers	Khaleel and Al-Zubaidy (2018); Nagapan et al. (2012b); Nagapan et al. (2011); Al-sari et al. (2012)
20	Shortage of skilled workers/use of unskilled	Asgari et al. (2017); Nagapan et al. (2012b); Nagapan et al. (2011); Esin and Cosgun (2007); Al-sari et al. (2012); Berk (2014); Luangcharoenrat et al. (2019); Muhwezi et al. (2012)

3. RESEARCH METHODOLOGY

This study aims to assess the labour-specific factors influencing construction waste generation on construction projects in Nigeria. A well-structured questionnaire was adopted for data collection, and it was developed following an extensive review of construction waste and literature. This questionnaire was administered to construction tradespeople on active construction project sites in Port Harcourt, Nigeria. The questionnaire is a common social research instrument and it can cover larger participants (Blaxter et al., 2001; Tan, 2008). For convenience purposes, Eze et al., (2017) grouped the tradespeople into; i) Group 1 - Concreters/Mason/Bricklayers, ii) Group 2 - Steel benders/fixers, iii) Group 3 – Carpenters, iv) Group 4 - Services Operators (Plumbers & Electricians), and v) Group 5- Finishers (Tillers, Painters, etc). This study adopted a similar grouping in its approaches. The condition for inclusion in the survey are; 1) at least 5 years of working experience in the construction industry, 2) knowledge of construction operations and waste, and 3) availability for the study.

The convenient sampling technique was used in the selection of samples based on their availability and ease of access (Kathori, 2004). The respondents were asked to rate the 20 selected variables based on their level of significance in contributing to construction waste during construction operation, on a 5-point Likert scale in which 1 is the lowest scale and 5 is the highest scale. With the aid of trained research assistants, a total of 182 well-filled and usable questionnaires were retrieved out of the 370 administered. This represents a response rate of 49.19% which is quite above the ideal response rate of the range of 20-30% (Moser & Kalton, 2001; Akintoye, 2000). The collected data were analysed using frequency; percentage; mean item score and the Kruskal-Wallis H test. Frequency and percentage were used to analyse data gathered on the basic information of the participants and mean item score (MIS) was used to analyse data collected on factors influencing waste generation in construction. There is a possibility to have differing views among the categories of respondents regarding the variables assessed. The Kruskal-Wallis H test was used to determine if there is a significant difference in the views of the participants.

Before the actual analyses, the reliability of the research instrument and normality of the collected data was carried out. The Cronbach's alpha test was used to determine the reliability of the research instrument. A Cronbach's alpha coefficient of 0.893 was obtained which is above the 0.70 suggested by (Pallant, 2005; Hair et al., 2010) (see Table 2). Therefore, the collected data have high internal consistency and reliability. Furthermore, the Shapiro-Wilk test was used to ascertain the data normality distribution as suggested by (Ghasemi and Zahediasl, 2012), since the sample size was far below 2000. A p-value of 0.000 (below 0.05) was obtained in all the variables. Thus, the data are non-parametric and justify the use of the Kruskal-Wallis test (See columns 5-7 of Table 3).

Table 2: Reliability test

	Case Processing Summary			Reliability Statistics	
		N	%	Cronbach's Alpha	Nr. of items
Cases	Valid	182	100	0.893	20
	Excluded[a]	0	0.00		
	Total	182	100		

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

Table 3: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Worker's no enthusiasm	0.187	182	0.000	0.868	182	0.000
damages caused by labour engaged by third parties	0.229	182	0.000	0.836	182	0.000
Ignorance of specifications	0.312	182	0.000	0.795	182	0.000
abuse of tools/Abnormal wear of equipment	0.237	182	0.000	0.793	182	0.000
Over mixing of materials for wet trades	0.285	182	0.000	0.764	182	0.000
Errors in the request of materials from the store	0.289	182	0.000	0.802	182	0.000
Poor labour supervision	0.235	182	0.000	0.815	182	0.000
Poor documentation of requested materials	0.231	182	0.000	0.833	182	0.000
vandalism and pilferage by workers	0.204	182	0.000	0.889	182	0.000
Too much overtime for workers	0.236	182	0.000	0.845	182	0.000
Poor workmanship	0.273	182	0.000	0.778	182	0.000
Poor material handling y workers	0.235	182	0.000	0.832	182	0.000
Workers' mistakes/errors leading to rework	0.411	182	0.000	0.614	182	0.000
Inappropriate use of materials	0.228	182	0.000	0.892	182	0.000
Lack of experience	0.265	182	0.000	0.794	182	0.000
Poor attitudes of workers	0.297	182	0.000	0.743	182	0.000
Incompetent worker	0.243	182	0.000	0.801	182	0.000
Insufficient training for workers	0.253	182	0.000	0.811	182	0.000
Damage caused by workers	0.178	182	0.000	0.907	182	0.000
Shortage of skilled workers/use of unskilled	0.321	182	0.000	0.762	182	0.000

a. Lilliefors Significance Correction

4. RESULTS AND DISCUSSION

4.1 Basic background information of respondents

Table 4 shows the result of the analysis of the respondents' basic background information. In terms of trades group participation, Concreters/Mason/Bricklayers are more by 27.47%, followed by Carpenters with 22.53%, then Finishers (Tillers, Painters, etc) with 20.33%, then Steel benders/fixers with 26.48%, and lastly Services Operators (Plumbers & Electricians) with 13.19%. This shows a fair representation of all categories of the major construction tradespeople on construction project sites.

With regards to the nature of employment, tradespeople on a permanent appointment is more with 42.31%, followed by casual appointments with 30.77%, and lastly, contract staffs are 26.92%. This shows that a lot of tradespeople are still being engaged on a casual and contract basis. The casualization of craftsmen could be a pointer

to the reason why construction wastes have remained a persistent problem in most developing countries. The role of casualization of labour and contract workers in the construction industry and waste generation will require further reflection. In terms of year of experience, 34.07% of the respondents have their years of experience range between 5-10 years, 36.81% of them have 11-15years, 15.93% have between 16-20years, 9.89% have 21-25years of experience and lastly, 3.3% have their years of experience to be over 25years. This implies that the respondents are experienced enough to an insight into the subject of this study.

Table 4: Basic background information of respondents

Variables	Classification	Freq.	%
Trades group	Concreters/Mason/Bricklayers	50	27.47%
	Steel benders/fixers	30	16.48%
	Carpenters	41	22.53%
	Services Operators (Plumbers & Electricians)	24	13.19%
	Finishers (Tillers, Painters, etc).	37	20.33%
	TOTAL	**182**	**100.00%**
Nature of employment	Permanent staff	77	42.31%
	Casual staff	56	30.77%
	Contract staff	49	26.92%
	TOTAL	**182**	**100.00%**
Year of experience	5-10years	62	34.07%
	11-15yrs	67	36.81%
	16-20yrs	29	15.93%
	21-25yrs	18	9.89%
	above 25yrs	6	3.30%
	TOTAL	**182**	**100.00%**

4.2.1 Labour specific factors influencing construction waste

The result of the analysis of the data gathered on labour specific factors influencing construction wastes generation is in table 5. It can be seen that the top five most significant labour-specific factors that influence construction waste generation are; workers' mistakes/errors leading to rework (MIS=4.58), Poor attitudes of workers (MIS=4.30), Shortage of skilled workers/use of unskilled (MIS=4.18), Poor workmanship (MIS=4.15), and Lack of experience (MIS=4.08). While the least labour-specific factors influencing construction waste generation are; Poor documentation of requested materials (MIS=3.74), Worker's no enthusiasm (MIS=3.65), Inappropriate use of materials (MIS=3.51), Damage caused by workers (MIS=3.38), and vandalism and pilferage by workers (MIS=3.20).

The study revealed that the most significant labour-specific factor that influence construction waste generation are workers' mistakes/errors leading to rework, poor attitudes of workers, shortage of skilled workers/use of unskilled, poor workmanship, and lack of experience. This finding is in line with the reports of (Luangcharoenrat et al., 2019; Al-Rifai and Amoudi, 2016; Ikau et al., 2016; Berk, 2014; Muhwezi et al., 2012; Nagapan et al., 2011). Mistakes/errors by craftsmen are another factors that were identified to contribute to waste. A good number of rework and repairs evolve from errors and mistakes by the craftsmen. Rework leads to the demolition of already finished work, which impacts materials, time, cost and even quality of work. Mistakes and/or errors contribute largely to the volume of construction and demolition wastes that is experienced in construction projects. A

mistake is a very influential labour-specific factor that leads to rework, and rework was identified by (Saidu and Shankantu, 2016a, 2016b) as a major factor responsible for materials waste on sites. Workers errors/mistakes were reported by (Bekr, 2014) as among the factors that led to waste generation on construction projects in Jordan. Mistakes by craftsmen and operatives were also found in the study of (Nagapan et al., 2011; Nagapan et al., 2012a; Ikau et al., 2016) to contribute to rework which lead to waste of materials and man-hour. However, if workers are well-trained and experienced and even motivated, the level of mistakes will reduce, and assigned tasks will be carried out with little or no delays. This can lead to timely delivery of building projects and within acceptable cost limits.

A craftsman with a bad attitude is a potential source of wastages and other negative vices on a project. A good attitude is what makes people last long on a project. Attitudes concerning listening, attention to detail, instruction and information are vital for suitable project delivery. Eating habits, alcoholism and smoking on sites can influence the behaviour and attitude of workers on site. These substances influence the attitudes and behaviours of workers on site which can increase the chances of mistakes and waste generations. This supports the reports of (Luangcharoenrat et al., 2019; Sakunde and Valunjkar, 2017), who reported that the attitude and behaviours of craftsmen and project team members are part of the major factors influencing a waste generation.

The shortage of skilled and experienced workforce is another factor that influences waste generation and project performance at large. The construction industry is dominated by small and medium scaled enterprises (SMEs) who always go for cheap labour in order to save costs and make more profits. These cheap labours are most times inexperienced and lack the basic skills needed to execute certain tasks. The lack of experience in handling certain jobs and materials is a leading cause of materials waste, delays, poor quality of work, among others.

Thus, the lack of basic experiences in the execution of tasks will lead to both physical and non-physical wastes. An inexperienced worker, who lacks the basic skills for carrying out a particular work, is in its self a misfit can cause serious problems to the progress of the work. This submission is in line with the findings of (Berk, 2014; Nagapan et al., 2011; Muhwezi et al., 2012). Therefore, experience and skills play a critical role in ensuring that building construction projects are delivered on time, within cost, with good quality and performance.

Kruskal-Wallis test was conducted to determine if there exist significant statistical differences in the rating of the assessed variables (see columns 6-8 of Table 5). It can be observed that 85%(17) of the variables have their p-value greater than 0.05, which implies a convergence of opinion among the five groups of the trades categories. Thus, there is no statistically significant difference in the perceptions of the various groups regarding the rating of these factors. However, a divergent opinion and a significant statistical difference were observed in 15%(3) of the assessed variables. This is evident in the p-values of these variables which is less than 0.05. These variables are; abuse of tools/Abnormal wear of equipment, vandalism and pilferage by workers, and damage caused by workers. These divergent opinions could be a result of their level of understanding of the variables and experiences on factors causing construction waste. Abuse of working tools (mean=4.03, ranked =8^{th}), vandalism and pilferage on-site by field operatives (mean=3.20, ranked=20^{th}), and damages caused by workers (mean=3.38, ranked =19^{th}) are contributors to waste generation on construction projects. The mean weights of these variables are high, which implies that they are significant to waste generation and should be given further consideration.

Overall, a p-value of 0.051 was obtained, thus, implying the non-existence of a significant statistical difference in the opinion of the tradespeople as regards the assed factors (see Table 6). This means a convergence of views amongst the five categories of tradespeople. Based on this, it can therefore be concluded that

construction tradespeople are in agreement that the assessed variables contribute to construction waste generation on a construction project.

Table 5: Labour specific factors influencing construction wastes

S/N	Variables	MIS	SD	Rank	Kruskal-Wallis Test		
					Chi-square	Sig.	Decision
1	Worker's no enthusiasm	3.65	1.1551	17th	5.302	0.258	Accept
2	Damages caused by labour engaged by third parties	4.00	0.9634	11th	8.316	0.081	Accept
3	Ignorance of specifications	3.91	1.1090	15th	4.507	0.334	Accept
4	abuse of tools/Abnormal wear of equipment	4.03	1.1070	8th	17.055	0.002*	Reject
5	Over mixing of materials for wet trades	3.93	1.2509	14th	5.016	0.286	Accept
6	Errors in the request of materials from the store	4.03	0.9743	8th	6.348	0.175	Accept
7	Poor labour supervision	4.07	0.9919	6th	9.267	0.055	Accept
8	Poor documentation of requested materials	3.74	1.2323	16th	1.538	0.820	Accept
9	Vandalism and pilferage by workers	3.20	1.3614	20th	12.019	0.017*	Reject
10	Too much overtime for workers	4.00	0.8668	11th	8.099	0.088	Accept
11	Poor workmanship	4.15	0.9490	4th	6.365	0.179	Accept
12	Poor material handling y workers	4.03	0.8913	8th	3.680	0.451	Accept
13	Workers' mistakes/errors leading to rework	4.58	0.7522	1st	8.037	0.091	Accept
14	Inappropriate use of materials	3.51	1.1260	18th	4.406	0.354	Accept
15	Lack of experience	4.08	1.0795	5th	2.256	0.657	Accept
16	Poor attitudes of workers	4.30	0.9103	2nd	2.760	0.601	Accept
17	Incompetent worker	4.05	1.0631	7th	4.521	0.330	Accept
18	Insufficient training for workers	3.95	1.1766	13th	7.908	0.087	Accept
19	Damage caused by workers	3.38	1.1487	19th	19.237	0.001*	Reject
20	Shortage of skilled workers/use of unskilled	4.18	1.0486	3rd	1.978	0.645	Accept

Table 6: Kruskal-Wallis Test for all trades group

S/N	Trades group	N	Mean rank	Chi-square	Sig.	Decision
1	Concreters/Mason/Bricklayers	50	124.76			
2	Steel benders/fixers	30	61.68			
3	Carpenters	41	87.95	9.361	0.051	Accept
4	Services Operators (Plumbers & Electricians)	24	89.19			
5	Finishers (Tillers, Painters, etc).	37	76.16			
	Total	182				

5 CONCLUSION AND RECOMMENDATIONS

This study assessed the labour-specific factors influencing construction wastes generation on construction projects in Nigeria, with a focus on active construction sites in Port Harcourt. A well-structured questionnaire was administered on construction tradespeople served as the primary means of data collection using a convenient sampling technique. The results from the analyses of the collected data led to some major findings.

The study revealed that the most significant labour-specific factor that influence construction waste generation are workers' mistakes/errors leading to rework, poor attitudes of workers, shortage of skilled workers/use of unskilled, poor workmanship, and lack of experience. Construction tradespeople are at the centre of the delivery of construction works. Their role in construction waste generation should not be neglected, as they are directly and physically involved in the construction and production of finished buildings. Efforts should be made to develop them for efficiency in tasks delivery and reduction of wastages. The study, therefore, recommends that adequate training should be organised to train and improve workers' knowledge and skills needed to execute projects. Such training would also be structured to impact their attitude and behaviours when they are on-site.

The outcome of this study will aid construction organisations in making decisions regarding labour development through training and skills development for better efficiency. This is vital because the number of and level of involvement of craftsmen on any project requires such attention for improvement. The activities of the tradespeople can make or mar the efforts of professionals in curtailing materials waste and other losses. It will also add the existing body of knowledge available on construction and demolition waste.

This study was carried out in Port Harcourt, and therefore, it is geographically bounded. Maximum care should be taken in generalising the findings. Also, the sample size may not be representative enough for generalisation. Based on this limitation, further study is recommended in other areas, stages of regions of the country or even in other countries. A similar study can be carried using the interview as the primary mean of data collection. A study that could assess the impact of labour casualization on construction waste generation should be carried out. Abuse of working tools, vandalism and pilferage on-site by field operatives, and damages caused by workers are significant contributors to waste generation and should be given a further consideration.

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