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PRINCIPAL COMPONENT ANALYSIS (PCA) OF THE ACTIVITIES OF INFORMAL CONSTRUCTION WORKERS/ARTISANS IN NIGERIA

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ABSTRACT

Every employment has deposit of activities to be performed by her employees. These activities vary with industries and who performs each of these activities is determined by how significance they are to the employment operation. Construction is one of such industries whose activities necessitate the growth and development of infrastructure needs of the societies. The activities in the construction industry are performed by different trades' artisans refer to as informal workers/artisans in this paper. Hence, this paper examines the activities of informal construction workers/artisans in Nigeria with a view to classify these activities according to various trades in the industry. A comprehensive list of construction activities was made and informal workers/artisans were asked to rank these activities based on the frequency of how they are being performed on construction projects. Data collected were analyzed using factor analysis which classified these activities into principal components that described construction trades. The result of the study shows that the most frequent activities are associated with demolition & reconstruction and woodwork while the least frequent activities associated with electrical works. The result also classifies activities in the industry into various trades including plumbing installations, mansory & blockwork, steelworks, woodworks, electrical installations, painting & decoration; and demolition & reconstruction. The finding of this study provides information on the activities of the informal workers/artisans in the construction industry for the professionals, employers and policy makers to provide enabling and friendly environment for efficient service delivery in the construction industry.

Keywords: Construction Workers/Artisans, Informal Activities, Informal Construction, Informal Sector, Nigeria

1. INTRODUCTION

The value added of construction ranges between 7% to 10% for highly developed economies and around 3% to 6% for underdeveloped economies (Lowe, 2003). In the developing countries, the value added could be higher because figures on the informal sector are mostly not included which could generate a significant casual employment in urban and rural areas (Ganesan 2000). In United Kingdom, construction industry contributes about 8 to 10 per cent of the GDP (BTEC's Own Resources, n.d.). In Nigeria, Aganga (2010) established that the construction industry contributes about 3 percent to the nation's Gross Domestic Product (GDP). In 2011, it was accounted to have contributed about 1.3% of Gross Domestic Product (GDP) (AEO 2012). Awodele et al (2010) noted that the contribution of the Nigerian construction industry to the GDP of Nigeria has reduced considerably from about 7% in 1980s to 1.3% in 2011. This contribution is below a range of 5 to 10 percent of GDP as envisaged by the United Nation and in developed nations like UK and America. Therefore, the construction industry in Nigeria is seen to be underperforming and performance in the industry retarding. Therefore, there is a need to investigate the activities and nature of operations of the informal workers/artisans who play significant roles in the construction industry in Nigeria.

Construction industry has been described in many ways. Construction activities play a vital role in the process of economic growth and development; and are of paramount importance for employment and economic growth (Mitullah and Wachira, 2003; Ogunsemi and Jagboro, 2006). It is further described to comprise of a regulated formal part and unregulated informal part (United Nations Centre for Human Settlement (UNCHS), 1996; Mlinga and Wells, 2001; Oladapo, 2006). Jewell et al. (2005) also stated that most construction sectors around the world have a high percentage of output being produced informally.

Mitullah and Wachira (2003) also reported that in some low-income countries the vast majority of construction labourers have always been employed informally. Output from the construction industry is a major and integral part of the national output, accounting for a sizeable proportion in the Gross Domestic Product (GDP) of both developed and underdeveloped countries (Ganesan 1997; Crosthwaite, 2000). Mlinga and Wells (2002) described informal construction sector as comprising "unregistered and unprotected individuals and small enterprises that supply labour and contribute in other ways to the output of the construction sector. Rogerson (1988) also describes construction industry as one of the largest employers of the informal sector workforce. Well (2007) stated that there is absence of regulation in the terms and conditions of employment as well as in the construction process of informal sector.

Jinadu (2004) cited in Sanni and Alabi (2008) stated that availability of manpower in both qualitative and quantitative terms is very crucial and constitutes the second largest single component of resource input required by the construction industry.

Manpower required for construction varies from professionals like Architects, Builders, Engineers, Quantity Surveyors, Urban and Regional Planners, Estate Managers to building artisans like bricklayers/masons, carpenters, welders/iron-benders, house painters, plumbers, electricians and the allied professions, and labour. Agbola (1985) established that manpower costs constitute about 40% of the total housing construction costs. In most cases, the types of manpower usually needed in large quantity for housing construction in Nigeria are artisans and labour (Sanni and Alabi, 2008) and this is equally applicable globally. This shows that there are two major classes of players/workers to the success of any construction industry; and both the professionals and informal worker/artisans ensure qualitative and quantitative performance of any construction activities respectively. Studies have also indicated that there are shortages in supply of skilled artisans in the construction industry globally.

In Mlinga and Wells (2001) opinion, the informal workers/artisans of the construction industry are generally ignored and receive little support from the government. They further argued that policies to develop the construction industries of developing countries should address the needs of the informal sector, where the bulk of the labour force is found (Mlinga and Wells, 2001). Meagher and Yunusa (1996) also stated that Nigeria has the largest, and arguably the most dynamic informal sector in sub-Saharan Africa and ILO (2002) has also described informal sector in sub-Saharan Africa as the largest concentration of informality globally. This invariably means that informal construction sector in Nigeria is significant both in Africa and developing countries thereby necessitate a need for its investigation. Consequently, the deficiencies, inadequacies and weaknesses of informal workers to construction sector have greatly affected the output of the industry with poor impact on nation Gross Domestic Products (GDP). Against this background, the paper assessed the activities of informal construction workers/artisans in the Nigerian construction industry with a view to provide information for policy formation to improving performance the informal construction sector in Nigeria.

2. LITERATURE REVIEW

2.1 Activities of Informal Workers/Artisans on Construction Projects

Construction industry has a strong connection with other sectors of the economy and the increase in the construction activities will have positive impact on the wealth of the country (Ogunsemi and Aje, 2005). Availability of manpower in both qualitative and quantitative terms is very crucial and constitutes the second largest single component of resource input required by the construction industry (Jinadu, 2004; cited in Sanni and Alabi, 2008). Manpower required for construction varies from professionals like Architects/ Planners, Quantity Surveyors, Builders, Engineers to building artisans like bricklayers/masons, carpenters, welders/iron-benders, painters, plumbers, electricians and the allied professionals and trades.

The former could be described as formal manpower requirement because their operations are regulated by the government in terms of level of operations/activities to carry out, forms/conditions of engagement and remuneration while the later is described as the informal players or workers whose activities are not regulated by the government although very crucial and form the core of construction works. The functions of each of the players are sets of activities to be performed at different stages of any construction projects. The formal players (professionals) activities are knowledge-based or knowledge-driven (less labour intensive) while the informal players (artisans) activities are labour intensive which requires forms of physical efforts/energies to be carried out. The extent of activities to be carried out by various informal players is imperative, hence the need for it assessment. The informal construction workers/artisans considered under this study include bricklayers/masons, carpenters, iron benders, painters, plumbers and electricians.

In construction projects/works, bricklayers/masons construct walls, partitions, fireplaces, chimneys, and other structures from brick, block, and other masonry materials such as structural tile, concrete cinder, glass, gypsum and terra cotta (AGCNH, 2011). According to Occupational Outlook Handbook (2011) brickmasons, blockmasons, and stonemasons are often called bricklayers. They create, build and repair walls, floors, partitions, fireplaces, chimneys, and other structures with brick, precast masonry panels, concrete block, and other masonry materials. In Nigeria, they are often called bricklayers or masons whose works include blocklaying, concreting, plastering, flooring and other works made from cement, sand and aggregates.

Carpenters, on the other hands erect wood framework in buildings; build forms for concrete; and erect partitions, studs, joints, drywalls, and rafters (AGCNH, 2011). Some carpenters construct docks, work with large timbers, and drive piles to support the foundations of buildings and bridges. According to Occupational Outlook Handbook (2011) carpenters construct, erect, install, and repair structures and fixtures made from wood and other materials. Carpenters are involved in many different kinds of construction, from the building of highways and bridges to the installation of kitchen cabinets. They then join the materials with nails, screws, staples, or adhesives. Depending on the employer, carpenters install partitions, doors, and windows; change locks; and repair broken furniture. In Nigeria, carpenters are trained skilled artisans that deal with wood works and the allied products such as plywood et al. Carpenters make formworks to concrete at foundation and superstructure levels. They construct roof, doors and windows with their frames, wardrobes, kitchen cabinets, ceiling noggins, and other furniture works.

Electricians lay out, install, and test electrical service and electrical wire systems used to provide heat, light, power, air conditioning, and refrigeration in homes, office building, factories, hospitals, and schools. They also install conduit and other materials, and connect electrical machinery, equipment, and controls and transmission systems (AGCNH, 2011). Electricians install and maintain all of the electrical and power systems for our homes, businesses, and factories.

They install and maintain the wiring and control equipment through which electricity flows. They also install and maintain electrical equipment and machines in factories and a wide range of other businesses. Electricians specializing in construction primarily install wiring systems into factories, businesses, and new home (Occupational Outlook Handbook, 2011). In Nigeria, electricians are skilled artisans trained to carry out wiring of building structure. They lay cable either surface or conduit; lay pipes for conduit, fix electrical fittings and accessories, build and repair electrical appliances. They also construct, generate and distribute power within a community (rural electrification).

According to AGCNH (2011) structural iron workers erect the steel framework for large industrial, commercial, or residential buildings, bridges, and metal tanks. They erect, bolt, rivet, or weld the fabricated structural metal members that support the structure during and after construction. Some iron workers, called rodmen, set steel bars (rebar) or steel mesh in forms to strengthen concrete buildings, bridges, and highways. Other ironworkers called Ornamental Iron Workers install and assemble grills, canopies, stairways, iron ladders, decorative iron railings, posts, and gates. Occupational Outlook Handbook (2011) also confirmed that structural and reinforcing iron and metal workers place and install iron or steel girders, columns, and other construction materials to form buildings, bridges, and other structures. They also position and secure steel bars or mesh in concrete forms in order to reinforce the concrete used in highways, buildings, bridges, tunnels, and other structures. Ironworkers also structural metal, steel frames and assemble the cranes and derricks that move structural steel, reinforcing bars, buckets of concrete, lumber, and other materials and equipment around the construction site. Iron workers also connect steel columns, beams, and girders. In Nigeria, iron workers are called iron benders whose works include cutting, erecting and assembling iron works such as iron rods in construction of lintels, upper floor beams, steel roof trusses, burglary proof et al.

According to Occupational Outlook Handbook (2011), painters prepare the surfaces to be coated, so that the paint will adhere properly. This may require removing the old coat of paint by sanding, wire brushing, burning, or water and abrasive blasting. Painters also fill nail holes and cracks, sandpaper rough spots, and wash walls and trim to remove dirt, grease, and dust. Painters apply paint, stain, varnish, and other finishes to buildings and other structures. They select the right paint or finish for the surface to be covered, taking into account durability, ease of handling, method of application, and customers' wishes. In Nigeria, painter on a new works ensure that surface to be painted are smooth for paint application while on the old work remove all existing paints, stains and materials to the surface before paint application. They select the best type, colour and quality of paint to be used by their client on any job.

Plumbers are skilled craftsmen who install, repair and alter pipe systems that carry gases, water and other liquids required for sanitation, storm water, industrial production, and other uses.

They install plumbing fixtures, appliances, bathtubs, basins, sinks, showers, and grease line systems. They work from blueprints and working drawings to determine materials required for installation. They cut and thread pipe using pipe cutters, cutting torches, and pipe threading machines. Plumbers may have to work indoors or outdoors on a ladder or scaffold, underground in a trench, a crawl space under a building, or in the unfinished basement of a new building (AGCNH, 2011). Plumbers, pipelayers, pipefitters, and steamfitters install, maintain, and repair many different types of pipe systems. Plumbers install and repair the water, waste disposal, drainage, and gas systems in homes and commercial and industrial buildings. Plumbers also install plumbing fixtures—bathtubs, showers, sinks, and toilets—and appliances such as dishwashers, waste disposers, and water heaters (Occupational Outlook Handbook, 2011). In Nigeria, they are called plumbers whose works include laying of pipes for waste and water supply into the building. They fix all appliances such as water closet, wash hand basin, water heater (cold/hot), bath, shower tray, etc.

2.2 Related Studies on Informal Construction Workers/Artisans

A major concern of stakeholders in the Nigerian Construction industry is how to improve service delivery. Mitullah and Wachira (2003) also reported that the development of an efficient construction industry is an objective of policy in most countries. In recent years, the informal construction sector has grown in size and importance in many African countries (Mlinga, 1998; Ngare, 1998; Wells, 2001). While small, unregistered construction enterprises were previously involved in the building, maintenance and repair of individual residential houses, they are now increasingly involved in the construction of complex and much larger commercial buildings (Wells, 2001). At the same time, due to unpredictable workloads in the construction industry and high costs involved in keeping idle labour, formal registered enterprises are resorting to subcontracting to the informal sector (Wells, 2001). This affirmed the level of significance and relevance of informal sector to the construction industry in African continent.

Extant literature has revealed challenges of skilled labour shortage in the construction industry. A study by the Construction User Round Table (CURT, 2001) in United States showed that owner companies considered the shortage of skilled labor as the most critical problem the construction industry today is facing. Statistics published by the Bureau of Labor Statistics of United States (BLS, 2004) indicated that by 2010, there will be a need to replace 1,469,000 construction trade worker jobs. A study on infrastructure in South Africa revealed a shortage of individuals to build and maintain infrastructure in underdeveloped areas (Philips et al., 1995). A study of railways in Japan linked the reduction in maintenance of the existing lines to the problem of labor shortages (Tarumi, 1994). The skilled labour shortage is due to the fact that people are no longer interested in going to these construction trades because of the nature of the activities in the industry. Hence, there is a need to appraise the activities of the informal workers/artisans in the construction industry because this will help in providing information to the policy makers to understand

better conditions of activities of the players and the need for policy to address the challenges of informal workers/artisans in the construction industry.

Related studies on informal construction workers/artisans include researches on the occupational conditions of informal construction workers; a study by Mackenzie et al. (2000) in UK confirmed the provision of education, skill acquisition & development for informal construction workers in developed nations. But studies in developing countries by Vaid (1999) and Anand (2000) in India, Zylberstajn (1992) in Brazil showed that the education of construction workers were low and poor. Review of literature on the level of employment of construction workers show that in both the developed and developing countries, unemployment is very high to workers on temporary contracts than those on permanent contracts (Harvey, 2000; Vaid, 1999; Yuson, 2001), also those on permanent or formal contracts earn far more than their counterparts on temporary or informal contracts (Yuson, 2001; Lux & Fox, 2000; Connolly, 2001; Allen, 1994; Muteta, 1998; Vaid, 1999; Saboia, 1997; Harvey, 2000).

On social security, occupation safety and living conditions, most construction workers on temporary or informal contracts were not covered by social security benefits while very few on permanent contracts receive such (Abdul-Aziz, 2001; Muteta, 1998; Vaid, 1999) and situation on safety, health conditions, unemployment and retirement (pension) do not differ (Wall Street Journals, 2006; ICI, 2001; Harvey, 2000; ILO, 1998 & 1999; Gyi et al., 1999). Health records and rate of accidents were reported very much worse in developing countries by Abdul-Aziz (1995), Yuson (2001) and Lux & Fox (2001). Moreover, the performance of construction workers can only be improved through continuous training and skill development, studies in developing countries revealed that most construction workers received their skill through apprenticeship/traditional or informal processes and have not received any further training and certification (Lux & Fox, 2001; Abdul-Aziz, 2001; Yuson, 2001; Assad, 1993) while training and skill development had been in record in developed countries like United Kingdom (UK) (Bowen, 1996) and funding for sustainability has been the major problem.

In Nigeria, related studies on informal construction sector such as Oladapo (2006) undoubtedly confirmed the existence of informal construction sector. Fagbenle and Olawunmi (2010) and Oladapo (2001) emphasized the poor impact of informal sector on construction output. Adeyemi et al. (2006) also established that the vast majority of labourers of the informal sector in the Nigerian construction industry are female who act either as labourers or unskilled labour force. Wahab (2010) established that the stress factors attributed to artisans in the Nigerian construction industry include qualitative and quantitative workloads, tight-time frame of works and unstable working hour. Nwaka (2009) emphasized on the need for the government (formal sector) to support informal sector and not allow the sector to content with self-help and fending for themselves. Hence, Mitullah and Wachira (2003) submitted that the focus of research and technical assistance to date has largely been upon the enterprises that comprise the sector – the contractors, subcontractors and consultants.

Little attention has been paid to the labour force, about which often very little is known.

None of these studies on informal construction sector in Nigeria has examined and explored the informal workers/artisans' activities. Although, ILO (2002) had stated that statistics on informal sector are needed as a tool for evidence-based policy-making and advocacy. Therefore, in Nigeria such statistics are not available and where exist there are little research works that provide such statistics about informal sector workers/artisans in the construction industry. The paper therefore aims to fill this gap by examining the activities of informal workers/artisans in Nigeria.

3. RESEARCH METHODOLOGY

The study area was for this research was Osun state in the southwestern Nigeria. Ọṣun State is an inland state in Southwestern Nigeria. Its capital is Osogbo. It is bounded in the north by Kwara State, in the east partly by Ekiti State and partly by Ondo State, in the south by Ogun State and in the west by Oyo State (Wikipedia, 2012). The state consists of 30 Local Government Areas, the primary (third tier) unit of government in Nigeria (Wikipedia, 2012). The 30 Local Government Areas are listed below with their headquarters in parentheses including Aiyedaade (Gbongan), Aiyedire (Ile Ogbo), Atakunmosa East (Iperindo), Atakunmosa West (Osu), Boluwaduro (Otan-Ayegbaju), Boripe (Iragbiji), Ede North (Oja Timi), Ede South (Ede), Egbedore (Awo), Ejigbo (Ejigbo) and Ife Central (Ile-Ife). Others include Ife East (Oke-Ogbo), Ife North (Ipetumodu), Ife South (Ifetedo), Ifedayo (Oke-Ila Orangun), Ifelodun (Ikirun), Ila (Ila Orangun), Ilesa East (Ilesa), Ilesa West (Ereja Square), Irepodun (Ilobu), Irewole (Ikire), Isokan (Apomu), Iwo (Iwo), Obokun (Ibokun), Odo Otin (Okuku), Ola Oluwa (Bode Osi), Olorunda (Igbonna, Osogbo), Oriade (Ijebu-Jesa), Orolu (Ifon-Osun), Osogbo (Osogbo) and Ife East Area Office (Modakeke).

Osun State is divided into three federal senatorial districts including Osun Central, Osun West and Osun East. Each senatorial district is made of 10 local government areas. Osun Central has 10 LGAs including Osogbo, Olorunda, Odo-Otin, Ila, Boluwaduro, Boripe, Ifedayo, Ifelodun, Ifon Osun and Ejigbo. Osun West has 10 LGAs consist of Aiyedade, Aiyedire, Ede North, Ede South, Egbedore, Irepodun, Irewole, Isokan, Iwo and Olaoluwa. Osun East (Ife/Ijesha) comprises of Ife Central, Ife East, Ife North, Ife South, Atakumosa West, Atakumosa East, Obokun, Oriade, Ilesha East and Ilesha West. The study population for this study was obtained from the result of preliminary survey conducted on informal workers/artisans of the construction industry in the Osun State. Preliminary survey was conducted because there was no statistics or official data of informal workers/artisans in the study area. The informal workers/artisans surveyed include masons, carpenters, iron benders, painters, plumbers and electricians. The statistics on the informal workers/artisans were obtained by contacting the leaders of their various associations.

The leaders provided us with the registers of their associations, where we got the number of registered members for each trade. Due to accuracy and reliability of the registers collected, the figures obtained were harmonized and factored for the purpose of this study.

Since the state has three senatorial districts comprising Osun West, Osun East (Ife/Ijesha) and Osun Central; and each district has 10 local government areas. Two local government areas were selected from each senatorial district which gave a total of 6 local governments representing 20% of the study area. The study population obtained comprised 1190 masons/bricklayers, 2185 carpenters, 455 iron benders, 291 painters, 375 plumbers and 705 electricians from the study area. This gave a total 5201 informal construction workers/artisans. 5% of informal workers/artisans from the 6 local government areas were selected for this study given a sample of 60 masons, 109 carpenters, 23 iron benders, 15 painters, 19 plumbers and 15 electricians. This gave a sample size of 261 out of total 5201 informal workers/artisans of the construction industry in the study area. Purposive sampling technique was adopted in the selection of the sample size from the study population and administration of questionnaire to the informal workers/artisans.

Purposive sampling technique was adopted because of the demographic characteristics of the study population in terms of their level of education, skills status and accessibility. Secondly, the purposive sampling was also used so as to collect valid information from right set of workers. In other to collect an organized and closed data for this study, a list of questions was made on a well structured and closed multiple choice questionnaire which was administered on informal workers/artisans. Most of these informal workers/artisans were contacted through site visits and attending their association meetings; and the questionnaire was administered to them by the survey crew in form of interview. 3 Likert rating scale was used in rating their responses and the usual 5 Likert scale was not used because the survey crews were responsible in making sound judgement of the opinion of the informal workers/artisans based on their views on every research question raised. The questionnaire was divided into four sections. The first section identified the characteristics of the informal sector players. These include their sex, age group, marital status, no of wife and children among others. The other sections of the questionnaire addressed the specific objectives of this study. A total of 165 copies of questionnaire out those gotten back were found suitable and used for analysis. The data obtained were imported into Statistical Packages for Social Sciences (SPSS) for analysis. Since the data collected are closed ended, both descriptive and inferential statistics were employed in analyzing the data collected. These include percentage, mean score, factor analysis and analysis of variance (ANOVA) as applicable to this paper. The percentage shows the proportion of their demographic information while mean score shows the ratio of the responses among the informal workers/artisans.

Factor analysis KMO and Bartlett's Test appraised the level of adequacy of the data collected and reduces long list of activities to minima groups for easy description of data while ANOVA establishes the level of significance of the activities of the informal construction workers/artisans. The mean scores (MS) were calculated using the mathematical model below:

$$MS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{(n_5 + n_4 + n_3 + n_2 + n_1)}$$

Where n_5 = number of respondents who picked 5
n_4 = number of respondents who picked 4
n_3 = number of respondents who picked 3
n_2 = number of respondents who picked 2
n_1 = number of respondents who picked 1

4. FINDINGS AND DISCUSSION

4.1 Respondents' Demographic Information

This paper examined the activities of the informal workers/artisans in the construction industry in Osun state Nigeria. Information on the personal characteristics of the informal workers/artisans such their sex, age group and academic qualification were examined. The results obtained show that all the respondents were male. The study also revealed the age group of the informal workers/artisans in the construction industry and found that 8.5% are less than 20 years of age while 63.6%, 26.1% and 1.8% are of 21-40, 41-60 and above 60 years respectively. The highest academic qualifications of the respondents shows that 29.7% are holders of primary school certificate, 14.0% hold junior secondary certificate, 37.0%, 12.7%, 4.2%, 1.2% and 1.2% hold senior secondary certificate, NABTEB Certificate/Trade test, OND/NCE, HND and other academic qualifications respectively.

4.2 Frequency of the Activities of Informal Construction Workers/Artisans

From the review of literature, a comprehensive list of the activities of informal workers/artisans in the construction industry was made as shown in the key to Table 1. The mean score values of informal workers/artisans' responses are described in Table 1. From Table 1, 14 out of 29 representing 48% of the activities has mean score values above 1.5 (1.5-2.06) from highest mean score value of 3.00 which indicates that less than half of the activities identified are the most frequently activities carried out by the informal players. Out of 29 activities identified, from the perspective of mason, the most frequent activities carry out include remove old materials in preparation for new works; plaster, level, smooth and shape surfaces;

construct walls and partitions; break existing structures such as walls, stone; mix concrete and mortar for laying block and plastering walls. Carpenters also ranked remove old materials in preparation for new works; build formwork for concrete; erect wood works; erect partitions, studs, joints and rafters; install floor covering, ceiling, paneling and interior design; smooth, chisel, cutting and fixing frames as the most frequent activities carry out on construction works.

The highest ranked activities by iron benders are to set steel bars; erect the steel framework for commercial, residential buildings; erect bolts and rivets; install and assemble grills, canopies, stairways, iron ladders; weld fabricated structural metal members and steel roof members; smooth, chisel, cutting and fixing frames. Painters also ranked preparation of surface for paint application; mix pigments, oils and other ingredients to obtain the required color as their most frequent activities. Plumbers also ranked read and interprets drawings to determine materials required for installation; measure, bend, cut and thread pipe using pipe cutters, cutting torches; join sections together as necessary using elbows, "T' Joints or other couplings; install plumbing fixtures, appliances, bathtubs, basins, sinks and showers; check leaks by forcing liquid steam or air through it under pressure; install and repair high pressure pipe system for industrial and commercial; install, repair and alter pipe system that carries gasses, water and other liquids as the most frequent activities perform on construction works. The electricians most frequent activities include lay out, install and test electrical services and electrical wiring; install conduits and other electrical materials; connect electrical machinery, equipments and control; read and interprets drawings to determine materials required for installation; measure, bend, cut and thread pipe using pipe cutters, cutting torches.

The overall assessment of these activities shows that the most frequent activities include; remove old materials in preparation for new works (2.06), read and interprets drawings to determine materials required for installation (2.03), build formwork for concrete (1.93), erect wood works (1.90), erect partitions, studs, joints and rafters (1.85), install floor covering, ceiling, paneling and interior design (1.82), smooth, chisel, cutting and fixing frames, et al. (1.81) and construct walls, partitions e.t.c. (1.79). It was noted the most frequent activities are most are associated with woodwork applicable in formwork and mansory. The less frequent activities include connect electrical machinery, equipments and controls (1.24), install conduits and other electrical materials (1.25), lay out, install and test electrical service and electrical wiring (1.29), Mix pigments, oils and other ingredients to obtain the required color (1.35) and install and high pressure pipe system for industrial and commercial. This shows that the least frequent activities of informal workers/artisans are associated with electrical works. The ANOVA test conducted on the result (at 5% significance) shows that all the activities of informal workers identified by this study were very significant eventhough 14 out of 29 representing 48% were ranked high by the informal workers/artisans. It was observed that the most frequently carried out by an artisan could be the least carried out by other artisans.

They are all considered gamine to the construction contract execution and equally important to construction industry. Table 2 further shows the list of the most frequent activities carried out by each of the informal construction workers/artisans in the industry.

4.3 Classification of the Activities of Informal Construction Workers/Artisans

The list of the activities highlighted in the Key to Table 1 were subjected to factor analysis with each item treated as a variable with the aim of reducing them to few significant activities which will be used in the description of closely related activities and those sharing the same features or perform by the same informal workers/artisans on construction sites. The appropriateness of those activities was tested using factor extraction, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) and the Bartlett's test of sphericity. The result was presented in Table 3 and from the Table, KMO value was 0.724. Field (2005) established that the KMO value of a set of scores should be close to 1 for factor analysis to yield distinct and reliable factors and Wiki (2007) also stated that Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) should be greater than 0.5 for satisfactory factor analysis to proceed. Hence, from these propositions, it could be concluded that factors analysis is appropriate for the data collected for this study. Also, Bartlett's test of sphericity showed that the result was highly significant ($\chi^2 = 4.839E3$, $p < 0.05$). The result agreed with Field (2005) recommendation and therefore confirmed the suitability of factor analysis for this study.

Key to Table 1

S/N	ACTIVITIES
1	Remove old materials in preparation for new works
2	Read and interprets drawings to determine materials required for installation
3	Build formwork for concrete
4	Erect wood works
5	Erect partitions, studs, joints and rafters
6	Install floor covering, ceiling, paneling and interior design
7	Smooth, chisel, cutting and fixing frames, e.t.c
8	Plaster, level, smooth and shape surfaces
9	Construct walls, partitions and etc
10	Break existing structures such as walls, stone, etc
11	Mix concrete and mortar for laying block and plastering walls
12	Measure, bend, cut and thread pipe using pipe cutters, cutting torches et al.
13	Join sections together as necessary using elbows, "T' Joints or other couplings

14	Install plumbing fixtures, appliances, bathtubs, basins, sinks and showers
15	Set steel bars or steel mesh in forms
16	Install and assemble grills, canopies, stairways, iron ladders, et al
17	Erect the steel framework for commercial, residential buildings etc,
18	Erect bolts and rivets
19	Weld fabricated structural metal members and steel roof members
20	Mould blocks and bricks
21	Prepare surface and apply paint, varnish, enamel, etc
22	Check leaks by forcing liquid steam or air through it under pressure
23	Install, repair and alter pipe system that carries gasses, water and other liquids
24	Install and repair high pressure pipe system for industrial and commercial
25	Mix pigments, oils and other ingredients to obtain the required color
26	Lay out, install and test electrical service and electrical wiring
27	Install conduits and other electrical materials
28	Connect electrical machinery, equipments and control etc
29	Prepare surface for paint application

Source: (Odediran, 2012)

Table 1: Activities of Informal Sector Workers/Artisans in the Construction Industry

Key	Mason		Carpenter		Bender		Painter		Plumber		Electrician		Overall		F	Sig.
	Mean	Rk	Mean	Rk	Mean	Rk	Mean	Rk	Mean	Rk	Mean	Rk	Mean	Rk		
1	2.35	5	2.14	6	2.27	9	1.17	9	1.69	9	1.60	9	2.06	1	6.149	.000*
2	1.88	7	1.84	7	2.33	11	1.36	4	3.00	1	2.67	4	2.03	2	8.056	.000*
3	1.77	8	2.88	1	1.43	16	1.14	10	1.00	21	1.27	22	1.93	3	37.950	.000*
4	1.73	9	2.82	2	1.50	15	1.00	19	1.00	21	1.33	21	1.90	4	41.519	.000*
5	1.67	11	2.74	3	1.57	14	1.21	7	1.00	21	1.07	29	1.85	5	33.270	.000*
6	1.71	10	2.58	4	1.29	21	1.36	4	1.08	15	1.14	26	1.82	6	19.010	.000*
7	1.58	15	2.22	5	2.86	6	1.18	8	1.08	15	1.40	18	1.81	7	14.933	.000*
8	2.91	1	1.18	15	1.36	18	1.00	19	1.15	12	1.40	18	1.78	9	79.942	.000*
9	2.89	2	1.28	11	1.00	27	1.07	16	1.15	12	1.43	16	1.79	8	65.288	.000*
10	2.61	3	1.24	13	1.43	16	1.00	19	1.77	8	1.60	8	1.78	10	12.522	.000*
11	2.41	4	1.30	9	1.20	22	1.07	16	1.08	15	1.40	18	1.63	11	29.027	.000*
12	1.35	19	1.02	27	2.40	8	1.14	10	2.92	2	2.20	5	1.53	12	42.439	.000*
13	1.29	24	1.20	14	2.27	9	1.14	10	2.92	2	1.67	7	1.51	13	21.944	.000*
14	1.62	14	1.06	22	1.67	13	1.14	10	2.92	2	1.53	10	1.50	14	15.914	.000*
15	1.42	20	1.16	16	3.00	1	1.00	19	1.08	15	1.47	12	1.43	21	28.551	.000*
16	1.65	12	1.06	20	2.87	4	1.00	19	1.38	10	1.47	12	1.48	17	22.033	.000*
17	1.56	16	1.25	12	2.93	2	1.00	19	1.15	12	1.20	24	1.49	15	21.605	.000*
18	1.35	18	1.41	8	2.93	2	1.00	19	1.38	10	1.20	24	1.47	18	22.887	.000*
19	1.37	17	1.16	16	2.87	4	1.07	16	1.08	15	1.47	12	1.40	22	24.268	.000*
20	1.94	6	1.30	9	1.00	27	1.00	19	1.00	21	1.27	22	1.44	20	11.075	.000*
21	1.42	20	1.06	20	2.60	7	2.64	2	1.00	21	1.13	27	1.47	18	31.480	.000*
22	1.31	23	1.04	23	1.07	24	1.14	10	2.92	2	1.93	6	1.38	23	30.851	.000*
23	1.33	22	1.08	19	1.00	27	1.36	4	2.85	7	1.47	12	1.36	24	22.298	.000*
24	1.27	25	1.04	23	1.33	19	1.14	10	2.92	2	1.53	10	1.35	25	25.640	.000*
25	1.25	26	1.04	24	1.93	12	2.43	3	1.00	21	1.40	16	1.35	25	25.788	.000*
26	1.23	27	1.04	24	1.33	19	1.00	19	1.00	21	2.80	1	1.29	27	39.442	.000*

27	1.15	28	1.02	27	1.13	23	1.00	19	1.00	21	2.87	1	1.25	28	88.925	.000*
28	1.15	28	1.02	27	1.07	24	1.00	19	1.00	21	2.87	1	1.24	29	109.680	.000*
29	1.65	12	1.10	18	1.07	24	2.86	1	1.08	15	1.13	27	1.49	15	20.988	.000*

Source: (Odediran, 2012) *: significant at 5% level

Table 2: The Critical Activities of the Informal Workers/Artisans on Construction Sites

IDENTIFIED ACTIVITES ON CONSTRUCTION WORKS	INFORMAL WORKERS/ARTISANS	MOST FREQUENT ACTIVITES	NO
Remove old materials in preparation for new works; Read and interprets drawings to determine materials required for installation; Build formwork for concrete; Erect wood works; Erect partitions, studs, joints and rafters; Install floor covering, ceiling, paneling and interior design; Smooth, chisel, cutting and fixing frames; Plaster, level, smooth and shape surfaces; Construct walls and partitions; Break existing structures such as walls, stone; Mix concrete and mortar for laying block and plastering walls; Measure, bend, cut and thread pipe using pipe cutters, cutting torches; Join sections together as necessary using elbows, "T' Joints or other couplings; Install plumbing fixtures, appliances, bathtubs, basins, sinks and showers; Set steel bars or steel mesh in forms; Install and assemble grills, canopies, stairways, iron ladders; Erect the steel framework for commercial, residential buildings; Erect bolts and rivets; Weld fabricated structural metal members and steel roof members; Mould blocks and bricks; Prepare surface and apply paint, varnish, enamel; Check leaks by forcing liquid steam or air through it under pressure; Install, repair and alter pipe system that carries gasses, water and other liquids; Install and repair high pressure pipe system for industrial and commercial; Mix pigments, oils and other ingredients to obtain the required color; Lay out, install and test electrical service and electrical wiring; Install conduits and other electrical materials; Connect electrical machinery, equipments and control; Prepare surface for paint application, Remove old materials in preparation for new works; Read and interprets drawings to determine materials required for installation; Build formwork for concrete	MASONS	Remove old materials in preparation for new works; Plaster, level, smooth and shape surfaces; Construct walls, partitions and etc; Break existing structures such as walls, stone, etc; Mix concrete and mortar for laying block and plastering walls	5
	CARPENTERS	Remove old materials in preparation for new works; Build formwork for concrete; Erect wood works; Erect partitions, studs, joints and rafters; Install floor covering, ceiling, paneling and interior design; Smooth, chisel, cutting and fixing frames, e.t.c	
	BENDERS	Set steel bars etc; Erect the steel framework for commercial, residential buildings; Erect bolts and rivets; Install and assemble grills, canopies, stairways, iron ladders; Weld fabricated structural metal members and steel roof members; Smooth, chisel, cutting and fixing frames;	6
	PAINTERS	Prepare surface for paint application; Prepare surface and apply paint, varnish, enamel; Mix pigments, oils and other ingredients to obtain the required color	3
	PLUMBERS	Read and interprets drawings to determine materials required for installation; Measure, bend, cut and thread pipe using pipe cutters, cutting torches; Join sections together as necessary using elbows, "T' Joints or other couplings; Install plumbing fixtures, appliances, bathtubs, basins, sinks and showers; Check leaks by forcing liquid steam or air through it under pressure; Install and repair high pressure pipe system for industrial and commercial; Install, repair and alter pipe system that carries gasses, water and other liquids	7
	ELECTRICIANS	Lay out, install and test electrical service and electrical wiring; Install conduits and other electrical materials; Connect electrical machinery, equipments and control; Read and interprets drawings to determine materials required for installation; Measure, bend, cut and thread pipe using pipe cutters, cutting torches	5

Source: (Odediran, 2012)

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.724
Bartlett's Test of Sphericity	Approx. Chi-Square	4.839E3
	Df	406
	Sig.	0.000

Source: (Odediran, 2012)

Table 4 illustrates the outcome of the factor loading which classified activities into various trades sharing equal and relevant features; and/or performs by an informal construction worker/artisan. Factor analysis reduces a large number of activities to a smaller number of trades for modeling purposes. This gave seven major activities of the informal workers/artisans in the construction industry which represent various trades in the industry. Each of these activities was grouped as sub-activities under the seven trades identified from factor loadings as shown in Table 4. The trades include plumbing and associated works, mansory & blockwork, steelworks, woodworks, electrical works, painting and decoration and demolition and reconstruction. The latter is not really a trade but a preliminary works common to most of the trades in the construction industry. Table 5 shows the classification of these activities to various trades based on the outcome of the factor analysis.

From Table 4 and based on result of rotated factor matrix (factors loading), the component 1 was named *plumbing and associated work*; the activities under the component comprises of install, repair and alter pipe system that carries gasses, water and other liquids; install plumbing fixtures, appliances, bathtubs, basins, sinks and showers; measure, bend, cut and thread pipe using pipe cutters; join sections together as necessary using elbows, "T' Joints or other couplings; install and repair high pressure pipe system; and check leaks by forcing liquid steam or air through it under pressure; install and repair high pressure pipe system for industrial. Component 2 was also named *mansory and blockwork* and the activities under this trade include construct walls and partitions; plaster, level, smooth and shape surfaces; break existing structures such as walls, stone; mould blocks and bricks; mix concrete and mortar for laying block and plastering walls. Component 3 was named *steelworks* with activities including smooth, chisel, cutting and fixing frames; erect the steel framework for commercial and residential buildings; erect bolts and rivets; weld fabricated structural metal members and steel roof members; install and assemble grills, canopies, stairways, iron ladders; and set steel bars or steel mesh in forms.

Component 4 was equally named *woodwork* with the activities to include erect wood works; build formwork for concrete; erect partitions, studs, joints and rafters; and install floor covering, ceiling, paneling and interior design. The 5th Component was *electrical works* having activities such as lay out, install and test electrical services and electrical wiring; install conduits and other electrical materials and connect electrical machineries, equipments and controls. The 6th Component was *painting and decoration* activities such as prepare surface and apply paint, varnish, enamel; mix pigments, oils and other ingredients to obtain the required color and prepare surface for paint application. The 7th Component was named *demolition and reconstruction* having activities such as remove old materials in preparation for new works and read and interprets drawings to determine materials required for installation. All these activities carried out by the informal construction workers/artisans agreed with the construction trades activities as highlighted by Associated General Contractors of New Hampshire (2011) and described by Occupational Outlook Handbook (2011).

5. CONCLUSION AND RECOMMENDATION

Based on the explorative survey of informal sector players in the Nigerian construction industry, this paper presents the findings of the activities of informal construction workers/artisans in Osun State Nigeria. The overall assessment of twenty nine (29) activities by the study shows that the most frequent activities of informal workers/artisans on construction works in the Nigerian include to remove old materials in preparation for new works, read and interprets drawings to determine materials required for installation, build formwork for concrete, erect wood works, erect partitions, studs, joints and rafters, install floor covering, ceiling, paneling and interior design, smooth, chisel, cutting and fixing frames; and construct walls and partitions. While the less frequent activities on the other hand include connect electrical machinery, equipments and controls, install conduits and other electrical materials, lay out, install and test electrical services and electrical wiring, mix pigments, oils and other ingredients to obtain the required color and install and high pressure pipe system for industrial and commercial. The study also classified the activities in the construction industry into various trades including plumbing and associated works, mansory & blockwork, steelworks, woodworks, electrical works, painting and decoration and demolition and reconstruction.

From the outcome of this study, the paper recommends that stakeholders in the execution of construction works and policy makers on informal sector should take a closer examination of the activities of informal workers/artisans in the industry. This will assist in providing enabling environment for operation of informal workers/artisans and for combating the challenges inhibiting the poor performance of the construction industry in general.

Table 4: Rotated Factor Matrix (Loading) of the Activities of the Informal Players on Construction Sites

	FACTORS	COMPONENTS						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	Construct wall, partition etc		0.921					
2	Plaster, level, smooth etc		0.921					
3	Break existing structure such as walls, stone etc		0.843					
4	Mould block and bricks		0.780					
5	Mix concrete and mortar etc		0.866					
6	Remove old materials in preparation for new one							0.553
7	Erect wood work				0.897			
8	Build formwork				0.909			
9	Erect partitions, studs etc				0.840			
10	Install floor covering, ceiling etc				0.666			
11	Smooth, chisel etc			0.437				
12	Erect the steel framework for large industrial etc			0.860				
13	Erect bolts and rivets			0.835				
14	Weld fabricated structural metal member			0.699				
15	Set steel bars etc			0.676				
16	Install and assemble grills etc			0.746				
17	Prepare surface and apply paints etc						0.761	
18	Mix pigments, oil etc						0.646	
19	Prepare surface for paint application						0.866	
20	Install, repair and alter pipe system	0.859						
21	Install plumbing fixtures etc	0.776						
22	Read and interpret drawings etc							0.613
23	Measure, bend, cut and thread pipe etc	0.727						
24	Join sections together	0.821						
25	Install and repair high pressure pipe system etc	0.944						
26	Check leaks by forcing liquid steam or air etc	0.854						
27	Lay out, install and test electrical services etc					0.910		
28	Install conduit and other electrical materials					0.971		
29	Connect electrical machinery, equipment etc					0.974		

Table 5: Extracted Activities through Principal Components Analysis with the loaded items

S/N	Component factors (Trade)	Loaded Items
1	Plumbing and Associated works	Install, repair and alter pipe system that carries gasses, water and other liquids
		Install plumbing fixtures, appliances, bathtubs, basins, sinks and showers
		Measure, bend, cut and thread pipe using pipe cutters et al.
		Join sections together as necessary using elbows, "T' Joints or other couplings
		Install and repair high pressure pipe system etc
		Check leaks by forcing liquid steam or air through it under pressure
		Install and repair high pressure pipe system for industrial and comer
2	Mansory and Blockwork	Construct walls, partitions and etc
		Plaster, level, smooth and shape surfaces
		Break existing structures such as walls, stone, etc
		Mould blocks and bricks
		Mix concrete and mortar for laying block and plastering walls
3	Steelworks	Smooth, chisel, cutting and fixing frames, e.t.c
		Erect the steel framework for commercial, residential buildings etc
		Erect bolts and rivets
		Weld fabricated structural metal members and steel roof members
		Install and assemble grills, canopies, stairways, iron ladders, et al
		Set steel bars or steel mesh in forms
4	Woodwork	Erect wood works
		Build formwork for concrete
		Erect partitions, studs, joints and rafters
		Install floor covering, ceiling, paneling and interior design
5	Electrical works	Lay out, install and test electrical service and electrical wiring
		Install conduits and other electrical materials
		Connect electrical machinery, equipments and control etc
6	Painting and Decoration	Prepare surface and apply paint, varnish, enamel, etc
		Mix pigments, oils and other ingredients to obtain the required color
		Prepare surface for paint application
7	Demolition and Reconstruction	Remove old materials in preparation for new works
		Read and interprets drawings to determine materials required for installation

Source: (Odediran, 2012)

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