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Residential Building Defects In Lokoja, Nigeria: Causes, Implications, And Mitigation Strategies

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ABSTRACT
This study examines the prevalent residential building defects in Lokoja, Nigeria, and their significant implications for homeowners, occupants, and the broader construction industry in the overall housing sector. The research investigates the root causes of these defects, critically reviews relevant literature, and presents an in-depth analysis of the findings. Through a mixed-methods approach which include surveys, interviews, and on-site inspections, the study reveals that causes of residential building defects in Lokoja include poor workmanship, inferior materials, lack of maintenance, etc. It also reveals wide ranging implications to include but not limited to health risks and safety hazards, decreased property value and delays in turnover to negative impacts on street walls and facades and on urban aesthetics. Recommendations were proposed for preventing and addressing these defects, ultimately contributing to improved housing and construction practices as a means of enhancing better living conditions for the residents.
Keywords: Residential, defects, buildings, housing, Lokoja.

INTRODUCTION

The rapid urbanization and population growth in Lokoja, Nigeria, have led to an increased demand for residential housing. Lokoja town used to be a stop-over town for travelers from the northern states to the southern states of the country and vice-versa before it became a bubbling business hub when it became the Kogi state capital in 1991. Fish merchants of the North, particularly from Kebbi state and environs found business activities very profitable and turned the initial stop-over town to destination-town. Similarly, the very enterprising southerners who's initial business expression was in article trade found comfort in eateries and associated businesses. This phenomenon lead to the sudden population explosion in the now destination city, hence increased housing demand.

The supply end of the housing market was stimulated and spurred. This surge in construction activities, bearing on delivery time, quantity and very few or outright lack of competent labour as the case may be led to accompanying rise in residential building defects, which pose significant challenges to both homeowners and the construction industry. Building maintenance is gaining recognition in recent times in most developing countries due to high demand on housing and its influence on the condition of existing facilities which is also referred to as one of the ways of sustaining existing stock of infrastructural facilities (Odediran et al., 2012; Olagunju, 2012). This article aims to examine the various types of defects that commonly occur in residential buildings within Lokoja, investigating their underlying causes, potential consequences, and possible mitigation strategies.

Literature Review

Defects are aspects of a building that are not performing adequately for their intended use. They are imperfections or physical deformation that keeps a building from its esteem. The performance of buildings depends to a great extent on the quality of its design and construction decisions. This conforms to the assertion of Okuntade (2014a, 2014b) who stated that inadequacies in the performance of buildings emanate from deficiencies in design and construction which reflect on the level of maintenance during operation.

Despite the level of technological advancement in recent times, residential buildings still suffer from defects resulting from inadequate design and construction, thereby making them vulnerable to unplanned maintenance during their life cycle. Building defects can arise from a variety of factors, spanning from design and construction processes to material choices and environmental influences. It has been observed that weather as an aspect of environmental factor, also plays a big role in causing building defects. According to Usman et al (2012), the necessity of maintenance work on buildings is noted in the fact that all buildings and the materials and components therein deteriorate or suffer loss in aesthetics, strength and/or functional value with exposure to the elements of weather over time.

Another major factor responsible for these defects can be attributed to key players in the housing sector, especially from professionals ignoring quality control and maintainability during design and construction, leading to buildings requiring constant repair and maintenance. This often translates to defects in buildings and subsequently, high cost causing dissatisfaction of users. This was further reiterated by Adejimi (2005) who observed that most professionals ignore the aspect of maintenance during design, and when such design is accompanied by poor construction, we obtain poor buildings requiring constant maintenance during their life cycle.

It is important to note that building defects are often the result of a combination of factors rather than a single cause. Preventing defects requires a comprehensive approach that involves proper planning, skilled labor, quality materials, effective communication, and adherence to industry standards and regulations. It is on this note that Adejimi (2005) and Mohammed and Hassanain (2010) stated that for the design process to be enhanced, the building team members (architects, planners, engineers, contractors, facility managers and all major actors in the construction industry) need to come together and contribute towards the building maintainability at the project inception rather than leaving it for the maintenance personnel at the end of construction to battle with emergency maintenance.

Aim and Objectives

The primary aim of this research is to identify, analyze, and categorize the prevalent residential building defects in Lokoja, Nigeria. The objectives of the study are to:

- Identify the common types of residential building defects in the study area.
- Investigate the causes and contributing factors behind these defects.
- Assess the implication of defects on home owners, occupants and the general housing sector.
- Recommend strategies for mitigating and preventing residential building defects.

RESEARCH METHODS

The research design is descriptive and relies on data collection from respondents by carrying out a field survey and through the use of close-ended questionnaires. Stratified random sampling technique was adopted to reach the target population including homeowners, occupants, as well as architects/planners and contractors who are key players in the housing industry. A sample size was derived by means of a demographic formula that is used for determination of sample sizes (Otte, 2006). The formula is as follows: $\mathbf{N= P (100 - P) x Z^2/D^2}$

Where: N = required sample size

P = anticipated prevalence

D = allowable error estimate (desired precision)

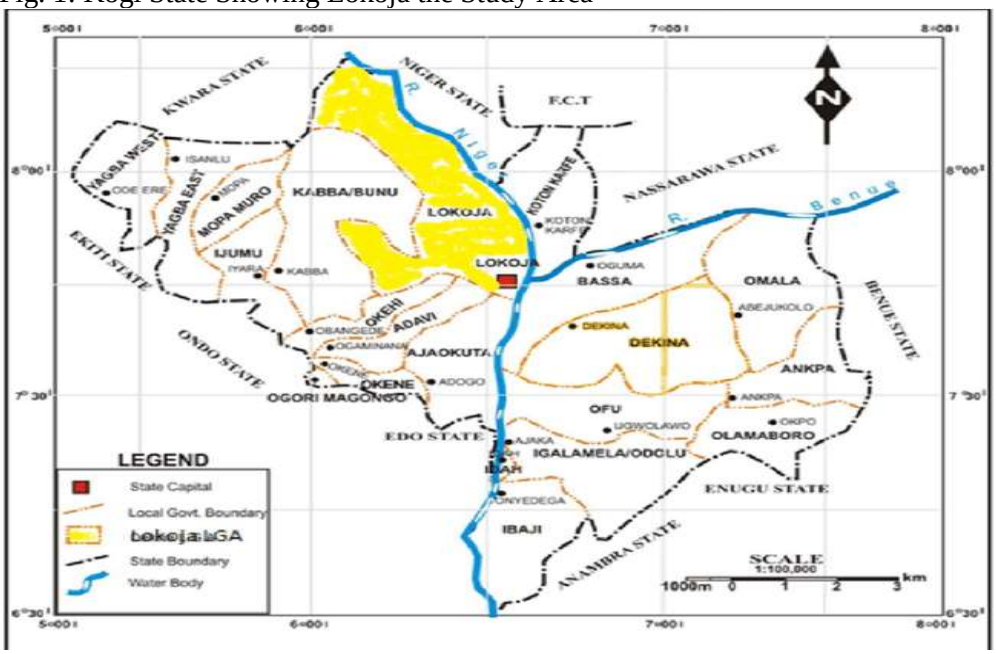
Z = appropriate value from the normal distribution for the desired confidence level.

The research anticipated a minimum response rate of 80% and an allowable error estimated of within 5% of the true prevalence: 80 (100 - 80) x ($1.96^2/5^2$) = 246. Therefore, a total of 246 respondents were taken as the sample size for the study. The sample size comprised of 85 occupants (35%), 72 resident homeowners ie owners of buildings who reside in the buildings (29%), 58 architects/planners (24%) and 31 contractors (12).

Study Area

Lokoja is the capital city of Kogi State in Nigeria which was created in 1991 from portions of eastern Kwara and western Benue states. It lies at the confluence of the Rivers Niger and Benue. Lokoja lies about 7.8023° North of the equator and 6.7333° East of the Meridian. Residential districts are of varying density, and the city has various suburbs such as Felele, Adankolo, Otokiti, Ganaja, etc. The town is situated in the Tropical Wet and Dry Savanna Climate Zone of Nigeria, and temperatures remain hot year-round. Lokoja is also a Local Government Area of Kogi State with an area of 3,180 km^2 and a population of 195,261 at the 2006 census.

Fig. 1: Kogi State Showing Lokoja the Study Area



Source: Geography and Planning Department, Kogi State University (2019).

RESULT OF FINDINGS

Based on the formula used to determine the sample size, Table 1 shows the composition of the respondents who were investigated for this study. The sample size comprised of a total of 246, which comprises of 85 occupants (35%), 72 resident homeowners ie owners of buildings who reside in the buildings (29%), 58 architects/planners (24%) and 31 contractors (12).

Table 1: Composition of Respondents

Category	Frequency	Percentage (%)
Occupants	85	35
Home owners	72	29
Architects/Planners	58	24
Contractors	31	12
Total	246	100

Source: Field Survey, 2023.

Common Types of Residential Building Defects Identified.

A survey was carried out among the respondents to identify the common types of residential building defects. The following defects were identified:

1. **Damp to External Walls**:

This is when there is a constant wetness on the outer parts of the wall. Commonly caused by the failure of the Damp Proof Course (DPC) or bridging the DPC by increasing external ground levels (usually 150mm above ground level.

2. Failed Gutters & Downpipes:

The most common failure points of rainwater goods are at the corners of guttering, joins and rainwater outlets. A blocked gutter can cause damp issues / failure of masonry and can lead to structural issues if left long enough. The most common guttering defects are blocked rainwater outlets, corroded gutters, cracked guttering and failure of rainwater goods below ground level.

3. Roof – Structural Failure:

In regards to roof structure, a whole host of defects can occur. These include woodworm, wet & dry rot, roof spread and sagging of purlins (a horizontal beam along the length of a roof, resting on principal beams and supporting the common rafters or boards.

4. Roof – Coverings Failure:

One of the most common failures of slate roof coverings are the nails holding the tiles to the batons corroding and causing the slates to move and slip out of place. When concrete or clay tiles are used, the tiles can crack and spool, leading to water ingress and structural problems due to rotting roof structures.

5. Structural Alterations:

A lot of residential defects are caused by alterations to the original structure, where proper materials or expert design have not been used. For example, if a load bearing wall is removed, a proper steel structure design must be used to ensure the load can be taken safely and without fault.

6. Condensation:

Condensation dampness usually occurs when there is a high relative humidity level, a measure of moisture content within the air. As the relative humidity increases beyond 100%, moisture droplets form as condensation on cold surfaces. Many factors could cause the relative humidity to rise including a lack of proper ventilation, the number of building occupants, drying clothes internally or cooking.

7. Condensation in Windows and Doors:

The most common issue with PVC doors and windows is condensation within the sealed double glazed unit, due to the degradation of the seals.

8. Defective Flat Roof:

Older flat roofs are generally constructed with a mineral felt or asphalt covering. These types of coverings generally have a life span of 10-20 years and therefore commonly found to be defective. Newer coverings, such as GRP (Glass Reinforced Plastic) can have a life span of 40 years plus, if maintained correctly. Ultraviolet rays can cause degradation to the outer surfaces and there can be weathering and cracking to the various layers. Other defects can include faulted flashings and ponding – meaning that the roof does not drain effectively.

9. Structural Movement:

Cracking, bowing or leaning walls and sticking doors or windows are all indicators of structural movement in a house. The main types of structural movement are subsidence, heave, settlement, thermal movement and seasonal movement.

10. Eroded Pointing:

Pointing to masonry walls used to be a lime based mix on older properties. However, on newer properties a harder cement based mix is used. Pointing generally occurs to brickwork exposed to the elements and weathered over time, or due to failed guttering.

Causes of Defects

A survey was carried out among the respondents to identify the causes of residential building defects. These were categorized as identified by the varying composition of the sample size made up of 85

occupants, 72 home owners, 58 architects/planners and 31 contractors (Table 1). The occupants and home owners identified defects based on their physical assessment and perception, while the architects/planners and the contractors identified defects based on professional experience.

A total of 14 causes were identified at varying frequencies/percentages by each category of respondents. These are listed below and displayed in Table 2.

1. **Poor Workmanship:**

Inadequate skills and lack of proper training among construction workers can lead to errors during the construction process. Substandard workmanship can result in structural weaknesses, improper installations, and other defects.

2. **Inferior Materials:**

Using low-quality or substandard building materials can lead to premature deterioration, reduced durability, and overall poor performance of the building components.

3. **Design Flaws:**

Design errors, inaccuracies, and oversights can lead to structural instability, inefficient use of space, inadequate ventilation, and other functional issues.

4. **Inadequate Supervision and Inspection:**

Lack of proper supervision and inspection during construction can result in the failure to identify and rectify errors and deviations from the approved plans, leading to defects.

5. **Environmental Factors:**

Extreme weather conditions, moisture infiltration, temperature fluctuations, and geological factors can cause degradation of building materials and compromise the building's integrity over time.

6. **Lack of Maintenance:**

Failure to conduct regular maintenance can exacerbate minor issues, leading to more significant defects. Neglected repairs can result in the deterioration of building components and systems.

7. **Poor Drainage and Water Management:**

Improper drainage systems and inadequate waterproofing can lead to water infiltration, which in turn can cause dampness, mold growth, and structural damage.

8. **Foundation Problems:**

Issues with the foundation, such as settling, shifting, or inadequate support, can result in structural instability and visible cracks in the building.

9. **Building Movement:**

Buildings are subject to various types of movement, including thermal expansion and contraction. If not accounted for in the design and construction, these movements can cause cracks and other defects.

10. **Lack of Communication and Collaboration:**

Poor communication and coordination between different parties involved in the construction process, such as architects, engineers, contractors, and subcontractors, can lead to misunderstandings and errors.

11. **Regulatory and Code Non-Compliance:**

Failure to adhere to local building codes, regulations, and standards can result in defects that compromise the safety, accessibility, and overall functionality of the building.

12. **Budget and Time Constraints:**

Pressure to complete construction within tight budgets and timelines can lead to rushed work, cutting corners, and inadequate attention to detail, resulting in defects.

13. **Inadequate Planning:**

Insufficient planning and preparation can lead to errors in logistics, scheduling, and resource allocation, ultimately causing defects during construction.

14. **Lack of Quality Control:**

Failure to implement quality control measures and inspections at different stages of construction can allow defects to go unnoticed until they become more challenging to address.

It's important to note that building defects are often the result of a combination of factors rather than a single cause. Preventing defects requires a comprehensive approach that involves proper planning,

skilled labor, quality materials, effective communication, and adherence to industry standards and regulations.

Table 2: Causes of Defects as Identified by Respondents

	Respondents by Category							
	Occupants (85)		**Home owners (72)**		**Architects/Planners (58)**		**Contractors (31)**	
Causes	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1. Poor Workmanship	67	79	59	82	53	91	29	94
2. Inferior Materials	44	52	39	54	54	93	23	74
3. Design Flaws	29	34	41	57	51	88	25	81
4. Inadequate Supervision and Inspection	31	36	50	69	47	81	27	87
5. Environmental Factors	64	75	33	46	39	67	20	65
6. Lack of Maintenance	80	94	27	38	49	84	30	97
7. Poor Drainage and Water Management	64	75	29	40	45	78	22	71
8. Foundation Problems	26	31	24	33	51	88	21	68
9. Building Movement	20	24	17	24	53	91	19	61
10. Lack of Communication and Collaboration	36	42	28	30	55	95	28	90
11. Regulatory and Code Non-Compliance	17	20	12	17	53	91	23	74
12. Budget and Time Constraints	29	34	22	31	46	79	29	94
13. Inadequate Planning	38	45	27	38	55	95	21	68
14. Lack of Quality Control	19	22	14	19	49	84	21	68

Source: Field Survey, 2023.

Implications of Building Defects

Building defects can have far-reaching implications that affect various stakeholders, from homeowners and occupants to construction professionals like architects/planners and contractors, as well as the broader housing sector. The consequences of building defects can range from safety concerns to financial burdens. These key implications of building defects are highlighted in Table 3.

Table 3: Implications of Building Defects

S/N	Implication	Resultant Effects	Cited Cases
1	Safety Hazards	Reduces the structural integrity of the building	Cracks, collapses, and other structural failures which can result in fatal injuries or even death.
2.	Health Risks	Water infiltration, poor ventilation, and mold growth	Indoor air quality problems and health issues for occupants, including respiratory problems and allergies
3	Decreased Property Value	Lower monetary values	Difficulties in selling or renting the property at desired monetary value
4	Financial Losses	Financial strain due to high cost of maintenance	High cost of repairs, renovations, or even complete reconstruction
5	Legal and Liability Issues	Expensive and time consuming	Legal actions against builders, contractors, and other parties involved in the construction process
6.	Reputation Damage	Dent on reputation and credibility	Negative reviews and reduced client trust on service delivery
7	Disruption of Daily Life	Disruption of normal routines and activities of occupants	Residents having to temporarily relocate during extensive repairs.
8.	Delays and Project Overruns	Project delays and additional costs	Additional time for assessments, planning, and execution of repairs
9.	Negative Impact on Urban Aesthetics	Reduces the visual appeal of a building and its surrounding environment.	Visible defects, such as cracks, discoloration, or uneven surfaces

Source: Field Survey, 2023.

Given the multifaceted nature of the implications of building defects, it is crucial to prioritize quality construction practices, effective quality control measures, and ongoing maintenance to minimize the risks and consequences associated with defects.

Recommendations for Mitigating Building Defects

Mitigating building defects requires a proactive approach that spans the entire lifecycle of a construction project, from design and planning to construction and maintenance. The following steps are recommended for effectively mitigating building defects:

1. **Robust Design and Planning:**

Experienced architects and engineers should be engaged to create well-thought-out and comprehensive building designs that consider all functional requirements, environmental factors, and local regulations. Implement thorough site investigations and geological assessments to inform foundation design and site-specific considerations.

2. **Quality Materials Selection:**

High-quality building materials that meet relevant standards and have a track record of durability and performance should be selected for building projects. This onus lies mainly on contractors to collaborate with suppliers to ensure that materials are sourced from reputable manufacturers. It is important to note

that as a matter of best practices some manufacturers, common with products like tiles, paints etc categorize their products into low-grade, mid-grade and high-grade, meeting the desires of targeted economic groups.

The application of floor tiles are pivotal in this consideration where tiles are purposely manufactured based on the nature of expected volume of traffic. Such areas are classified into low, mid and high traffic areas in design and construction of buildings. Such materials are not sub-standard but graded materials.

Dulux Paint, for instance categorizes its products into DULUX being the premium brand for the high income while CAPLUX and SANDTEX are the standard brands for use by the mid and low income groups.

3. Skilled Workforce and Training:

Employ skilled and qualified construction workers who have the necessary training and expertise in their respective fields. Key stakeholders can also provide ongoing training and skill development opportunities to improve workmanship and keep up with contemporary housing best practices.

4. Strict Quality Control and Predictive Supervision:

Relevant agencies and bodies should implement stringent quality control procedures at every stage of the construction process to identify and address defects promptly. It will be of great importance to ensure regular site inspections and supervision by qualified professionals to monitor progress and plan the processes and procedures for the next stage of work to ensure adequate and appropriate use specified materials and adherence to other specifications.

5. Compliance with Regulations:

Contractors, architects and planners should adhere to local building codes, regulations, and standards to prevent non-compliance issues that could lead to defects. This can be achieved by engaging with regulatory authorities to ensure that all necessary permits and approvals are obtained.

6. Effective Communication and Collaboration:

A clear communication and collaboration among all stakeholders, including architects, engineers, contractors, subcontractors, and regulatory authorities is highly necessary. This will help to regularly update all parties involved on project progress, changes, and potential issues.

7. Pre-Construction and On-Site Testing:

key players in building process should conduct thorough testing of materials before construction to ensure they meet quality standards and specifications. These can include on-site tests during construction, such as soil testing and concrete strength testing, to validate the quality of the work.

8. **Proper Waterproofing and Drainage:**

Implement effective waterproofing and drainage systems to prevent water infiltration and dampness issues that can lead to defects.

9. Regular Maintenance and Inspections:

Establish a routine maintenance schedule for the building and its components to address minor issues before they escalate. Regular inspections are necessary to identify and address any emerging defects.

10. Post-Construction Performance Assessment:

Periodically assess the performance of the building and its systems after construction to identify any latent defects. This will go a long way to address any issues promptly to prevent further deterioration.

10. **Warranty and Guarantee Programs:**

Relevant professionals should offer warranty and guarantee programs to homeowners to ensure that any defects arising after construction will be rectified by the builder or contractor.

12. Learning from Past Projects:

Conduct post-mortem analyses of completed projects to identify lessons learned and areas for improvement in future projects.

13. Technology Adoption:

Leverage technology such as Building Information Modeling (BIM) to enhance design accuracy and project management, reducing the likelihood of defects.

Mitigating building defects requires a comprehensive and systematic approach that involves collaboration, communication, and a commitment to delivering high-quality construction projects that meet safety, functionality, and durability requirements.

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