



<sup>1</sup>Yazeed Rabi'u ABUBAKAR, <sup>2</sup>Abdelnaser OMRAN, <sup>3</sup>Abdul Aziz HUSSIN

## INVESTIGATING THE CAUSES OF EARLY BUILDING DEFECTS IN FATARA HOUSING ESTATE IN NIGERIA

<sup>1</sup>Local Government Service Commission Duste Jigawa State, NIGERIA

<sup>2</sup>School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Sintok, Kedah State, MALAYSIA

<sup>3</sup>The Office of Abdul Hakim Abdul Rahman & Co, Advocates & Solicitors, Batu Uban, Pulau Pinang, MALAYSIA

**Abstract:** This study investigates the occurrence of early building defects in public housing estate Jigawa State, Nigeria. An early building defect is considered as those originate from poor workmanship or deficient materials used in the construction project, defects occur due to the fact that improper skills and care are assigned on the building. Defects can be caused by the wrong selection or specification of materials by the designers. Questionnaire method was selected to perform the study to meet the aim and to answer the research questions. As results, the respondents' feedback, the results indicate that defects such as crack caused by settlement (RII = 0.785), "dampness" (RII = 0.725), and "cracks" (RII = 0.710) as the common types of building defects observed in construction projects in that state. It can be concluded that proper communication is a necessary tool in building construction industry to provide communication between supervisors and construction labors, proper communication and teamwork are also necessary between contractors and subcontractors. Also, strict supervision is highly required for solving the problem of causes of early building defects in Jigawa State.

**Keywords:** Causes, Defects, Early building, Jigawa State, Nigeria

### INTRODUCTION

Housing refers to buildings or other shelters in which people live. To most nations, housing is a critical component in their social and economic landscapes. It serves as a fundamental foreground of human needs. Being a unit of the environment, it has deep influence on the many things, such as health, efficiency, social behavior, and so on (Onibokun, 1998). A lot of us would see housing to mean shelter but to others it is the best hallmark for a person's standard of living and his or her status and position in the society (Nubi, 2008). Attaining a good living standard is a priority and thus, is important to the rural and urban people. Housing could be provided by the government, as well as through private developers.

Public housing is a form of housing provision, at the same time stressing the role of the government and its agencies in helping to fulfill housing requirements, especially for the disadvantaged groups in the society. The public housing or other descriptive terms, which are often used in its place such as social housing, state housing, state-sponsored housing, and so on (Van Vilet,

1990) had been one of the most prominent housing challenges worldwide and the forms are varied in different geographical contexts. Many countries have had to deal with the issue of adequate housing that has to be delivered to the various economic groups. Thus, in most of nations, housing was claimed as a problem. Despite the fact that many countries have a variety of materials allocated to urban-based residents, housing in developing countries like Nigeria is generally low in quality and less spacious than housing in developed countries, and government efforts to upgrade housing conditions have been showing slow progress.

Nigerian governments including states and local council have been providing public residential quarters since independence (Wazri & Roosli, 2013). These houses are often subject to early collapse which is linked with building or structural defects. Building defect suggests that there is an element constructed that has somehow violated the contract, or the result of some actions not authorized by the contract (Nigel, 1996). Summerlin and Ogborn (2006) opined that Building defects can result from manufacturing flaw, architects' erroneous designs,



and wrong installation of materials or a few others. When the standard materials specified in the contract is deficient and quality of workmanship inadequate, the building works are put at stake. Alan (1990) described building defects in building works as premature failure stemming from errors of workmanship, design, to name a few. In a legal context, a building defect is a violation of the applicable building code, the standard of care in the community in which the project is located, or that of the manufacturer's recommendations. Various studies have demonstrated that building defects are caused by activities associated with the construction processes. As it can be seen in the case in Fatara housing estate in Jigawa state, building defects are more pronounced in public housing.

Therefore, the agitating research question lies in the causes behind buildings' early defects? A study conducted by Assaf et al. (1996) stated that some major causes in early building defects are generated from civil design, architectural design, among others. However, in another way, Thomas et al. (1995) elaborated that contractors and designers are collectively responsible for causing early building defects occurred by wrong specification's, which are totally interpreted as faults of Architectural designers for not followed the specification which is the contractors' responsibility. Watt (1999) suggested that unsuitable materials applied to the building and poor expert decisions are causes of early defects. There are two dimensions for the term 'defect', a common term for a physical defect and for a process defect. It would be regarded as a physical defect when project documentation, a building material, a structure or a part of a structure lacks the expected abilities according to the construction contract, public requirements or good building practice. It is considered a process defect when the construction process is carried out in a way that represents a significant loss in resources or time. Jigawa state is one of the Nigeria's states that are very much provided with public housing for its various social groups. The focus of this study is to look into the immediate and remote causes of early building defects in Fatara Housing Estate, Jigawa State. This estate is less than two years' old since the commission but what is striking is that it already demonstrates a substantial degree of noticeable early obsolescence within and across the built structures.

In this context, the study was focused intensively on causes of early building defects, in Fatara housing estates in Jigawa State Nigeria. It was an attempted to find the answers to *why* this problem happens and how to avoid early defects in buildings. Building defect is one of the major components of building that requires serious attention, because when a building fails to perform as it should, there must be an immediate action to be taken towards this problem. The study is also

attempted to find an answer to whether be possible for identifying someone to be the person responsible for the problem? Is the problem an act of nature? Was the proper maintenance of the building not performed as it should have been? Watt (1999) proposed on his study improper equipment used during the building construction and also bad making decisions by experts are the two causes for defects in building. Abdul Razak et al. (2010) had quoted from Pratt (2000) when he states the quality of Malaysia construction project is still below par. By contrast, through a survey of the 27 building projects which had been done by Andrew (1999), the "quality decline" would be caused by the "lack of skill", "lack of knowledge" of the site operative, "careless", "hard to build" and "unclear project information". To add, in a research that has been done in Singapore, "the most common defects found were pointing, hollowness in tiles, rough finishing, chip offs, evenness problem, cracks, stains, gap, and alignment out" during the construction phase and these defects are mainly due to the deteriorating quality of workmanship (Kiong and Pheng, 2005). Hence, it is necessary to identify the source of the problems and then find out some alternative for solution.

#### **LITERATURE REVIEW**

In building construction projects delivery, construction defects cannot be avoided and they are usually contentious between the parties which are directly involved. The qualities of a project which are unacceptable can be identified and remedied are the construction defects stage (Malleon, 2003). The construction industry still hails as one of the most dangerous industries due to the number of accidents reported every year (Jaselskis & Suazo, 1994). Studies by Lingard & Rowlinson (1994) and Spillane et al. (2011) reported that the construction industry in most developing and developed countries have been reviewed to be performing very poorly in the area of safety according to the international standards. Omran et al. (2010) added that the construction industry is globally characterized as one with a poor safety culture. Narrowing the scope of this study, a very serious safety problem facing Nigeria is the problem of building defects which occurs in respect of bad quality and poor workmanship. Defects in construction project can also encompass the incompliance or lack of conformity with the contract agreement.

The problem of defective construction as seen in the construction sector is tackled by the introduction of "Quality Assurance (QA) techniques" as has been initiated by other industries, however, the technique is still being improved to make sure that it is more adaptable for the construction companies. A study by Wai-Kiong & Sui Pheng (2005) claimed that the absence of incentive is the key factor that affects workmanship





quality. Defects in buildings can therefore arise from either one, or a combination of the occurrences in the following situations; faulty designs by the Architect, manufacturing flaws, material defects and many others. General forms of defects can be the defects in structure contributing to cracks or collapse, defects or faults in installations, inadequacy of drains, insufficient ventilation provision, and so on. In addition, defects in building may also be resulting from fungus, termite, or vermin infection to name but a few. Damages resulting from earth settlement or land movement can also destruct the building. The certainty over the defects in building can only be validated by experts, who will be able to tell the crux of the problem, based on their training and experience.

### **EARLY BUILDING DEFECTS**

Early building defects can be elaborated as faulty electrical wiring or defective and /or lighting; structural defects further causing cracks or collapse; inadequate or faulty ventilation; heating; and various others (Kenneth, 2002). Early building defects can contribute to serious or fatal injuries. Early on, most defects can be discovered through detectable symptoms. If not rectified the soonest possible, minor defects can become more serious, leading to even more grievous failure or sudden collapse, endangering lives and becoming more expensive to fix.

Even worse, these effects sometimes extend to the loss of human life, and loss of materials and capital investments, not to mention long-term psychological pains (Arayela and Adam, 2001). Buildings can start to collapse from the time they are complete, and ready for use and to that time when maintenance is needed. This gradual deterioration cannot be prevented, but the speed of deterioration can be slowed down judging from the way buildings are maintained (Olagunju, 2011). Thus, the rate of building deterioration depends largely on the nature and manner of maintenance. Poor building maintenance can contribute to the fragility of the building structure; most especially when unplanned maintenance is expected out of the building owner/user.

### **DEFECTS RELATED TO THE CONTRACTOR**

In many occasions, contractors' failure to build according to plans and specifications or poor mixing and placement of concrete can largely contribute to structural defects. These actions often boil down to contractors' inexperience, lack of care or high profit pursuits. On the other hand, poor inspection of construction materials and mix ratio by the engineers may also spark the ill-intention of the contractors to undermine the importance of doing their job to prevent structural defects from occurring. Salty sand used to make concrete, substitute inferior steel for the original specified are some precursors to defects in buildings. Contractors and designers are the parties responsible

for defects derived from poor specifications, which are generally the fault of designers but failures to comply with specifications can be placed on the contractors; there are the implied warranties on design and construction works that can protect the building owners from possible early building defects (Thomas et al., 1995). Khalid et al. (2006) agreed with the fact that the role of subcontractor can attribute to construction project deficiency of poor workmanship and a lot of people have overlooked this factor. Indeed, the role of the subcontractor is very important in the construction project, some serious issues in the co-ordination of work and attainment of quality standards (quoted from Shui On, 1991; Fan, 1994).

Since there are various types of subcontractors involved in the same construction project, the main contractor may have to deal with the difficulty in inspecting, supervising and controlling the works that have been done by the subcontractors. These primary causes may operate independently or in combination, and result in defects indicated by changes in the composition of materials. With regards to the care and conservation of historic buildings in Malaysia, Ahmad (2004) pointed out that understanding the nature of the building materials and accurate diagnosis of defects are very important. He associates historic buildings with older people, where both are vulnerable to various diseases. Therefore, in order to tackle this problem, conservators, architects, and others directly involved in building conservation should first adapt themselves to the building materials before penetrating into the proper techniques.

### **FACTORS CONTRIBUTED CAUSES OF EARLY BUILDING DEFECTS**

A study by Abdul Rahman et al. (1996), had been mentioned some factors that contributed causes of early building defects. These factors are:

- (i) Poor Project Management;
- (ii) Complicated role of Subcontractor;
- (iii) Lack of Experience and Competency of labors;
- (iv) Language barrier to Communication and lack of Communication;
- (v) Unsuitable Construction Equipment's;
- (vi) Poor weather Condition;
- (vii) Limited time; (viii) Limited cost; and
- (ix) Poor Quality of Materials and Construction methods.

Dai et al. (2009) mentioned that ineptitude management is generally known as a major factor of poor construction productivity (Sanvido, 1988). It is further mentioned that the management factors may be explained by the lack of supervision on site. In fact, poor supervision on site can contribute to the poor site workmanship and it can be seen in many occasions on-site (Kasun and Janaka, 2006). Moreover, the ability of management on the construction site is the primary





cause that affects labors' daily productivity (Dai et al., 2009). Jha and Chockalingam (2009) stated that the quality of project manager is one of the causes that affect project quality (has quoted from Anderson, 1992). Concerning the complicated role of subcontractor, Khalid et al. (2006) stated that the role of subcontractor is one of the factors that contribute to construction deficiency (poor workmanship) and many people do not seem to be aware of this.

The role of the subcontractor is essential in construction work. This is because most of the site work is completed by subcontractors and the main contractors have full reliance on the subcontractors (Khalid et al., 2006). They further stated that roughly 90% of the site work is executed by various subcontractors whereas the main contractor stresses on management and coordination. Besides, Chan et al. (2006) had also mentioned that labor sub-contracting also creates severe problems in the coordination of work and attainment of quality standards (Shui On, 1991; Fan, 1994). Since there are various types of subcontractors involved, the inspection, supervision and controlling of the works that have been done by the subcontractors can become a major stumbling block. Therefore, the complicated role of subcontractors in construction projects can lead to poor workmanship.

#### **❑ Lack Experience and Competency of Labors**

As mentioned by Kasun and Janaka (2006), productivity cannot be achieved by speed and harder work only without adopting better work practices (Banik, 1999). Besides, industry stakeholders have agreed that insufficient skilled manpower is the most important matter that they are concerned about (Jorge et al., 2005). In Turkey, Kazaz and Birgonul (2005), stated that some construction companies usually favor employing short-term unskilled labors and consequently have problems which relate to the quality of work produced. Hence, the lack of experience and competency of labors must be accounted for, as a contributing factor to poor workmanship.

#### **❑ Language Barrier to Communication and Lack of Communication**

The language barrier between the foreign labors and local supervisors does contribute to the communication failure at the site. This is supported by Augusto et al. (2009) as they stated that the most general trouble faced by American site supervisors when communicating with the foreign subordinates is the language.

To add, from the work of Kasun and Janaka (2006), more than 40% of the respondents from the construction site had qualms about the lack of communication. Not understanding what the other one is saying can lead to some misunderstanding by the labors regarding their work and tasks, and this can easily lead to bad workmanship.

#### **❑ Unsuitable Construction Equipment's**

The equipment used in the construction can also influence the workmanship quality in construction. Faisal et al. (2006) cited from Adrian (1983) and Al-Hazmi (1987) stated that the lack of the most recent information about equipment can influence the project quality. In a research done by Kazaz and Birgonul (2005) shed light on the poor quality of the housing projects for the public in Turkey. They confirmed that the dismal condition is mostly due to the low cost construction techniques which have been totally overlooked. Poor weather condition is another factors contribute to early defects. Dai et al. (2009) had pointed out that extreme climate condition can also affect labor productivity and workmanship in construction sites. Also, Faisal et al. (2006) who based on their study on the sites in Saudi Arabia, the Saudi's climate that is hot and severe during summer is the reason for the troubling construction work such as concreting. Insufficient time indicates that the project executed has to be rushed. According to Andrew (1999), a number of "show houses" on the site, which are very crucial for many construction projects, tend to be the products of hurried work. Due to such speed, the senior managers had to perform checking, which is inadequate.

#### **❑ Limited Cost**

An inadequate allocation of cost in construction projects would easily determine the 'fate' of the project- the project will have to deal with insufficient cost. As labor cost is a fraction of the construction cost, Proverbs et al. (1999) point out that labor has been the most difficult component to price. Obviously, labor cost estimation has always been volatile (Proverbs et al., 1999). In addition, contractors who have not prepared enough budgets for the project will cause the labor cost to be reduced.

Consequently, the labor supplied to complete a project is not sufficient and there will be construction defects. According to Watt (1999), unsuitable materials applied to the building and poor expert decision making can also justify why a building would be defected. Nonetheless, Anand et al. (2003), propose in their study that better design could rectify some future issues in workmanship. BRE (1991) and Richardson (1990) had highlighted the importance of weather, environmental condition, soil impart, among other things. Calder (1997) has discovered that poorly worded specifications and unclear designs are also causes for building defects. Meanwhile, Seeley's (1987) study also mentioned that more than 50% of the defects were caused by faulty design, while a survey conducted by Ransom (1981) names poor design decision and poor material and workmanship. Josephson and Hammarlund (1999) further showed the chain effects of building defects, and they stressed on the importance of process control, management, knowledge, and the termination of the





chain reactions that would lead to early causes of building defects.

Inadequate information, unawareness, incorrect assumption, and lack of knowledge, also several organization and motivational factors also contribute to early defects, as stated by Sunyoto and Minato (2003). However, Ilozor et al. (2004) demonstrate that some defects tend to be the precursor to several other defects, and preventing them would be a wise move.

#### **❏ Poor Quality of Materials & Construction**

##### **Methods**

The use of inferior material is also the contributor to building defect cases in Nigeria (Oyewande, 1992). Likewise, most block industries in this country tend to fail to use required measures and they need to be aware of this. Mohammed (2004) had asserted that the ideal measure is to blend a certain quantity of cement by weight with an appropriate quantity of sand, but most block molding industries in Nigeria prefer to go by volume. Such is the attitude of contractors, whose habit is to use materials that do not adhere to the standard requirements.

#### **STEPS IN MINIMIZING AND PREVENTING OF EARLY BUILDING DEFECTS**

There were six possible measures adopted to mitigate and prevent early building defects:

- (i) strict supervision;
- (ii) training and education;
- (iii) proper communication among parties involved;
- (iv) proper construction management;
- (v) proper manpower management; and
- (vi) proper design.

Concerning the strict supervision, Ghaffar et al. (2010), cited from Howell and Ballard (1998) had noted that quality enhancement by strict supervision at the site is one of the common features in the construction sector's recent practices. Daily supervision should be done by the contractors or subcontractors so issues regarding workmanship can be identified and the remedy work can be executed instantaneously. As supervision is performed, contractor supervisory staff must possess the necessary criteria to administer the construction work and monitor the craft worker efficiently (Maloney, 2002). With regard to training and education, Chan et al. (2006) stated that many researchers opined that appropriate training and enlarging experience are vital for quality project transfer. Similarly, Osama and Khan (2010) stated that labor productivity is becoming important in construction because of its impact on project completion. Proper Communication among Parties Involved was one of possible measures adopted to mitigate as it is an essential in construction. As found out by Augusto et al. (2009), 80% of the Hispanic workers in the U.S. construction sector claimed that the communication with the supervisors needs to be

improved. Therefore, supervisors in America have suggested that the training in communication skills is carried out soon, to eradicate the language barrier formed among themselves and the foreign labors. Ling et al. (2007) stated that effective communication can help expedite the project completion (Walker and Walker, 1998). As Tai et al. (2009) mentioned that no communication means no management. Other than that, proper communication and teamwork are also vital to be developed between the contractors and subcontractors. With this ongoing communication among parties involved, working relationship among the construction parties can be better. Xiao and Proverbs (2002) have found that better quality performance of Japanese construction projects can be attained subsequent to the good working relationship between the contractors and subcontractors. Therefore, proper communication is very important to improve the relationship among members in the construction team, and consequently the workmanship quality in the domain of construction. Another possible measure to be adopted in mitigating early building defects is by providing a proper Construction Management.

A study by Olson (1982) stated that the capability of construction managers to organize the work would affect the constructions labor productivity. Therefore, it can be said that proper construction management is set to improve the workmanship quality in construction. Another measure can be through proper Manpower Management, a study by Robby et al. (2001) suggested that manpower management with regards to the amount and quality of skill workers is an important determinant of contractor performance, and this is one of the leading concerns of the employers. A construction project with proper manpower will produce a high quality project. Besides, Abdulaziz (2010) had mentioned that manpower is the sole productive resource; thus the total reliance of construction productivity to human Endeavour and performance is undisputable.

Therefore, the management of manpower in construction projects should be skillfully arranged. The last measures to be considered is the proper design, Wai Kiong and Sui Pheng (2005) found that better design is the solution to workmanship defects and a good way to avoid defects. Inadequately worded specifications and the continuously-changing designs are common causes for low construction quality (Calder, 1997). Wai Kiong et al. (2006) as quoted from Anand's et al. (2003) also stated that a better design may have the capability to correct some defects in masonry work. In addition, Robby et al. (2001) further stated that well-prepared designs and drawings can make future projects easier and the defects in particular, can be better identified and rectified.





**RESEARCH METHOD**

Questionnaire method was selected to perform the research to meet the objectives and to answer the research questions. The questionnaire was adopted from previous published studies, after they were modified to tailor for the study context. It had four sections; section one deals with the demographic profile of the respondents. Section two concerns with the common types of building defects, while section three was to identify the immediate causes of early building defects, and section four suggest some strategies that will help monitor the building defects in the early stage and foresee the defects.

The questionnaire for the study was measured based on a 5 point Likert scale, which is from 'strongly disagree' to 'strongly agree'. However, for the last part of the questionnaire, open-ended questions are included to elicit further details from respondents. The distribution of the survey instrument began on 6<sup>th</sup> February 2014 to Jigawa, Nigeria and the survey was completed on 10<sup>th</sup> March 2014. The data were collected through the self-administered questionnaires. Thus, the perceptions of the respondents toward the causes of early building defects in Fatara housing estate in Jigawa, Nigeria were obtained using the survey method. A total of 80 questionnaires were administered to the respondents. However, only 50 questionnaires were subsequently completed and retrieved for analysis, yielding 62.5% response rate. Various analyses techniques were run to authenticate the psychometric properties of the instruments used in this study.

The data collected were analyzed using the statistical package for social science (SPSS) version 20.0 for MS Window. First of all, the demographic profile of firm and respondent were analyzed using the frequency statistics. The Relative Importance Index (RII) is used for the following sections to describe in detail the statistical analysis performed in this study. Data obtained was screened prior to the frequency statistics.

**RESULTS ANALYSIS AND DISCUSSION**

**☐ Respondents Background**

The data shows that male 45 (90%) while female are only 5 (10%). This proved that the population of male in professional in the study area is higher than that of female. Table (1) indicated 31-40 years are 27 (54.0%), then 41-50 years are 15 (30%), while 21-30 and 50 years above are equally the same 4 each (8%). The respondents' professional which indicated in Table (1) shows that Architect was the highest of 14 (28%), followed by Quantity surveyor and Engineer (24%). The data also shows that most workers had experience from 6-10 years 16 has (32%), 11-15 years 12 (24%), more than 20 years 10 (20%) and 6 each (12.0%) for 1-5 and 16-20 years. In term of qualification, Table (1) illustrated that the respondents who had BSc/HND 21

gets (42%), then 14 (28%), from MSc while PGD 9 has (18%) and ND 6 (12%).

Table 1. Frequency Distribution of Type of Professional

Items	Frequency	Percent
<b>Age Group</b>		
21-30 years	4	8%
31-40 years	27	54%
41-50 years	15	30%
50 years and above	4	8%
<b>Type of professional</b>		
Project manager	6	12%
Architect	14	28%
Engineer	12	24%
Quantity surveyor	12	24%
Builder	3	6%
Others	3	6%
<b>Level of Education</b>		
MSc	14	28%
PGD	9	18%
BSc/HND	21	42%
ND	6	12%
<b>Respondents' background in respect of organization</b>		
Building in residential & Non-residential Construction	28	(56%)
Infrastructure in civil engineering Construction	15	(30%)
Mechanical & Electrical	5	(10%)
Others	2	(4%)

**☐ Analysis the common types of Building defects in construction projects**

As shown in Table (2), ten common types of building defects in the construction projects that identified. However, based on the respondents' feedback, the results of the Relative Important Index (RII) analysis indicates that Crack caused by Settlement was the first ranked types of defects with (RII = 0.785), followed by "dampness" with (RII = 0.725), then the third one was "cracks" with (RII = 0.710).

Table 2. The Common types of Building defects in construction

Factors	RII	Ranking
Crack caused by settlement	0.785	1
Dampness	0.725	2
Cracks	0.710	3
Peeling Paint	0.685	4
Shrinkage cracks	0.675	5
Durability of Cracks	0.645	6
Insect or Termite Infestation	0.615	7
Salt Attack	0.600	8
Cracks caused by structural distress	0.595	9
Wooden Defect	0.590	10

**☐ Factors causes of early building defects in construction projects**

In order to determine or identify the causes early building defects there are twenty-one different kind causes have been identified and the RII results of the





respondents' feedback shown as the first among other listed items "Unsuitable construction equipment's (RII = 0.680), then the second was ranked "Lack experience and competency of labors" (RII = 0.655) and "Poor quality of materials" was ranked third (RII = 0.650), as per shown in Table (3).

Table 3. Immediate causes of early Building defects in construction projects

Factors	RII	Ranking
Unsuitable construction equipment's	0.680	1
Lack experience and competency of labor's	0.655	2
Poor quality of materials	0.650	3
Bad civil design	0.645	4
Poor project management	0.635	5
Improper construction method	0.625	6
Defects due to Specification	0.625	7
Bad Architectural design	0.620	8
In adequate project manager's work	0.615	9
Design issues on Maintenance Practicality and adequacy	0.610	10
Defects due to Consultant firm administration	0.600	11
In effective planning scheduling of projects	0.590	12
Complicated role of subcontractor	0.580	13
Poor weather condition	0.560	14
Conflicts between project manager and other parties	0.555	15
Limited cost	0.545	16
Frequent change of sub-contractors	0.540	17
Defects due to Construction drawing	0.525	18
Delay in sub-contractor work	0.515	19
Limited time	0.505	20
Language barrier to communication and lack of communication	0.505	21

Table 4. Strategies that can help in minimizing the defects

Factors	RII	Ranking
Good quality materials on site	0.745	1
Standard sub-contractor	0.740	2
Proper project planning and scheduling	0.725	3
Good project manager and experience	0.722	4
Proper design	0.690	5
Proper manpower management	0.675	6
Proper construction management	0.660	7
Make accurate initial cost estimate	0.650	8
Proper communication among parties involved	0.640	9
Proper equipment on site	0.635	10
Strict supervision	0.630	11
Training and education	0.625	12
Make frequent progress meeting	0.620	13
Proper emphasis on past experiences	0.595	14

### Strategies for minimizing the defects in the early stage before it happens

In this section, fifteen factors were identified in relation with investigating the causes of early building defects but these fifteen item is the proposed strategy ways that can help to monitoring the defects in the early stage before it happens.

Table (4) presents the RII results of such factors ranking "Good quality materials on site" as the first factor with (RII = 0.745), followed by "Standard sub-contractor" second with (RII = 0.740), the third one "Proper project planning and scheduling" (RII = 0.725).

### CONCLUSION AND RECOMMENDATIONS

This study investigated the occurrence of early building defects in public housing estate Jigawa State, Nigeria. There are three objectives of this research which has been achieved as follows. The first research objective was to identify the common type building defects. This objective was successfully investigated and achieved, where a total of ten common types of building defects were identified. With regard to the second objective, it was to identify immediate the causes of early Building defects in Fatara housing estate in the mentioned state in which identified twenty-one causes of early building defects.

The last objective was to recommend some strategies that can be used to minimize the early building defects in Fatara housing estate, Jigawa State so that to achieving improve performance on cost, time, quality, productivity and safety. Therefore, it needs a special attention in term of management because of the importance that it brings to construction industry in Implication of this study is that project managers and other stakeholders should take focus on these factors at the early stage of project proposal and planning; and when project have been awarded, all the construction teams must ensure strict compliance to the strategies put in place to manage the contributing success factors. Some general problems and common types of defects occurred in building cracking, spalling, and salt, peeling paint, insect or termite attack, erosion of mortar joints, wood defects and dampness. It is vital to recognize and diagnose the defect that occurs at various locations with deferent types of causes and symptoms.

Some factors were identified to be the immediate causes of early building defects such as workmanship quality and proper measure for minimizing and preventing were identified. These factors are poor management, complicated role of sub-contractor, lack of experience and competency of labors, language barrier to communication and lack of communication, unsuitable construction equipment, poor weather condition, limited time and cost.





From the above, it was concluded that:

- » Proper communication is a necessary tool in building construction industry to provide communication between supervisors and construction labors, proper communication and teamwork are also necessary between contractors and subcontractors.
- » Limited cost or fund for the public building projects was the major factor that causes of early building defects in Jigawa.
- » All these factors identified are fairly important to be the only problem facing poor workmanship in Jigawa.
- » Identified solutions to the problems are important based on the study with points and these are strict supervision, training and education, proper communication among parties involved, construction management and manpower management and quality with strong and positive correlation.
- » Out of these solutions, strict supervision is highly required for solving the problem of causes of early building defects in Jigawa.

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