

## Study on Causes, Effects and Remedial Measures of Building Defects in Case of Public Building Project in Nekemte Town, Ethiopia.

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**ABSTRACT:** Ethiopia was one of the developing countries and many projects are being implemented. Currently, building defects are very common and often arising or spot in the building project, especially in the project which has poor management or supervision in the construction site. This study was conducted to identify types, causes and effects of building defect problems in Nekemte Town. The research design was adopted both quantitative and qualitative framework and case study was used and The study also finds the Types, Cause, Effect and Remedial measure of Building defects in case of Public Building Project in Nekemte Town, In general, the study concludes based on findings in line with each specific objective to improve quality achievement levels in public building project in Nekemte Town. Finally based on the findings the researcher recommends that special attention need to be given to improve building defects in the Nekemte public building project Based on the findings of this study. In addition, the whole construction management process should be improved then cooperation between stakeholders, strict supervision of building projects must be provided and inspection of works executed should be practiced.

**KEYWORDS:** - Defect, construction, Building defect, public building, construction industry

Date of Submission: 02-12-2020

Date of acceptance: 17-12-2020

### I. INTRODUCTION

Ethiopia was currently in the intermediary phase of development and industrialization whereby many construction projects are being developed. There are many projects that have been constructed such as commercial buildings, residential buildings, public buildings and industrial buildings. The project of public buildings includes educational buildings, hospital buildings and government buildings (Ahmad, A.G., 2004). The purpose of conduct this study was to investigate the common public building defects in the construction project. Once the defects study, it is also necessary focus on the causes, effects of the building defects that were occur, since defect is precedent of effects of the construction defects (Abdul Razak et al, 2010) , In additional, in order to minimize the building defects, an evaluation on methods to minimize the building defect were also be focused on this research and the next step was to identify the significance and objectives of the study as well as outlining the scope of study in order to achieve the set objectives. The literature has critically reviewed from a variety of sources such as books, Internet, journals, articles and unpublished thesis. Literature review was essential to develop the research hypothesis which formed the framework of the research. Next, visual inspection was carried out on the public building project in Nekemte Town to determine their current building condition. There was all condominium building projects in Nekemte town selected as case studies in this research. The building defects found were recorded and the data were collected for data analysis. After that, the researcher concluded the findings and provided recommendations to rectify the problems. Therefore, this thesis focuses on investigating different types of building defects in general and causes & effects of building defects in particular and finally providing procedures which can reduce their occurrence.

## II. LITERATURE REVIEW

### 2.1. Category of Building Defects

According to Northern Territory Consolidated Regulation, 2001) the defect can be divided into two categories, which are:

**Structural defects:** - Structural defect means any defect in a structural element of a building that is attributable to defective design, defective or faulty workmanship or defective material and sometimes any combination of these. Building structure includes earth retaining walls, columns, beams and flat slabs. (Engineering Encyclopedia, Retrieved November, 2014) According to the (Engineering Encyclopedia, Retrieved November, 2014) structural defect can be categorized as cracks in foundations (Substructure), cracks in floor or slabs (superstructure), and cracks in walls (superstructure). These defects can be caused by improper soil analysis, inappropriate site selection, and the use of defective materials. Most of the structural problem can be avoided by implying the exact and detail of the design and planning. Structural defects in a building can occur over time due to deterioration, wear and tear, overloading, and poor maintenance., cracks, and deflection.

**Non-structural defects:** Non-structural defect in a residential building is described as a defect in a non-structural element of the building as a result of defective residential building work and also non-structural defect includes defect in brick work, dampness in old structures, and defects in plaster works (Engineering Encyclopedia, Retrieved November, 2014)

Building defect can be classified as 2 types, which are 'Patent Defects' and 'Latent Defects'. Patent Defects can be detected by the normal inspection or testing and apparent to naked eye, for example roof leak or a foundation crack. However, Latent Defects are hidden and cannot discoverable by normal examination or testing which will appear itself after a period of time (Anon 1, 2007).

### 2.2. Causes of Building Defect

According to the researcher from the University of Florida, building defects can be various types and influenced building by many factors in the construction industry. The common types and the causes of the construction defect can be included (Calvin "Cal" E. Beyer, 2011): Improper design Poor workmanship that leads to poor finishing quality, Improper means or methods of installation, Improper or poor quality of the materials, Defective material or poor material performance, Missing or inadequate protection from weather or environmental condition in the construction site and Soil subsidence, movement and settlement, According to Marianne (2005), those causes of defects listed above can be grouped in to 4 categories which are: Design deficiencies, Material deficiencies, Construction deficiencies and Subsurface/geotechnical problem.

### 2.3. Effect of the Building defect

According to (Atkinson, 1999) Building defect can decrease and affect the value of the buildings. defects are developments in construction that reduces the project's value instead of adding to it. Other than reduces the project value, where the building defect apparent, it also can cause the project totally delay which mean not complete with in the period state in the contract. Cost overrun can be known as one of the effects when the construction defects happen in the construction site. Building defect will also affect society at large due to possible danger posed and result in direct and indirect cost in repairs, abnormally high maintenance dispute and possible loss of building Literature reviews: Project delay ,Construction cost overrun ,Decrease the value of project ,Risk of possible danger on the tenant and/or passenger, High maintenance cost, High disputes and possible loss of building ,Decrease project functionality and It negatively affects contractor and/or consultant reputation

### 2.4. Remedial Measures to Prevent or Minimize the Building Defects

In construction industry, there is varying of the remedial measures to minimizing or reduce the building defects. According to Alice M. Noble-Allgire (2008), improving quality control can be known as a method to minimize the building defects occurs. There were six possible measures that suggested by researchers in order to minimize workmanship quality problem. The six measures are: Strict supervision, Training and education, Proper communication among parties involved, Proper construction management, Proper manpower management and Proper design Strict supervision

## III. RESEARCH METHODOLOGY

### 3.1. Research Design

The study adopted both quantitative and qualitative framework. However, a case study design approach was adopted for this research to investigate the study on causes, effects and remedial measure of building defects as applied in public buildings in Nekemte Town: Quantitative: - Quantitative research is concerned with measuring of quantity or amount and involving statistical manipulation, or hypothesis testing. It deals with

numbers and their manipulation in order to gain insight in that which is being studied (Davis, 1997). Kothari 2003 defines quantitative research as that which involves generation of data in quantitative form, which is then subjected to rigorous quantitative analysis in a formal and rigid way. Data collecting techniques included questionnaires, and actual physical measurements of the phenomena such as weight, height, ages, and duration of projects. Qualitative: -Qualitative research is primarily exploratory research .it used to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research Data collecting techniques included group discussion, individual interviews and participation/ observation (Susan E. De Franzo, 2011), Case Study Method :- Case study research method can be defined as the in-depth study of one or a few events or cases in order to understand the phenomenon being investigated. Rather than study a large sample and study a limited number of variables, I'm limited to one or two cases and an in-depth study longitudinally is done (Fryberg, 2006). According to Frankfort-Nachmias and Nachmias (1996 p. 146), a case study involves an observation of a single group or event at a single point in time, usually subsequent to some phenomenon that allegedly produced change.

### 3.2. Research Population and Sample Size.

This is the method by which the researcher purposefully selects the topic, place and respondents. The population of my research is Stake holders on building construction project in Nekemte town and the selected respondents are those professionals engage in Major project stakeholders such as Owners, contractors, consultants and other participants such as project manager and site Engineers. Consequently, according to research advisors (2006), an equation is provided to determine sample size for categorical or quantitative data as depicted in equation 3.1 below is used to determine the sample size for limited population.

The formula requires knowledge of variance or proportion in the population and determination to the maximum desirable error, as well as the acceptable error risk for example confidence level.

$$N = \frac{(X^2 * N * P * (1 - P))}{(ME^2 * (N - 1) + (X^2 * P * (1 - P)))} \dots\dots 3.1 \text{ [Source; the Research Advisors (2006)]}$$

Where; n = sample size,

X<sup>2</sup> = chi- square for the specified confidence level (95% confidence level),

N = population size,

P = population proportion (percentage picking a choice, expressed as a decimal (50% used for sample size needed) and

ME = desired margin of error which is (5%) expressed as a proportion.

### 3.3. Method of Data Analysis

In this research a descriptive statistical method has been used for the analysis of the data which provides general overviews and details in order that some kind of interpretations and discussions can be made on the results. Moreover, reviewed literature was also used as one of the main backbones for the analysis of the findings.

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. In these regards, participants were asked to indicate the importance level of influence factors or research variables by ranking them as 1, 2, 3, and 4....in ascending order. The numbers assigned to the important (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical marks for ranking choices of response.

Laws et al. (2003) suggest that data analysis is based on the literature reviewed in relation to the research objectives and questions.

Relative Importance Index (RII) will be used to analyze the data collected through questionnaire Survey.

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{A * N}$$

Where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 1 (0 not inclusive), higher the value of RII, more important will be the cause, effects and remedial measures of building defects)

IV. RESULT AND DISCUSSION

4.1 Types of building Defect.

Results of Common Types and Causes Public Building Defects respond from construction stake holders in construction site. The questionnaire of this study considered 22 common types of building defects seen during and after construction and respondents were required to determine how frequently the listed defects occurred in public building construction projects in Nekemte Town, Ethiopia.

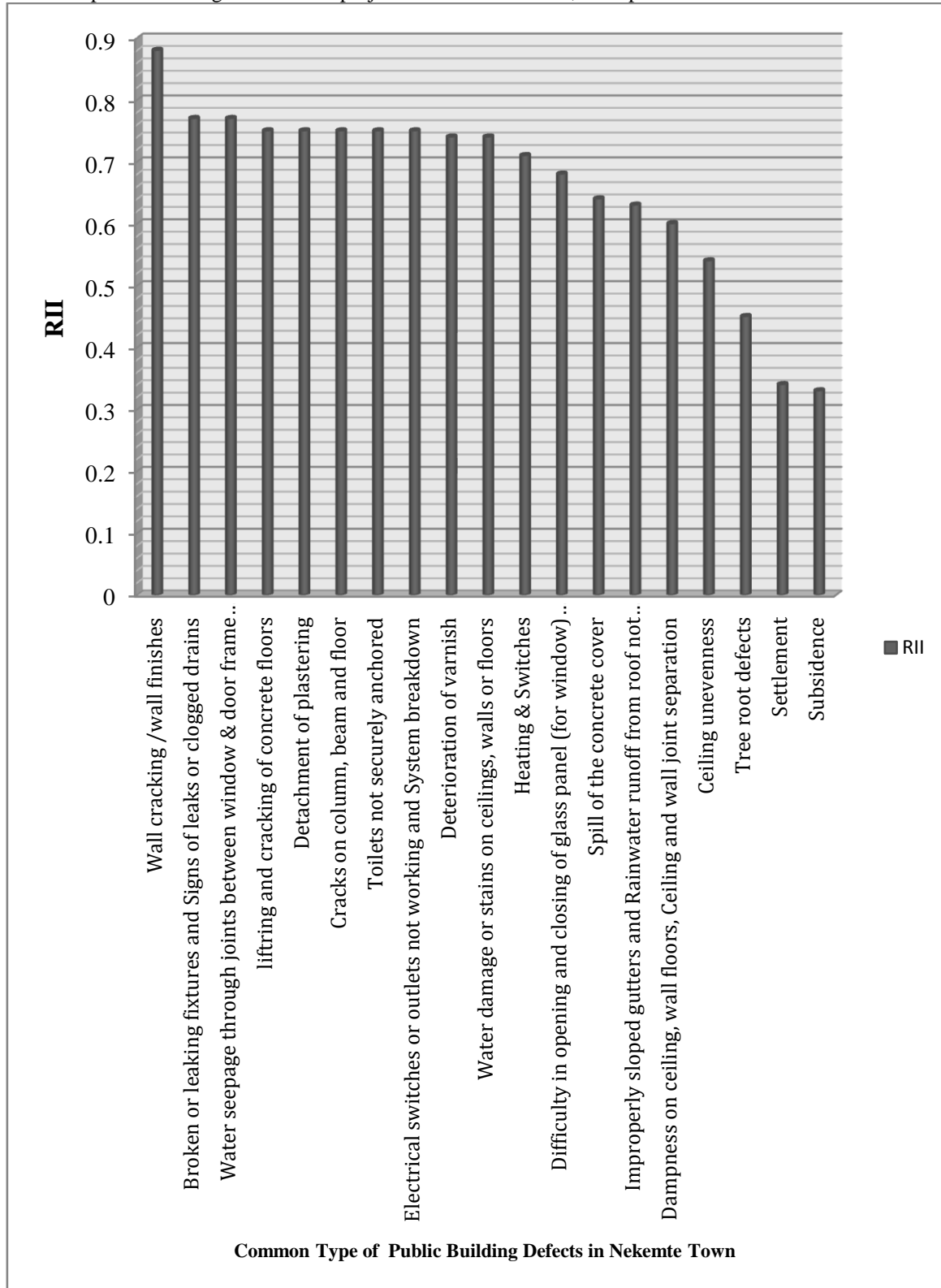


Figure 4.1 Overall Ranking of Common types of public building defects in Nekemte Town, Ethiopia

**4.2 Causes of public Building defect**

According to the finding the following figure 4.1 shows four major causes of Public building defects and the questionnaires was respond from construction stake holders in construction site.

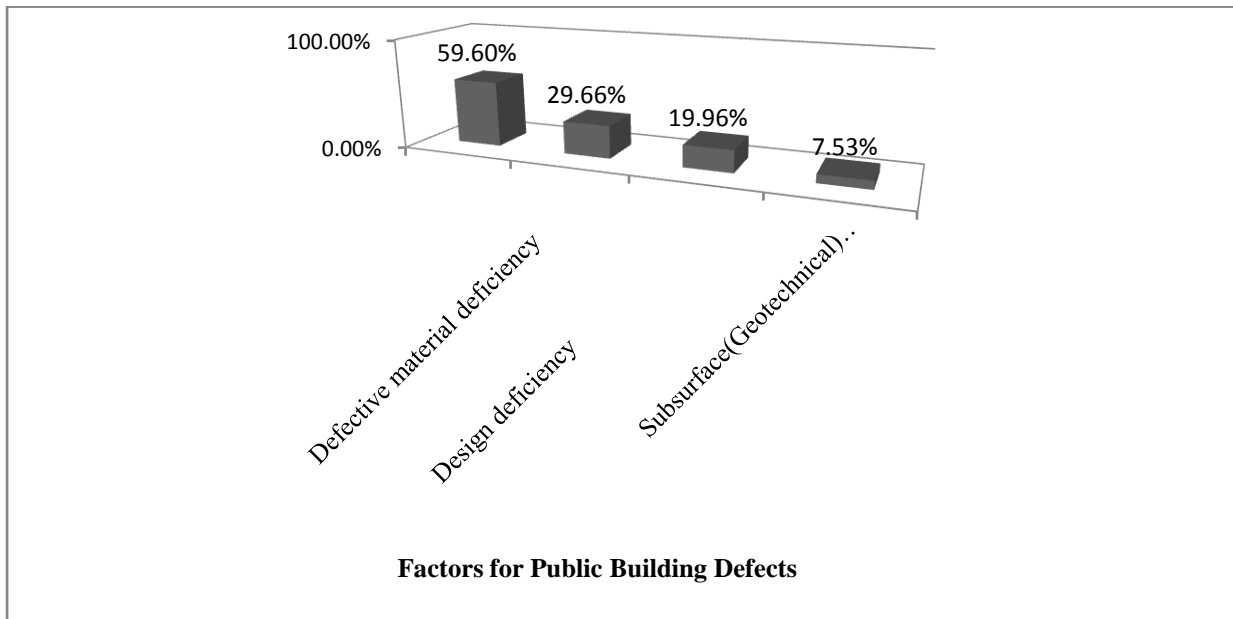


Figure 4.2. Over all ranking of Major Causes of Building defect in Nekemte Town, Ethiopia

**4.3. Effects of Public Building Defects**

According to the finding the following figure below shows five major effects of Public building defects and the questionnaires was respond from construction stake holders in construction site.

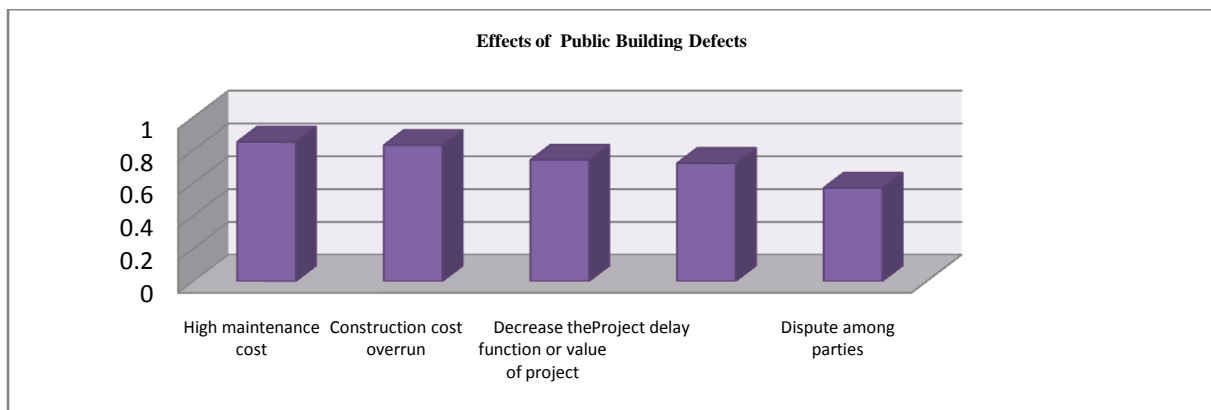


Figure 4.3. Over all ranking of Major Effects on building defects in Nekemte town, Ethiopia.

#### 4.4. Remedial measures to minimize the building defects.

In construction industry, there is varying of the methods to minimizing or reduce the building defects. According to Alice M. Noble-Allgire (2008), improving quality control can be known as a method to minimize the building defects occurs.

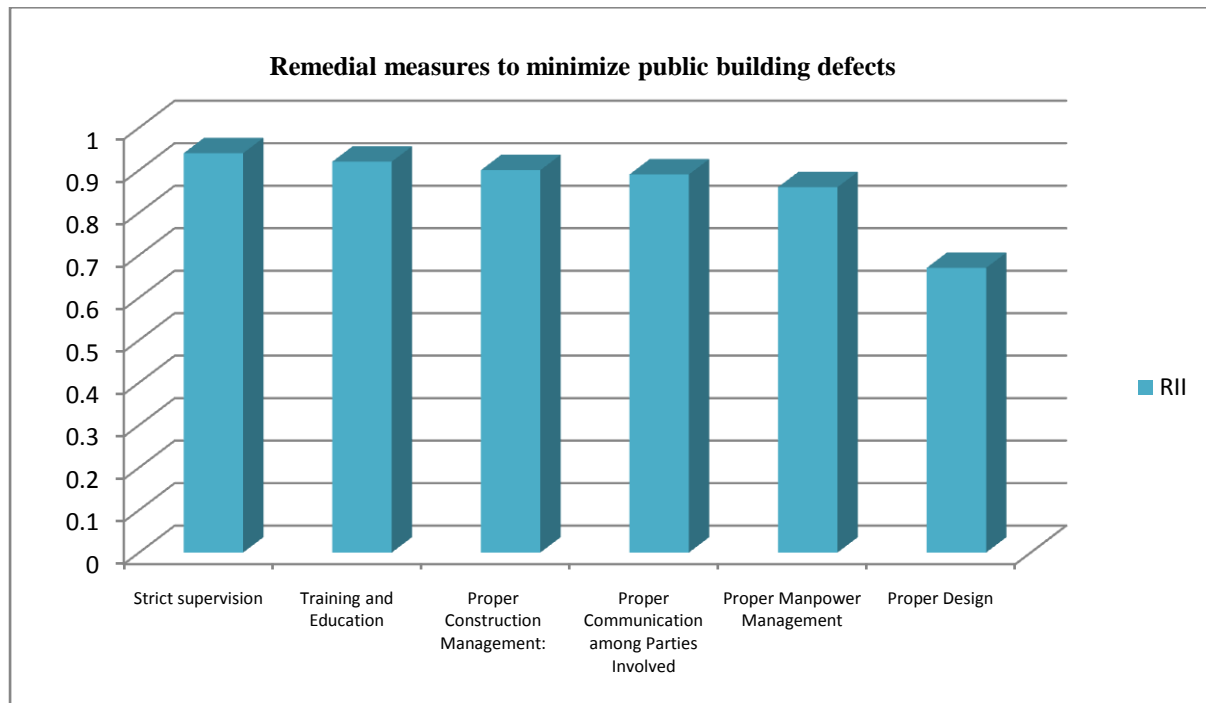


Figure 4.4. Over all ranking how to Remedial measures to minimize the building defects in Nekemte town, Ethiopia

## V. CONCLUSIONS

This chapter has four sections in this study the following major conclusion were drawn based on findings in line with each specific objective. The first aim of the study was to assess the common type of building defect. By reviewing literatures and research done on building defect and site observation the extent of building defect was assessed. So, Wall cracking /wall finishes: is ranked 1<sup>st</sup> most frequently occurring defect from all respondents, client, consultant and contractor respondent's point of views with (Average RII, 0.88), The second aim of the study was to investigate the cause of building defect. By reviewing literatures and research done on building defect and site observation the extent of building defect was assessed. Form questioner survey senior officer of the client, project manager and office engineer from contractor and consultant side reported 59.60% of building defects were caused by poor workmanship is ranked 1<sup>st</sup>, 29.66% were because of defective material is ranked 2<sup>nd</sup> and the remaining 19.96% and 7.53% of construction defects were caused by design error and poor subsurface investigation is ranked 3<sup>rd</sup> and 4<sup>th</sup> respectively from all respondents so Poor workmanship is one of the major factors that lead to building defects and failures problems. The third aim of the study was to examine the effects of building defect. By reviewing literatures and research done on building defect and site observation the extent of building defect was assessed. Form questioner survey senior officer of the client, project manager and office engineer from contractor and consultant side reported High maintenance is the major effects of building defect and which ranked with (RII 0.85), Construction cost overrun is the second major effects of building defect and which ranked 2<sup>nd</sup> with (RII 0.83), Decrease the function or value of project is the third major effects of building defect and which ranked 3<sup>rd</sup> with (RII 0.74), Project delay is the fourth major effects of building defect and which ranked 4<sup>th</sup> with (RII 0.72). Dispute among parties is the third major 5<sup>th</sup> effects of building defect and which ranked 3<sup>rd</sup> with (RII 0.57). The fourth aim the study was to observe the remedial measures to be taken to minimize building defect. By reviewing literatures and research done on building defect and site observation the extent of building defect was assessed. Form questioner survey senior officer of the client, project manager and office engineer from contractor and consultant side reported Strict supervision is the first major remedial measures to minimize building defect and which ranked 1<sup>st</sup> with (RII 0.94), Training and Education the second major remedial measures to minimize building defect and which ranked 2<sup>nd</sup> with (RII 0.84), Proper Construction Management is the third major remedial measures to minimize building defect and which ranked 3<sup>rd</sup> with (RII 0.90), Proper Communication among Parties Involved is the



fourth major remedial measures to minimize building defect and which ranked 4<sup>th</sup> with (RII 0.89), Proper Manpower Management is the fifth major remedial measures to minimize building defect and which ranked 5<sup>th</sup> with (RII 0.86), Proper Design is the sixth major remedial measures to minimize building defect and which ranked 6<sup>th</sup> with (RII 0.67).

### ACKNOWLEDGEMENTS

First of all, I thanks to the Almighty **God**, Who gave me the commitment and tolerance to pass various obstacles and come up to the accomplishment of this thesis.

Secondly, I would like to express my deepest appreciation to my advisor, **Alemu Mosisa (Ass.Prof.)** for his supervision and excellent advice throughout the preparation of this thesis. And my Co-advisor **Mr. Gemedo Etefa (MSc.)** for all their limitless efforts in guiding me through my work and for providing me useful reference materials.

Thirdly, my deepest appreciation goes to Wollega University, School of Graduate Studies, wollega Institute of Technology, Department of Construction Technology and Management and **Mr.M.Vignesh Kumar (Assistant Professor) M.Sc** Co-Ordinator and program leader of the construction technology and management.

Finally, I would like to express my appreciation to **all organizations** and individuals who contributed directly or indirectly to this thesis and provided the necessary materials and support for realization of this thesis. Especial thanks are forwarded to contractors, consultants and client who sacrificed their time in filling the questionnaires.

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Ketama Fayera Tolera, M. Vignesh Kumar et. al. " Study on Causes, Effects and Remedial Measures of Building Defects in Case of Public Building Project in Nekemte Town, Ethiopia." *American Journal of Engineering Research (AJER)*, vol. 9(12), 2020, pp. 40-48.