

**FACTORS AFFECTING QUALITY ASSURANCE OF ROAD
CONSTRUCTION PROJECT DELIVERY IN SOUTH-EASTERN
NIGERIA**

BY

**AJOKU, CHIDIEBERE ONU CHISOMAGA
REG NO: 20154941038**

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CERTIFICATION

This is to certify that this study; Factors Affecting Quality Assurance of Road Construction Project Delivery in South-eastern Nigeria, is the original work of Ajoku, Chidiebere Onu Chisomaga (Reg. No 20154941038) of Department of Project Management Technology, School of Management Technology (SMAT) of the Federal University of Technology, Owerri, in partial fulfilment for the award of a Masters Degree in Project Management Technology.



Dr. I. I. Echeme
Supervisor

29/3/2023

Date



Dr. I. I. Echeme
HOD, Project Management Technology

29/3/2023

Date

Prof. O. T. Ebiringa
Dean, SMAT

Date

Prof. B. O. Esonu
Dean, Postgraduate School

Date



Prof. A. E. Oluleye
External Examiner

Date

DEDICATION

This research work is dedicated to God Almighty, my creator, my strong pillar, my source of inspiration, wisdom and knowledge.

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TABLE OF CONTENTS

Cover page	i
Certification	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of contents	vi
List of Figures	x
List of Tables	xi
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background of Information	1
1.2 Problem Statement	4
1.3 Objectives of the Study	6
1.4 Research Hypotheses	6
1.5 Justification of the Study	7
1.7 Scope of the Study	8
CHAPTER TWO	8
LITERATURE REVIEW	9
2.1 Conceptual Review	9
2.1.2 Quality Assurance Techniques/Processes	12
2.4.1 Quality Planning	13
2.1.2.1 Quality Planning Inputs	18
2.1.2.2 Quality Planning: Tools and Techniques	20
2.1.2.3 Quality Planning: Outputs	23

2.1.3 Quality Assurance	26
2.1.3.1 Quality Assurance: Inputs	27
2.1.3.2 Quality Assurance: Tools and Techniques	30
2.1.3.3 Quality Assurance: Outputs	32
2.1.4 Quality Control	33
2.1.4.1 Quality Control: Inputs	37
2.1.4.3 Quality Control; Outputs	45
2.1.5 Obstacles Confronting Road Construction Projects	48
2.1.6 Possible Strategies for Combating the Obstacles in Road Construction Projects	53
2.1.7 Factors Affecting Quality Assurance on Road Construction Projects in South-East Nigeria	58
2.1.7.1 Project Funding Pattern	59
2.1.7.2 Lack of Quality Control Metrics	59
2.1.7.3 Political Influence/ Interference	60
2.1.7.4 Attitude of Contractors to Quality Standard	61
2.1.7.5 Inclement Weather Conditions	61
2.1.7.6 Unnecessary Bureaucratic Process	62
2.1.7.7 Level of Knowledge Base/Competence	62
2.1.7.8 Quality of Materials/Equipment's	63
2.1.8 Conceptual Framework	63
2.2 Theoretical Review	64
2.3 Empirical Review	66
2.4 Research Gaps	70

CHAPTER THREE	72
3.1 Research Design	72
3.1.1 Restatement of Hypothesis	73
3.2 Study Population	74
3.3. Sampling Size and Sampling Procedure	75
3.4 Method of Data Collection	76
3.4.1 Pilot Study	76
3.4.1.1 Validity of Research Instrument	77
3.4.1.2 Reliability Test	77
3.4.2 Nature of Questionnaire Distribution to the Selected Respondents	78
3.5 Content Analysis Procedure	79
3.5.1 Variable Definition	80
3.5.2 Decision Rule for Testing Hypothesis	81
3.6 Method of Data Analysis	82
CHAPTER FOUR	85
Results and Discussions	85
4.1 Results from Analysis of Data	85
4.1.2 Analysis of the Data Collected from the Respondents	85
4.1.3 Descriptive Statistics for each of the Factors (Y, X ₁ to X ₆)	87
4.1.4 Test of Multicollinearity Using the Correlation Matrix	88
4.1.5 Analysis of Unstandardized Beta Coefficients	90
4.1.6 Testing the Significance of the Inclusion of All the Independent Variables in the Model	92
4.1.7 Hypotheses Testing	94

4.1.8 Ranking the Level of Priority of the Factors	98
4.2 Discussion of Findings	99
CHAPTER FIVE	107
CONCLUSIONS AND RECOMMENDATIONS	
5.1 Conclusions	107
5.2 Recommendations	110
5.3 Contributions to Knowledge	111
REFERENCES	113
APPENDIX I	121

LIST OF FIGURES

Fig: 2.1	Project Quality Management Overview	13
Fig 2.2:	Quality Assurance: Inputs, tools and techniques and outputs	27
Fig 2.3:	Quality Control Tools and Techniques	39
Fig 2.4:	Cause and effect diagram	40
Fig 2.5:	Sample Process Flowchart	42
Fig 2.6:	Conceptual Framework	64

LIST OF TABLES

Table 3.1	Selected Road Construction Projects in the South-east States	74
Table 3.2	Questionnaire Distribution	78
Table 3.3	Content Analysis of Literature Review for Factor Identification	80
Table 3.4	Identified Quality Assurance Factors and Associated Authors using Content Analysis	81
Table 3.5	Acronyms for the Identified Quality Assurance Factors	83
Table 4.1:	Statistics of Questionnaire Distributed and Returned.	86
Table 4.2:	Scores for X_1 to X_5 for Respondent 1	87
Table 4.3:	Level of Quality Assurance in Road Construction Project Delivery for Respondent 1.	87
Table 4.4	Descriptive Statistics Scores of the Factors (223 Respondents)	88
Table 4.5	Test of Multicollinearity	89
Table 4.6	Multiple Regression Coefficients	90
Table 4.7	Analysis of Correlation Coefficient (r) and Coefficient of Determination (r^2)	92
Table 4.8	Analysis of Variance (ANOVA) For Multiple Regression	93
Table 4.9	ANOVA Result for Deviation between Actual Quality of Road Construction Projects and Quality Plan	94
Table 4.10	t-test Result of Multiple Regression	95
Table 4.11	Priority Ranking of the Factors	98

ABSTRACT

This study focused on factors affecting quality assurance in road construction projects in South-eastern Nigeria. The objectives are to ascertain whether there is any significant deviation between actual quality of road construction projects and quality plan, to identify and analyze the collective and individual effects of the factors affecting of quality assurance in the construction of road projects, to determine the extent to which actual quality assurance of road construction projects correlate with economic development. Analysis of Variance (ANOVA), Multiple Regression and Correlation analytical techniques were used to analyze the data collected from 223 respondents through questionnaire administration. The ANOVA result show that there is a significant deviation between the actual quality of road projects and quality plan. The multiple regression result show that political interference is the most significant factor that negatively affect quality assurance in delivery of road projects in Imo State. Contractors' attitude towards quality standard and bad climatic conditions were not significant factors. However, the correlation analysis shows high level of association between road projects and economic development. Based on this, the study recommends positive political interference geared towards ensuring honesty and transparency in contract awards, proper funding of road projects and policy formulation that will criminalize poor quality performance of projects, especially road construction projects.

Keywords: Road construction projects, Quality assurance, Political interference, Project funding, Economic development, South-East.

CHAPTER ONE

INTRODUCTION

1.1. Background Information

Quality road construction projects facilitates economic development as most economic goods and services are being transported from one location to the other. There are no doubt that good and quality roads facilitates economic activities which drive development of an area. Recently, the quality of construction projects witnessed in Nigeria, especially in the South East have nothing to be desired, especially road construction projects. This problem have socio-economic effects on the state allocation as these roads deplete soonest after construction hence calling for reconstruction. This problem is believed to have been the log in the wheel of development in the South-eastern geopolitical zone of Nigeria.

Project organizations especially those of the Royal Roc Construction Company, Mortain Nig Ltd and Ever Favored International Ventures and due to management's inability to recognize and address the variables impacting quality assurance in the execution of such projects, additional construction businesses in the region may have been impacted by underperformance and abandonment.

Jaideep (2009), however refers to project quality as the standard and measures adopted to ensure successful realization of project objectives. This begins from the project's inception and continues through to completion. As regards road

construction projects, quality management means “managing quality standards and measures for the project right from its initiation to all stages of the project life cycle.” However, a project life cycle as described by Ikande (2018) consist project conception, initiation, planning, execution and, termination.

Also, the New York office of Technology (2015), posited that to perform quality assurance means the application of quality management tools and techniques in order to ensure quality output that will meet customer requirements under all operational conditions. Thus, using planned, systematic quality activities is what we mean by "quality assurance." This is done to make sure that the project will use all the procedures required to achieve the criteria. Activities related to quality assurance are frequently supervised by a department dedicated to it or a comparable entity. Continuous process improvement and another crucial quality activity are covered by quality assurance. According to Caltrans (2017), total quality management offers an iterative strategy for enhancing the quality through continuous process improvement (TQM). Quality activities include quality assurance inputs which must be performed ensure proper quality outcome. The quality assurance inputs according to PMNetwork (2012) “include but not limited to quality management plan, quality metrics, process improvement plan, work performance information, approved change requests, quality control measurement, implemented change requests, implemented corrective actions, implemented defect

repair and implemented preventive action.” The issue here is that most construction firms have failed to apply these quality assurance tools or inputs in construction activities hence deliver poor quality roads, especially in the South-eastern, Nigeria.

Okoro (2006), opines that a few tools and methods for ensuring quality, such as planning phase, quality audits, process analysis, and quality control tools and techniques ought to be properly performed. Unfortunately, the case is different in most construction projects in Nigeria and specifically, the South East. However, there must also be the performance of quality assurance outputs. PMNetwork (2012) listed them to include but not limited to; “requested changes, recommended corrective actions, organizational process assets (updates), and project management plan (updates).” However, Ofor, (2018) stated that unfortunately, most of these quality assurance techniques are not considered in the planning and implementation of projects by most construction firms. The question that follows poor quality assurance of road project performance is whether the road contracts were made according to due process to ensure that the best qualified contractors are awarded road construction projects in the South-eastern geopolitical zone of Nigeria. Arguments from various quarters’ have it that most road contracts in the zone are being awarded based on family ties and relationship which encourage corruption and indiscipline. Then one wonders whether these twin problem are the

only problem in quality assurance of road construction projects. Authors have blamed it on kickbacks and all manner of ill-feeling surrounding road contract award (Anyanwu, 2007; Okoro, 2006; and Anyamkpa, 2017).

Although researches have been made by authors on the best approach to tackle the issue of poor quality performance of construction projects in Nigeria, yet the problem still persists due to mainly political related reasons, hence subjecting the citizens to poverty and untold hardship as economic activities becomes difficult. Therefore, this research is being conducted to determine the possible factors affecting quality assurance in road construction projects in South-eastern geopolitical zone and Nigeria in general.

1.2 Problem Statement

Road projects are veritable means of movement of goods, services and people from one location to another. These road projects, if successfully completed to meet the necessary specifications will improve quality standard, enhances economic activities and attract economic development. Unfortunately, the low level of quality assurance achieved by most road construction projects in Nigeria, especially in the South-eastern region, appear to be the major problem hindering economic development of the region. There is no doubt that the application of quality assurance procedures on road projects in the South Eastern States has not

been up to speed. Various Ministries, Departments, Agencies and even Contractors seem not to be concerned with the quality of the road projects, rather they focus on the cost and time of delivery of projects.

Many construction firms in the South-east geopolitical zone provided finished road construction projects in the past that fell short of design requirements and quality standards. Anyamkpa (2017). (2017). The majority of the roads do not even make it through one wet season. Additionally, field research has shown that many modern road building projects lack longevity and dependability since they are unable to endure the extreme climatic and environmental difficulties in the region. This have made these roads almost impassable by road users therefore frustrating the economic activities in zone.

Nevertheless, the essence of project output is to meet the cost, time and quality standards and allow users to accept and use the project in fulfilling the desired objectives. This expected goals are yet to be realized in road construction projects. The study by Anyamkpa (2017), dwelt on meeting design specification and quality standards in road projects without considering the forces that hinder the realization of design specification and quality standard. Hence, the problem still persist. It is in the light of the above problem that this research is conducted.

However, the hypothesized factors that influence quality assurance of road construction projects in the South-east, Nigeria include; political party inclinations,

lack of quality standard metrics, poor attitude of contractors to quality standards and inclement weather.

1.3 Objectives of the Study

The main objective of this study is to analyze the factors affecting quality assurance of road construction project delivery in South-East Nigeria for improved performance. However, the study focused on the following specific objectives:

- i. To ascertain quality assurance issues and identify factors affecting quality assurance of road construction projects.
- ii. To ascertain whether there is any significant deviation between actual quality of road construction projects and quality plan.
- iii. To analyze the collective and individual effects of the factors affecting of quality assurance in the construction of road projects.

1.4 Research Hypotheses

The following hypothesis in relation to the study formulated and tested:

H₀₁: There is no significant deviation between actual quality of road construction projects and quality plan.

H₀₂: The collective effect of all the identified quality factors do not significantly affect the realization of quality assurance in the construction of road projects.

H₀₃: Not all the individual quality factors have significantly effect on the quality assurance of road construction projects.

1.5 Justification of the Study

This study is justified because of the hardship that has befalling the people of South-east due to poor road network caused by low level of quality road project delivery in the zone. The consequences of this is the low level of economic activities which has drastically affected the standard of living of citizens, especially those occupying South-eastern part of Nigeria. South-east geopolitical zone is one of the main hub of both government and business activities, hence require better road network to facilitate the socio-economic activities of the Zone and improve the livelihood of the people. However, this can only be achieved through effective and efficient delivery of quality road projects to ease movement and improve the economic development of the area.

The factors identified in this study appear to be very disturbing in the successful delivery of construction projects, particularly, road construction projects. Also the factors seem to have direct bearing on the quality assurance of road construction projects in the South-east zone of Nigeria.

Hence, This research will be used by project managers to identify the crucial variables and roles that quality assurance may play in project owners' satisfaction. This activity will help project team members comprehend the need to develop their quality assurance capabilities. This study will be used by project management

consultants to teach their customers about quality assurance and by project-based businesses to raise the caliber of their work, accordingly.

Further researchers will benefit extensively in the areas of literature review and methodology.

1.7 Scope of the Study

The geographical scope is South-east, Nigeria. The road projects include; the Owerri-Orlu-Awka road located between Imo State and Anambra State, Enugu-Abakiliki road, Okigwe-Mbano-Ihitte/Uboma-Umuahia road, Umuahia-IkotEkpene road projects.

The content scope is identification and analysis of factors affecting quality assurance in the execution of road construction projects in South-east, Nigeria. The target respondents for the study include road construction experts in project management, engineering (Civil), quality management, quantity surveying, architecture etc.

However, the study covers road construction projects between 2016 to 2019.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

Government awards contracts and very few times will they emphasize on the quality of the project. Notwithstanding, contractors are blacklisted for not meeting the expected time for the project and not for failure to meet the project quality already stated in the project plan (Anyamkpa, 2017). This has made the concept of quality assurance to be less talked about in construction projects and specifically road construction projects in the state. However, literature review and field study have shown that many construction firms and their construction business, project managers find it challenging to identify the variables that impact quality assurance for effective project execution. Femi (2014), Hassan & Bolaji (2011). This has been a critical problem confronting most road construction projects in the South-east, Nigeria. It could likewise be hard for project fruition assuming there are low execution records because of powerlessness to set up quality affirmation strategies in project development.

It is additionally difficult to understand that most undertaking directors are yet to comprehend the connection between quality review and information materials in

development firms. This is intensified by the apparent unfortunate disposition of venture development firms to quality affirmation strategies in the South-east geopolitical zone due to their inclinations to political powers in the Zone.

However, quality administration, in an authentic perspective, has consistently been of significant interest for producers. In any case, the term of value has been critical, because of the many advantages that it brings to those organizations that center their organizations towards a quality administration framework, and furthermore for the greatness that exists in a globalized and evolving world. These days, it needs to separate itself from the remainder of organizations here and there, rehashing continually (Montes and Fuentes, 2005). In the event that we talk about quality as an administration reasoning, we should return first to its starting points and how the term advanced to what exactly is presently known as Total Quality Management. Since, in late many years, it expanded its significance as a wellspring of upper hand gathered by the organizations. The beginning of the term was significantly sooner, principally, in the Industrial Era. Hence, the course of improvement of value the board is related with the economy progression where a progression of stages can be recognized. Montes and Fuentes (2005) or Sánchez, Dueñas and Izquierdo, (2016). Furthermore, the consideration ought to likewise be paid to the purported masters of value, as they are firmly connected to the stages with the commitment of every master in the various periods of the advancement of

the term quality. The primary stage that can be recognized is a quality way to deal with review. Nonetheless, up to 1900 there was no quality framework and there were simply the craftsman who fabricated and sold their items. From the introduction of the advanced mechanical time, manufacturing plants started to seem to supplant the craftsman studios as method for creation. Then, at that point, we can discuss similarity with the specs and the division of work, since they completed the items under pre-set up design. Thus, there was a sure consistency of the items, and toward the finish of the cycle, they were changed to notice in case they were as indicated by these particulars. With the investigation that they were searching for was the recognition of blunders in light of the fact that, around then, it was sure that the customer esteemed the items made by consistency. The issue of a quality way to deal with investigation was neither anticipation nor an arrangement of progress however it expected a significant expense to create in mass and couldn't be reviewed all Montes and Fuentes (2005) or Sánchez, Dueñas and Izquierdo (2016). One more disadvantage of the stage was not the answer for all that nor to expand the quantity of assessments and this master Deming (1982) was clear, as it express the instance of an association where they had three controllers and didn't fill in as they accepted in light of the fact that they unwind during the undertakings Zornoza, Cruz& González (2017). Somewhere in the range of 1920 and 1940, W.A. Shewhart and the gathering of architects of the Bell

Company that he coordinated had the possibility that the pre-owned methodology until that time was not effective, as, reviewing all items to view mistakes didn't appear to be the best strategy. Also, as well as seeing that there was variety in delivering various pieces by a similar specialist and hardware, he felt that this fluctuation ought to be concentrated by the standards of insights and likelihood. Hence, with the mediation of the United States in the Second World War, they started to utilize procedures of factual control of the quality, being a triumph toward the decade's end Montes and Fuentes (2005) or Sánchez, Dueñas and Izquierdo, (2016). In addition, the term of value, that is implied in this methodology, is the factual definition that they had by then Shewhart, Deming and Taguchi Zornoza, Cruz and González (2017). In this methodology, to recognize the normal and unique reasons for variety, Deming incited the utilization of the APC(statistical cycle control). Similarly as the control diagrams utilized at this stage contrived at first by Shewhart Zornoza, Cruz and González (2017).In this stage, the popular set of three for the administration of nature of Juran seems to recognize three interrelated cycles Zornoza, Cruz and González (2017).Some of the downsides of the way to deal with the measurable control of value is that solitary factual procedures were utilized to identify blunders and apply in the creation division of the organizations.

2.1.2 Quality Assurance Techniques/Processes

Quality planning, quality assurance, and quality control are all part of the project quality management procedures. The Project Management Body of Knowledge PMBoK(2005), Project Management Institute PMI, and Figure 2.1 offer an overview of the project quality management procedures (2015), and PMNetwork, (2012).

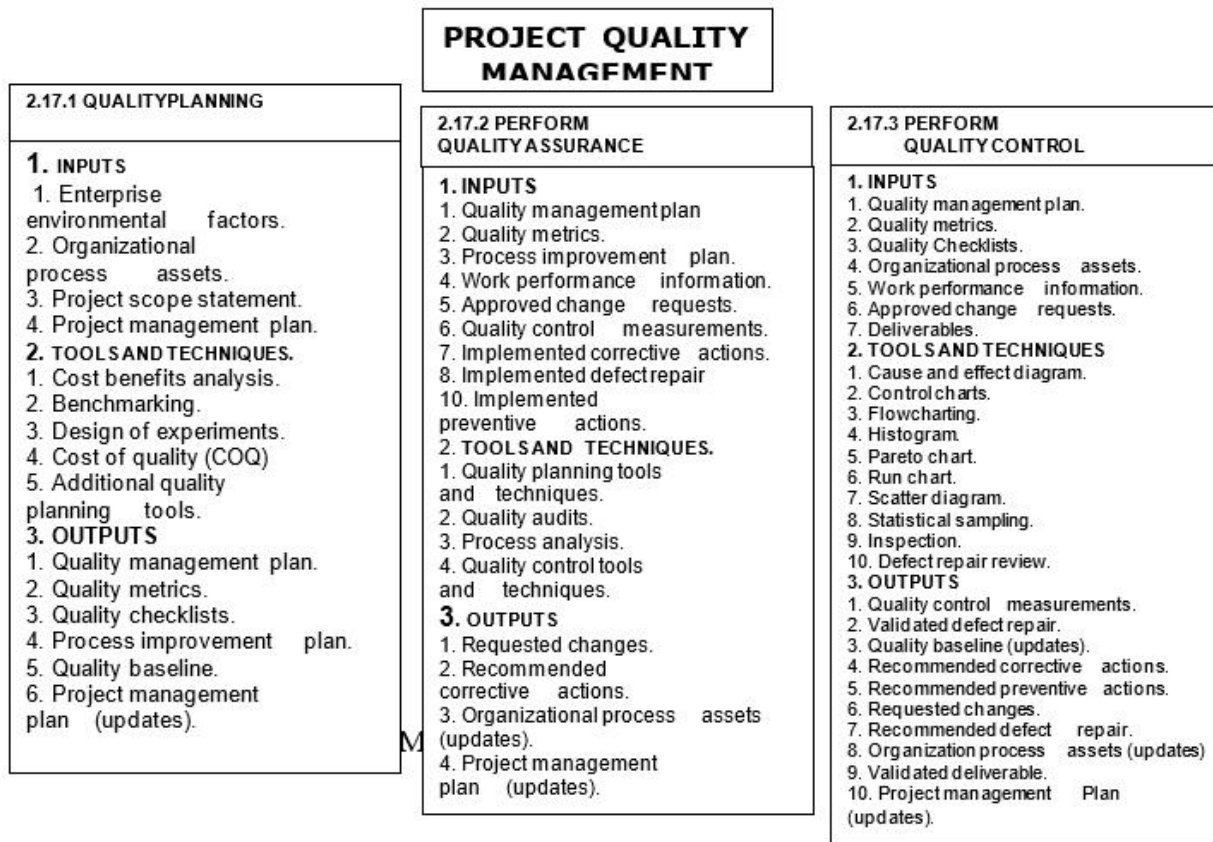


Figure 2.1: Project Quality Management Overview.
Source: PMBoK (2005), PMI, (2015), PMNetwork, (2012)

2.4.1 Quality Planning

Quality planning includes recognizing which quality principles are pertinent to the undertaking and deciding how to fulfill them. It is one of the key cycles while doing the arranging system bunch and during advancement of the task arranging measures. For instance, the necessary changes in the item to satisfy recognized quality guidelines may call for adjustments to the budget or schedule, or the ideal product quality may call for a detailed risk analysis of a notable problem.

The quality planning methods included in this article are those that are applied to projects the most. There are other others that could be beneficial for specific projects or application areas. The idea that quality is planned, created, and built in rather than examined in is one of the cornerstones of contemporary quality management (PMI, 2015).

Quality plans should define the following according to PMBOK (2005), PMI (2015)

- i. Objectives to be accomplished (for example, characteristics or subtleties, consistency, reasonability, style, process term, cost, typical resources, utilization, yield, reliability, and so on)
- ii. Steps in the cycles that contain the functioning practice or methodologies of the affiliation

- iii. Allocation of commitments, authority, and resources during the different times of the cycle or undertaking
- iv. Specific documented standards, practices, methodologies, and headings to be applied
- v. Suitable testing, evaluation, appraisal, and survey programs at fitting stages
- vi. A recorded technique for changes and modifications to a quality game plan as a cooperation is gotten to the next level
- vii. A strategy for assessing the achievement of the quality targets
- viii. Other exercises essential to meet the objectives
- ix. Quality plans result from both sent indispensable quality courses of action (which are associated with various leveled key plans) and from the specific authentic rules, industry standards, affiliation procedures and frameworks, inside rules, and incredible practices expected to meet clients' essentials for things or organizations.
- x. Strategic-level quality plans are made and passed on through the fundamental orchestrating measure. These sweeping based quality plans become the standard for every limit's or on the other hand division's supporting quality

course of action. Where fitting, every limit or division could make and inside convey working level quality plans.

xi. Operating-level quality plans routinely are the ensuing document(s) from a creation booking limit. In light of everything, this documentation regularly consolidates frames, a copy of the client's association, references to important standards, practices, frameworks, and work bearings, and nuances on the most ideal way to make the specific thing or organization.

xii. When the thing or organization is conveyed, the organizing reports may be expanded by assessment documentation, SPC charts, and copies of transportation records and client required testaments. At the same time, the plans are changed from reports to records. In a totally mechanized system, the reports referred to likely could be canny PC screens, gotten to at executives' work spaces and control centers. These screens, inside, become records when managers, reviewers, carriers, and others make PC sections to the screens PMNetwork (2012).

xiii. Quality affirmation includes applying the arranged, methodical quality exercises to guarantee that the venture utilizes all cycles expected to meet prerequisites.

At the main level, quality goals and plans should be consolidated with in everyday fundamental plans of the affiliation. As legitimate objections and plans are sent all

through the affiliation, every limit frames its own most ideal way for adding to the general targets and objectives PMBOK (2005).

At lower levels, the quality plan acknowledges the occupation of a significant game plan. Such plans could take a large number of designs depending upon the outcome they are to make. Quality plans may in like manner be addressed by more than one kind of document to make a given outcome.

A delineation of this is a gathering association that machines metal parts. Its quality course of action includes relevant procedures (depicting the creation collaboration and commitments), suitable workmanship standards, the assessment versatilities alright, the portrayal of the material rules, and so forth. These may be generally segregated records.

More component information that connects with a particular client may be made sense of on individual work orders (to a great extent called explorers). Work orders decide the machine game plans and versatilities, exercises to be performed, tests, surveys, managing, taking care of, packaging, and transport moves toward be followed.

A functioning level quality plan deciphers the client necessities (the what) into exercises expected to make the best outcome (the how) and couples this with material strategies, standards, practices, and shows to demonstrate unequivocally

what is required, who will get it done, and how it will be done. A control plan could show thing protections, testing limits, and affirmation models. While the stating could differentiate, the key system is practically identical for organization and various kinds of affiliations Goldman(2014).

2.1.2.1 Quality Planning: Inputs

The quality planning inputs include the following;

i. Enterprise Environmental Factors.

“Governmental agency regulations, rules, standards, and guidelines specific to the application area may affect the project” Warner (2008).

ii. Organizational Process Assets

Organizational quality policies, techniques and rules, authentic information bases and exercises gained from past projects explicit to the application region might influence the venture. The quality strategy, as supported by senior administration, is the expected heading of a performing association as to quality. On the off chance that the performing association does not have a conventional quality strategy, or on the other hand if the task includes various performing associations (likewise with a joint endeavor, the undertaking supervisory group should foster a quality approach for the project. Shrivastava (2009).

“Regardless of the origin of the quality policy, the project management team is responsible for ensuring that the project stakeholders are fully aware of the policy through the appropriate distribution of information.”

iii. Project Scope Statement

The project scope explanation is a vital contribution to quality arranging since it reports significant venture expectations, the task destinations that serve to characterize prerequisites (which were gotten from partner needs, needs and assumptions, edges, and acknowledgment models. Edges which are characterized as cost, time, or asset esteems utilized as boundaries, can be essential for the undertaking extension proclamation. In the event that these limit esteems are surpassed, it will require activity from the task supervisory team. Hellsloot(2007).

Acknowledgment rules incorporate execution necessities and fundamental conditions that should be accomplished before project expectations are acknowledged. The meaning of acknowledgment models can fundamentally increment or diminishing venture quality expenses. The aftereffect of the expectations fulfilling all acknowledgment models infers that the necessities of the client have been met. Formal acknowledgment approves that the acknowledgment standards have been fulfilled. The item scope portrayal, encapsulated in the venture

scope explanation, will frequently contain subtleties of specialized issues and different worries that can influence quality arranging. Boin(2009).

iv. Project Management Plan

The project management plan process incorporates the activities important to characterize, incorporate and organize all auxiliary plans into a task the executives plan. The task the executives plan content will shift contingent on the application region and intricacy of the undertaking. This cycle brings about a venture the executives plan that is refreshed and modified through the coordinated change control measure. The task the board plan archives the assortment of yields of the arranging system of the planning process group.

The project management plan may be detailed or at the summary level, and it may include one or more subsidiary plans in addition to other elements. Every subsidiary plan and component is described in detail to the degree needed for the particular project. The quality management plan is one of the supporting plans or elements of the project management plan. Hart (2016).

2.1.2.2 Quality Planning: Tools and Techniques

The tools and techniques include the following;

i. Cost-Benefit Analysis

Cost-benefit tradeoffs must be taken into account in good planning. Less rework translates into improved production, reduced costs, and higher stakeholder satisfaction, which is the main advantage of achieving quality criteria. The expense connected with project quality management operations is the main cost of achieving quality criteria. Stern (2009).

ii. **Benchmarking**

Comparing planned or current project practices to those of other projects can help create suggestions for improvements and serve as a benchmark for performance review. These additional projects may be carried out inside or outside of the performing organization, in the same or a different application area. Robert (2011).

iii. **Design Of Experiments**

Design of experiments (DOE) is a statistical strategy that distinguishes which components might impact explicit factors of an item or interaction a work in progress or underway. It additionally assumes a part in the enhancement of items or cycles. A model is the place where an association can utilize plan of investigations to decrease the item execution's susceptibility to sources of variability brought on by natural assembly contrasts. The main part of this strategy is that it gives a factual structure to deliberately changing the entirety of the significant variables, rather than changing the components each in turn. The

investigation of the trial information ought to give the ideal conditions to the item or cycle, featuring the variables that impact the outcomes, and uncovering the presence of collaborations and synergisms among the elements. For instance, automobile designers use this strategy to determine which combination of suspension and tires would provide the optimum ride characteristics at an affordable price. Lamberton, (2009).

iv. Cost Of Quality (COQ)

The overall cost of investing in avoiding nonconformance to standards and failing to achieve requirements is known as the "quality expenses" (Rework). Expenses of failure are frequently divided into internal and external costs. Costs of failure are also known as costs of subpar quality. Janette, (2010).

v. Additional Quality Planning Tools

To further characterize the situation and aid in the planning of efficient quality management operations, further planning tools for quality are frequently utilized. The following come to mind: brainstorming, affinity diagrams, force field analysis, conventional group approaches, matrix diagrams, flowcharts, and prioritizing matrices (Eduardo, 2011).

2.1.2.3 Quality Planning: Outputs

This includes the following;

a) Quality Management Plan

“The quality management plan describes how the project management team will implement the organization’s quality policy. The quality management plan is a component or a subsidiary plan of the project management plan.” Richard, (2013).

The project's quality control (QC), quality assurance (QA), and continuous process improvement must all be included in the quality management plan, which contributes to the overall project management strategy. Depending on the needs of the project, the quality management plan may be formal or informal, extremely thorough or vaguely structured. The quality management plan should include initiatives at the beginning of an endeavour to ensure that prior decisions, such as those on ideas, plans, and testing, were sound. These activities should be carried out with the exclusion of everyone who has handled with the material under investigation through an independent companion audit. The benefits of this survey might include reduced costs and time constraints brought on by improvement. (Brown, 2004).

b) Quality Metrics

A metric is a functional definition that portrays, in unmistakable terms, what something is and how the quality control measure estimates it. An estimation is a real worth. For instance, it isn't sufficient to say that gathering the arranged

timetable dates is a proportion of the board quality. The undertaking supervisory crew should likewise demonstrate whether each movement should begin on schedule or just completion on schedule and regardless of whether individual exercises will be estimated or just certain expectations, and provided that this is true, which ones. Quality measurements are utilized in the quality confirmation and quality control measures. A few instances of value measurements incorporate imperfection thickness, disappointment rate, accessibility, dependability, and test inclusion. Hansen (2008).

c) Quality Checklists

A checklist is a systematic, frequently component-specific tool used to confirm the completion of a list of necessary activities. Lists can be straightforward or complicated. They are typically written as questions or imperatives, such as "Do this!" or "Have you done this?" Standardized checklists are readily available in many businesses to guarantee uniformity in regularly performed tasks. Checklists are also offered from professional groups or for-profit service providers in specific application areas. The quality control method makes use of quality checklists (Fyodor, 2009).

d) Process Improvement Plan

According to Project Management body of knowledge PMBOK (2013), “the process improvement plan is also a subsidiary of the project management plan. The process improvement plan details the steps for analyzing processes that will facilitate the identification of waste and non-value added activity, thus increasing customer value such as”:

- i. **Process Boundaries:** This describes the purpose, start and end of processes, their inputs and outputs, data required, if any, and other owner and stakeholders of processes.
 - ii. **Process Configuration:** This is a flow chart of processes to facilitate analysis with interfaces identified.
 - iii. **Process Metrics:** this maintains control over status of processes.
 - iv. **Target for Improved Performance:** This guides the process improvement activities.
- e) **Quality Baseline**

“The quality baseline records the quality objectives of the project. The quality baseline is the basis for measuring and reporting quality performance as part of the performance measurement baseline.” Carol (2008).

F) Project Management Plan (Updates)

The venture the executives plan will be refreshed through consideration of an auxiliary quality administration plan and interaction improvement plan. Mentioned changes (augmentations, alterations, cancellations) to the task the board plan and its auxiliary plans are handled by survey and attitude through the incorporated change control process (Suneel, 2011).

2.1.3 Quality Assurance

“Quality assurance (QA) is the application of planned, systematic quality activities to ensure that the project will employ all processes needed to meet requirement.”

A quality confirmation division or comparable association, frequently supervises Quality confirmation exercises. Quality affirmation support, no matter what the unit's title, might be given to the venture group, the administration of the performing association, the client or sponsor, as well as different partners not effectively engaged with crafted by project. Quality affirmation likewise gives an umbrella to another significant quality movement, persistent interaction improvement. Consistent interaction improvement gives an iterative means to working on the nature, everything being equal. Mei (2009).

Persistent cycle improvement diminishes squander and non-esteem added exercises, which permits cycles to work at expanded degrees of proficiency and adequacy. Process improvement is separated by its recognizable proof and survey of

association too, from miniature cycles, for example, the coding of modules inside a product program, to large scale cycles like the launch of new business sectors (Kaplan, 2010).

Figure 2.2 illustrates the quality assurance inputs, tools and techniques, and outputs. This illustrations were made based on the views of PMBoK (2005) and PMI (2015).

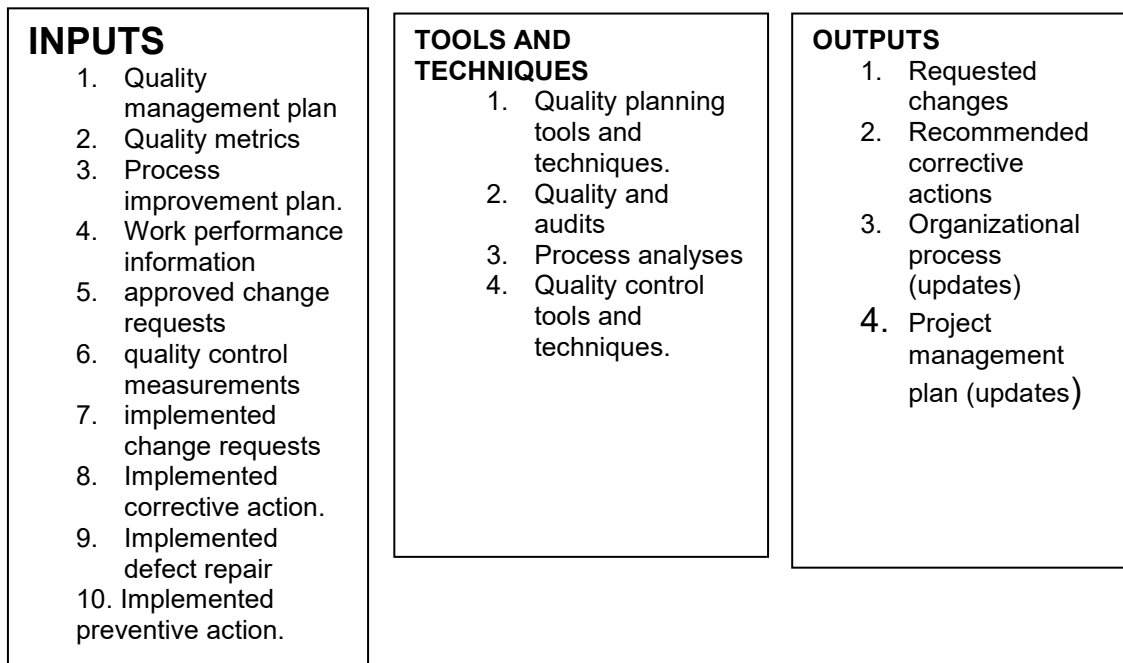


Figure 2.2: Quality Assurance: Inputs, tools and techniques and outputs.
Source: PMBOK(2005) and PMI(2015)

2.1.3.1 Quality Assurance: Inputs

They include the following;

a) Quality Management Plan

The quality management plan describes how quality assurance will be performed within the project. It provides input to the overall project management plan and must address quality control (QC), quality assurance (QA), and continuous process improvement for the project.

b) Quality Metrics

A metric is an operational definition that describes, in very specific terms, what something is and how the quality control process measures it. PMI(2015). A measurement is an actual value. For example, it is not enough to say that meeting the planned schedule dates is a measure of management quality. The project management team must also indicate whether every activity must start on time or only finish on time and whether individual activities will be measured or only certain deliverables and if so which ones. Quality metrics are used in the quality assurance and quality control processes. Lowry (2012).

c) Process Improvement Plan

The procedures for examining processes that will make it easier to identify waste and non-value-added activities, hence enhancing customer value, are detailed in the process improvement strategy.

d) Work Performance Information

“Work performance information, including technical performance measures, project deliverables status, required corrective actions and performance reports are important inputs to quality assurance and can be used in areas such as audits, quality reviews, and process analysis.” Frankel (2010).

e) Approved Change Requests

According to PMI (2015), Modifications to labor processes, product requirements, quality requirements, scope, and timeline are all examples of accepted change requests. The impact of approved modifications on the quality management plan, the quality measurements, or the quality checklists must be examined. Approved modifications can be used in areas like audits, quality reviews, and process analysis and are significant contributions to quality assurance. Undocumented modifications should not be processed or put into effect. Instead, they should all be officially documented in writing and discussed verbally (Alexander, 2009).

f) Quality Control Measurements

“Quality control measurements are the results of quality control activities that are fed back to the quality assurance process for use in re-evaluating and analyzing the quality standards and processes of the performing organization.” PMBOK (2013).

g) Implemented Change Requests

The authorized requested changes that have been carried out by the project leadership team throughout project execution are referred to as executed change requests.

h) Implemented Corrective Actions

The project manager has carried out the agreed remedial measures in order to bring predicted future project performance into compliance with the project plan.

i) Implemented Defect Repair

The program management group has put authorized product defect fixes into practice throughout project execution.

j) Implemented Preventive Actions

“The implemented preventive actions are the approved preventive actions that have been implemented by the project management team to reduce the consequences of project risks.” Daniel (2002).

2.1.3.2 Quality Assurance: Tools & Techniques

According to PMBOK (2005), they include the following;

a) Quality Planning Tools And Techniques

Quality planning tools such as cost-benefit analysis, benchmarking, design of experiments, cost of quality, brainstorming etc can be used for Quality Assurance activities.

b) Quality Audits

A quality audit is an organized ward survey to decide if project exercises consent to authoritative and project strategies, cycles, and systems. The goal of a quality review is to recognize wasteful and incapable arrangements, cycles, and methods being used on the venture. The ensuing work to address these insufficiencies should bring about a diminished expense of value and an expansion in the level of acknowledgment of the item or administration by the client or support inside the performing association. Quality evaluations may be scheduled or random, conducted by adequately trained internal examiners or by individuals not affiliated with the performing organization.

“Quality audits confirm the implementation of approved change requests, corrective actions, defect repairs, and preventive actions.” Wren (2004).

c) Process Analysis

Process analysis follows the step illustrated in the process improvement plan to personality required enhancements from an authoritative and specialized point of view. This investigation additionally looks at issues experienced, limitations experienced, and non-esteem added exercises recognized during measure activity. Cycle investigation incorporates main driver examination, a particular strategies to dissect an issue or circumstance, decide the hidden makes that drove it, and make preventive activities for comparable issues. PMBOK (2005).

2.1.3.3 Quality Assurance: Outputs

Quality assurance outputs include but not limited to the following;

a) Requested Changes

Quality improvement incorporates making a move to expand the adequacy and proficiency of the approaches, cycles, and systems of the performing association, which ought to give added advantages to the partners, everything being equal. Changes mentioned to extend or decrease project scope, to alter arrangements or methods, to adjust project cost or financial plan or to overhaul to project plan are frequently distinguished while project work is being performed. Solicitations for a

change can be immediate or aberrant, remotely or inside started, and can be alternatively lawfully/authoritatively commanded. Metcalf (2007).

b) Recommended Corrective Actions

Quality improvement incorporates prescribing activities to build the adequacy and productivity of the performing associations. Restorative activity is an activity that is suggested promptly because of Value confirmation exercises, like reviews and cycle examination.

c) Organizational Process Assets (Updates)

The efficacy and effectiveness of the executing companies' quality standards and procedures to satisfy requirements are validated by updated standards of quality. The quality control method employs these criteria of excellence Velopi (2014).

d) Project Management Plan (Updates)

Changes to the quality administration plan that result from changes to the perform Quality Assurance measure will be used to update the project management plan. These updates may include improvements to measures that have been identified,

estimated, and are ready to be put into action, as well as consolidation of cycles that have seen consistent interaction improvement PMI (2015).

2.1.4 Quality Control

“This involves monitoring specific project results to determine whether they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance.” PMI (2015) and PMNetworks (2017).

These cycles connect with one another and with the cycles in the other information regions too. Each cycle can include exertion from at least one person or gatherings of people dependent on the requirements of the task. Each interaction happens to some degree once in each venture and happens in at least one undertaking stage, if the task is isolated into stages. Albeit the cycles are introduced here as discrete components with obvious interfaces, by and by they might cover and communicate in an unexpected way. Roberts (2009).

Undertaking quality administration should address the administration of the venture and the result of the task. Item quality measures and procedures are tailored to the particular kind of item made by the work, whereas project quality administration applies to all activities without much consideration for the notion of their item. For instance, quality administration of programming items involves various methodologies and measures than thermal energy stations, while project

quality administration approaches apply to both. Regardless, inability to meet quality necessities in either measurement can have genuine unfortunate results for any or the entirety of the project stakeholders. For example:

- a) Meeting client necessities by workaholic behavior the undertaking group might create adverse results as increment representative whittling down, unwarranted blunders or adjust.
- b) Meeting project plan destinations by surging arranged quality reviews might deliver unfortunate results when mistakes go undetected.

Quality is “the degree to which a set of inherent characteristics fulfill requirements” (PMBOK, 2005). Stated and inferred needs are the contributions to creating project necessities. A basic component of value the executives in the venture setting is to turn partner needs, needs, and assumptions into prerequisites through partner investigation, performed during project scope the board. Womack (2008).

Quality and grade are not the same. Grade is a class appointed to items or administrations having a similar utilitarian utilize however unique specialized attributes. Inferior quality is consistently an issue, second rate may not be. For instance, a product item can be of great (No undeniable deformities, comprehensible manual) and second rate (A predetermined number of elements),

or of inferior quality (Many imperfections, ineffectively coordinated client documentation) and high grade (Numerous provisions). The task chief and the venture supervisory crew are liable for deciding and conveying the necessary degrees of both quality and grade. James (2009).

Project management is complemented with contemporary quality management. For instance, both disciplines acknowledge the significance of:

- i. **Customer satisfaction:** - Understanding, assessing, characterizing and overseeing assumptions with the goal that client necessities are met. This requires a blend of conformance to necessities (the venture should create what it said it would deliver) and qualification for use (The item or administration should fulfill genuine requirements).
- ii. **Prevention of over-inspection:-**The expense of forestalling botches is for the most part substantially less than the expense of amending them, as uncovered by assessment.
- iii. **Management responsibility:** “Success requires the participation of all members of the team, but it remains the responsibility of management to provide the resources needed to succeed.”
- iv. **Continuous improvement:** “The plan-do-check-act cycle is the basis for quality improvement.” PMBOK (2005). According to the book, “quality improvement initiatives undertaken by the performing organization, such as TQM

and six sigma, can improve the quality of the project's management as well as the quality of the project's product.”

According to PMNetworks (2012), “the cost of quality refers to the total cost of all efforts related to quality. Project decisions can impact operational costs of quality as a result of product returns, warranty claims, and recall campaigns.” However, “the temporary nature of the project means that investments in product quality improvement, especially defect prevention and appraisal, can often be borne by the acquiring organization, rather than the project, since the project may not last long enough to reap the rewards.” Lewis (2010).

2.1.4.1 Quality Control: Inputs

They include the following;

a) Quality Management Plan

As described earlier, the project managers will put the performing organisation's overall policy into practice in accordance with the quality management strategy.

“The quality management plan provides input to the overall project management plan and must address quality control (QC), quality assurance (QA), and continuous process improvement for the project” (Brown, 2014).

b) Quality Metrics

“A metric is an operational definition that describes, in very specific terms what something is and how the quality control process measures it. Quality metrics are used in the Quality Assurance and Quality Control processes.”

c) Quality Checklist

“A checklist is a structured tool, usually component specific, used to verify that a set of required steps has been performed. Many organizations have standardized checklist available to ensure consistency in frequently performed tasks. Quality checklists are used in the quality control process.” Brown(2014).

d) Organizational Process Assets

All of the resources that are utilized to impact the undertaking a good outcome can be drawn from hierarchical cycle resources. Authoritative interaction resources likewise address the association's gaining and information from past activities; for instance, finished plans, risk information, and procured esteem information.

The association's cycle resources could be assembled into two classes.

- i. Organization's cycles and methods for directing work which among others incorporate authoritative standard cycles, like guidelines, strategies (for

example wellbeing and wellbeing strategy and undertaking the board strategy), standard item and task life cycles and quality approaches and systems (for example process reviews, improvement targets, agendas, and normalized process definitions for use in the association.

- ii. Authoritative corporate information base for putting away and recovering data which among others incorporate undertaking records (for example scope, cost, timetable and quality baselines, execution estimation baselines, project schedules, project plan network charts, risk register, arranged reaction activities and characterized risk influence Suneel (2011).

e) Work Performance Information

Work performance information counting specialized execution measures, project expectations fruition status, and the execution of required remedial activities, are significant contributions to quality control. Data from the venture the executives plan about the arranged or expected outcomes ought to be accessible alongside data about the genuine outcomes and carried out change demands.

f) Approved Change Requests

Endorsed change solicitations can incorporate alterations, for example, updated work techniques and reexamined plan. The convenient right execution of supported changes should be checked

g) Deliverables

“A deliverable is any unique and verifiable product, result or capability to perform a service that is identified in the project management planning documentation and must be produced and provided to complete the project.” Suneel (2011).

2.1.4.2 Quality Control: Tools & Techniques

The quality control tools and techniques which are also used for Quality Assurance include cause and effect diagram, control charts, flowcharting, histogram, Pareto

chart, run c
review, as s

TOOLS AND TECHNIQUES
1. Cause and effect diagram.
2. Control charts
3. Flowcharting
4. Histogram
5. Pareto chart
6. Run chart
7. Scatter diagram
8. Statistical sampling
9. Inspection
10. Defect repair review

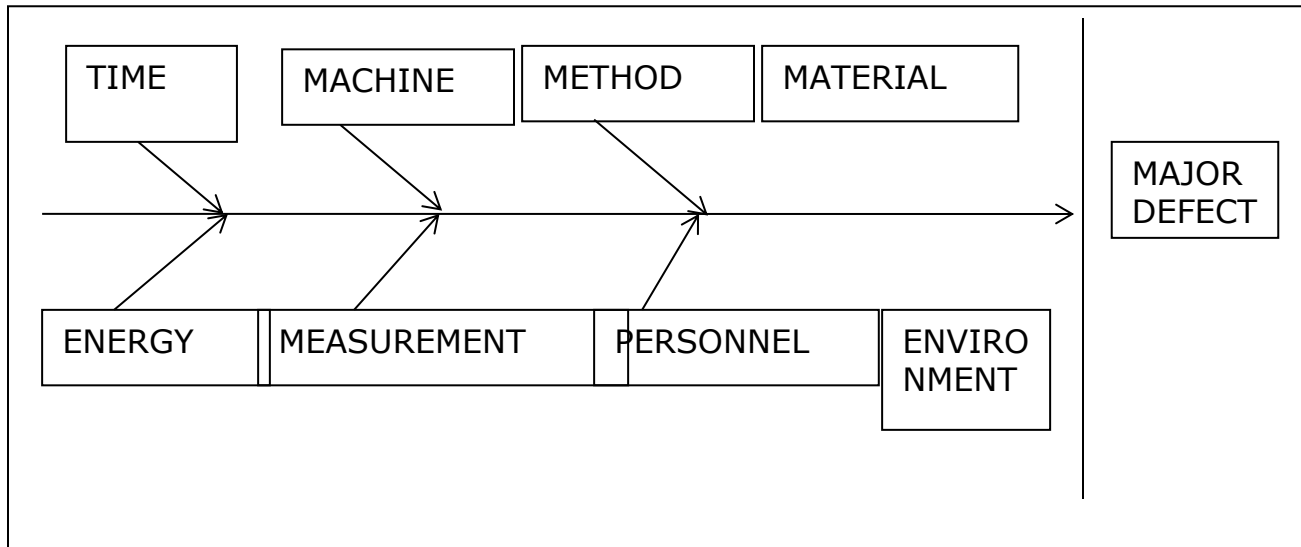
mping, inspection and defect repair

Fig 2.3: Quality Control Tools and Techniques

Source: Project Management Institute PMI (2015)

a) Cause And Effect Diagram

Diagrams of causes and effects show how numerous elements may be connected to future issues or outcomes. This is illustrated in figure 2.4 below.



POTENTIAL CAUSES

Figure 2.4: Cause and effect diagram

b) **Control Charts**
Source: (Pyodor, 2009)

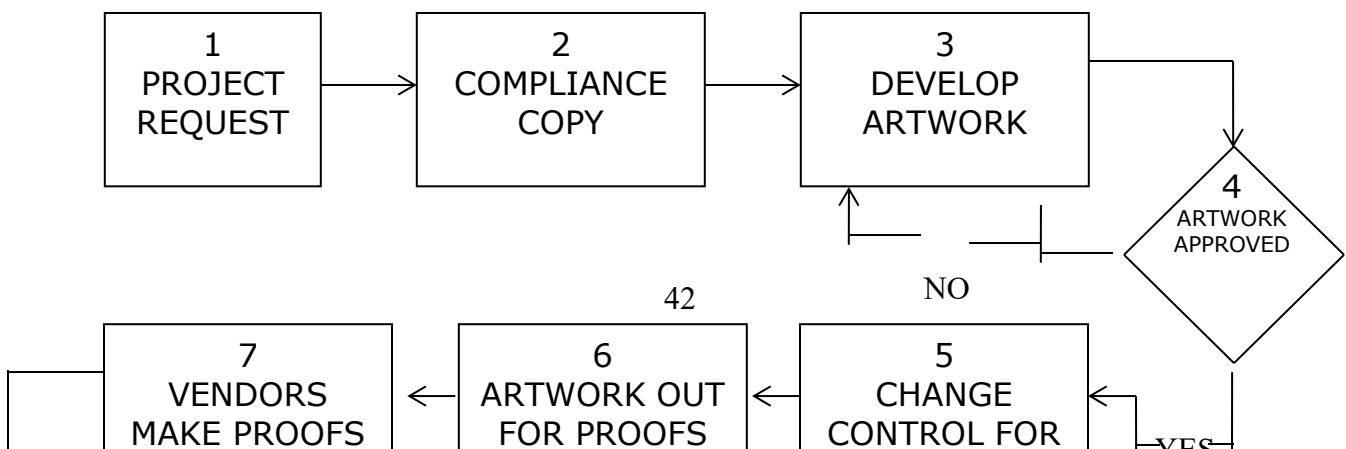
The purpose of a control chart is to determine whether or not a process is stable or Has unsurprising execution. Control diagrams might fill in as an information gathering instrument to show when an interaction is dependent upon unique reason variety, which makes a wild condition. Control diagrams additionally represent how an interaction acts after some time. They are a realistic showcase of the collaboration of interaction factors on a cycle to address the inquiry, are the interaction factors inside satisfactory cutoff points? By observing the yield of an

interaction over the long haul, a control diagram can be utilized to evaluate whether the utilization of cycle changes brought about the ideal enhancements.

Control outlines can be utilized for both task and item life cycle measures. An illustration of undertaking utilization of control diagram is deciding if cost fluctuations or timetable changes are outside of satisfactory cutoff points. An illustration of item utilization of control graphs is assessing whether the quantity of deformities found during testing are adequate or inadmissible corresponding to the association's guidelines for quality. Fyodor (2009).

c) Flowcharting

A flowchart is a graphical portrayal of a cycle. Flowcharting assists with breaking down how issues happen. Although cycle flowcharts come in a variety of designs, they always display exercises, choice of emphasis, and the need for preparation. Flowcharts demonstrate the relationships between the various parts of a framework. The venture group may create strategies for mitigating quality concerns by using flowcharts to help them anticipate when and where they may occur. Figure 2.6 is an example of a process flowchart for design reviews.



d) Histogram

A histogram is a bar chart showing a dissemination of factors. Every segment addresses a quality or normal for an issue or circumstance. The stature of every segment addresses the overall recurrence of the trademark. This instrument distinguishes the reason for issues in an interaction by the shape and width of the appropriation. Omachonu and Ross (2014)

e) Pareto Chart

A Pareto chart is a particular sort of histogram, requested by recurrence of event, which shows the number of imperfections were created by type or class of recognized reason. The Pareto procedure is utilized principally to distinguish and assess dissensions. The venture group should make a move to fix the issues that are causing the best number of deformities first. Juran and Godfrey (1998).

f) Run Chart

A line graph called a run chart displays data points drawn in the sequence in which they occur. A run chart reveals the evolution and occurrence of variance. Run charts display trends over time, variations over time, decreases or improvements over time in a process. PMI (2015). Run charts are used for trend analysis. Utilizing mathematical methods, trend analysis predicts future outcomes based on past performance.

g) Scatter Diagram

The pattern of association between two variables is displayed in a scatter diagram. The quality team may examine and determine any connections between changes seen in two variables using this tool. The relationship between dependent and independent variables is displayed. The more closely connected two points are, the nearer they are to a diagonal line. Montgomery (2009).

h) Statistical Sampling

Selecting a subset of a population of interest for statistical sampling (for example, selecting ten designs at random from a list of seventy-five). The cost of quality control may frequently be decreased with appropriate sampling. The project's management team ought to be knowledgeable with a range of sampling methods. Dale and Mcquater (1998).

i) Inspections

An assessment is the assessment of a work item to decide if it adjusts to principles. For the most part the consequences of an assessment incorporate estimations. Examination can be directed at any level. For instance, the consequences of a solitary action can be assessed, or the eventual outcome of the venture can be reviewed. Investigations are additionally called surveys, peer surveys, reviews, and walkthrough. Examinations are additionally used to approve deformity fixes.

j) Defect Repair Review

The quality control division or a comparable agency may conduct a defect repair evaluation to make sure that product flaws are fixed and brought into accordance with standards or specifications (Mei, 2009).

2.1.4.3 Quality Control: Outputs

According to PMBoK (2005) and PMI (2015), they include the following;

a) Quality Control Measurement

Quality control estimations address the consequences of value control exercises that are taken care of back to quality affirmation to rethink and break down the quality guidelines and cycles of the performing association.

b) Validated Defect Repair

The fixed things are re-examined and will be either acknowledged or dismissed before warning of the choice is given. Dismissed things might require further imperfection fix.

c) Quality Baseline (Updates)

The quality pattern records the quality target of the task. The quality benchmark is the reason for estimating and announcing quality execution as a feature of the presentation estimation gauge.

d) Recommended Corrective Actions

Remedial moves include activities made because of a quality control estimation that demonstrates that the assembling or improvement process surpasses laid out boundaries.

e) Recommended Preventive Actions

Preventive move includes activity made to thwart a condition that might surpass laid out boundaries in an assembling or improvement process, which might have been shown through a quality control estimation.

f) Requested Changes

Mentioned changes will be changes mentioned to extend or diminish project scope, to alter arrangements or methodology, to adjust project cost or spending plan or to overhaul the undertaking plan. Goldman, (2014) believed that these are frequently recognized while the venture work is being performed. If the recommended corrective or “preventive actions require a change to the project, a change request should be initiated in accordance with the defined integrated change control process.”

g) Recommended Defect Repair

A deformity is where a part doesn't meet its necessities or determinations, and should be fixed or supplanted. Defects are recognized and suggested for fix by the quality control division or comparatively named association. The undertaking group ought to put forth every sensible attempt to limit the blunders that cause the requirement for deformity fix.

h) Organization Process Assets (Updates)

In the improvement of a task contract and thusly project documentation, all the resources that are utilized can be drawn from hierarchical cycle resources. “Organizational process assets also represent the organization’s learning and knowledge from previous projects, for example completed schedules, risk data and earned value data.” PMI (2015).

“When checklists are used, the completed checklists should become part of the project’s records. The causes of variances, the reasoning behind the corrective action chosen, and other types of lessons learned from quality control should be documented so that they become part of the historical database for both this project and the performing organization.” PMBOK (2005).

i) Validated Deliverables

The objective of value control is to decide the rightness of expectations. The aftereffects of the execution of value control processes are approved expectations.

j) Project Management Plan (Updates)

This includes refreshing the venture the executives intend to reflect changes to the quality administration plan that outcomes from changes in playing out the quality control process. Mentioned changes (increments, adjustments or cancellations) to the undertaking the executives plan and its auxiliary plans are handled by audit and demeanor through the incorporated change control process (Lowry, 2012).

2.1.5 Obstacles Confronting Road Construction Projects

Proper road construction greatly improve economic activities, “the wellbeing of citizens, improve their lives, connect large cities with remote rural areas, expand social and economic activities, reduce accident rates and attract foreign investments.” Femi (2014). However, there are a number of obstacles hampering the effective delivery of road projects.

Ikande(2018) outlined some of the obstacles confronting road construction projects to be the following;

a. Extension of deadlines

A close observation of all the projects being carried out in South-east, Nigeria, uncover that a couple of them get finished on schedule. Most occasions work gets extended past the arranged span, which is a proof of powerless discipline.

Because of lack of foresight, it will in general take substantially more energy, cash and time to understand the plans being set out. This recommend that the authorities answerable for completing these tasks regularly err everything necessary, that is they are not capable in their field of action.

Workers for hire ought not begin huge scope occupations without knowing every one of the subtleties, or contemplating the construction; else, they end up in circumstances where coordinators just don't comprehend which course to move in. shockingly, numerous street advancement projects in Imo state are being done with such carelessness.

It is important to ascertain everything ahead of time to try not to need to suspend work because of the expansion of new capacities and undertakings that go past the recently concurred plan. On the off chance that time and cost of street development materials are not painstakingly determined toward the beginning, the whole task winds up less useful than anticipated.

The change in planning becomes inescapable if the venture fires up excessively summed up and ambiguous. The accompanying variables can cause this as placed by Brown, (2014):

- i. Lack of an unmistakable succession of documentation.
- ii. Unforeseen clashes between colleagues, clients and entertainers.
- iii. Also, clients can demand getting extra work at an unnecessarily discounted cost.
- iv. Starting work without cautiously ascertaining expenses and benefits.
- v. Change of introductory necessities.
- vi. Sometimes coordinators guarantee astonishing outcomes under a spending plan yet wind up acknowledging it can't work, so they wind up conveying more terrible outcomes.

b. Insufficient funding

The development of streets require significant monetary assets; the gear's expense a great many naira, so project workers generally speaking, end up going up against manage money related issues. The yearning to buy materials more affordable and pay less money to agents by and large goes with antagonistic outcomes. Nonattendance of satisfactory resources can be a support dismissing road improvement projects. Ikande (2018) complemented that clients don't impart a ton of confidence in novice laborers for recruit since they would rather not consume cash on sketchy endeavors and become overcomers of deferrals; banks moreover

rarely finance them. Cash is even more consistently provided for gigantic associations. State Service of Works is responsible for the arrangement, improvement, recuperation and orchestrating of road associations. This affiliation appropriates immense arrangements generally through the state and controls the execution of road projects. The public authority can hardly be implied as a trustworthy supervisor since portions for specialists of venture laborers are consistently delayed Ikande (2018).

c. Poor Quality Control

Another problem road construction projects often face is weak quality control; this results in circumstances where unquenchable specialists for enlist end up buying unassuming materials and keeping the excess equilibrium in their own pockets. The situation furthermore gets puzzled by lacking funding. If constructors don't move toward all that they expect to work satisfactorily, it turns out to be difficult to blame them for terrible results. Now and again the commonplace recklessness prompts antagonistic results as critical nuances are not given authentic thought. Checking of all cycles and materials required for advancement end up not getting finished precisely (Mary, 2018).

d. Unfinished Projects

In the construction industry, in the development business, there are numerous instances of undertakings that have been quickly dispatched however never finished; more often than not the workers for hire don't get back to them. This brings up a significant issue - why bother beginning these undertakings in any case just to squander cash and energy? These circumstances are particularly found in government projects on the grounds that there is debasement and political issues in regulatory contraption. Change of force carries basic impacts to a ton of things in the country; the new government may not be keen on proceeding with work on certain undertakings, so they simply freeze them. Such a destiny has come to pass for some encouraging thoughts. Ikande (2018).

e. Low Knowledge Base

Perhaps the most issue of street development is that accomplished specialists don't give information to their adherents. New experts don't have a clue how to appropriately complete soil testing, adjust the street, and lay rubble or black-top. What's more, constructors should check the nature of the materials being utilized. Counseling firms don't prepare experts in the turn of events and translation of drawings, so consistently the nature of street works deteriorates. Mary (2018). More often than not, counseling associations draw in employed architects yet don't permit youthful experts to take an interest in fostering the activities. This prompts an enormous hole in information. Thusly, most alumni of designing preparing

organizations in Nigeria don't have pragmatic information. Present day strategies for development are likewise not completely utilized nowadays. In this way, numerous streets don't relate to real necessities as far as time, cost and quality.

f. Poor Maintenance

Poor road upkeep has turned into an illustration of negative culture in the nation and a propensity which the specialists are delayed to battle. Notwithstanding the tremendous speculation, Nigerians don't get the outcomes they merit. Streets are once in a while laid on ominous, unsteady soil. In certain spaces, you can consider a to be measure of trash as spotless ups don't get done consistently. In provincial regions, some side channels stay totally hindered; this is particularly found in the eastern piece of the nation where the dirt is inclined to disintegration. Really focusing on waste channels and frameworks is critical for Nigeria. The focal channel should be appropriately associated with every one of the channels. In the event that enough consideration isn't paid to such subtleties, the revamped streets wind up getting back to their miserable state. Ikande (2018).

g. Bureaucracy

The method involved with dispersing material assets and acquiring every one of the archives essential for doing work can be very lengthy. Delays and depleting strolls starting with one office then onto the next lead to circumstances where the

underlying arrangement loses pertinence, and the wellsprings of subsidizing might be lost, in this manner, promising thoughts don't convert into the real world Mary (2018).

2.1.6 Possible Strategies for Combating the Obstacles in Road Construction Projects

This study highlighted few strategies to make quality assurance more valuable and therefore making it an effective strategy in tackling poor quality of road projects:

a. Project Monitoring

According to Abe (2012), “monitoring and control are two management functions that play a very important role in delivering a quality project.” A lot of authors have taken planning as the most important factor in a project life cycle. Arranging characterizes the systems, strategies and techniques for accomplishing project targets, while observing and control give the expected balanced governance for guaranteeing that the plans and generally speaking venture goals are accomplished.

It is observed that the monitoring and control of projects in the state is being handled majorly by the contractors. It is quite understood that the Imo state Ministry of works are in Charge of projects in the state but there has been inadequacy in the monitoring of the project. This gives these contractors the leverage to use substandard materials in executing the project, hence, quality in

affected. In Cross River State for instance, the government introduced a department whose sole responsibility is to monitor project from its inception to closeout phase and this yielded tremendous results. Monitoring and Control gives the client a feedback of what is going on in the field. Checking is viewed as series of perceptions in time, did to show the degree of consistence with a formed norm or level of deviation from a normal standard. Nabris (2002) "in his own view characterized observing as a continuous movement to follow the headway being made by an element or a peculiarity against an arranged undertaking." As per Abe (2012) checking is focused on the accompanying:

- I. Further developing proficiency and adequacy;
- ii. Assisting with keeping work on target and permits the executives to know when things are turning out badly (ordinary criticism)
- iii. Empowering associations to see whether assets accessible are adequate and being very much utilized accountably;
- iv. Seeing whether limit accessible is adequate and fitting; and
- v. Giving helpful base to assessment

b. Quality Planning

The quality planning methods included in this article are those that are applied to projects the most. There are other others that could be beneficial for specific projects or application areas. The idea that quality is planned, created, and built in rather than examined in the PMBOK is one of the core foundations of contemporary quality management (2005).

Definition of the goals to be accomplished is aided by good quality plans.

A well-defined quality plan outlines how duties, authority, and resources are distributed throughout the many stages of the process or project. This will help in knowing who is responsible for any type of failure or poor quality. Monitoring will be a lot easier this way because it will help the monitoring team to be more specific in their duties.

“At the highest level, quality goals and plans should be integrated with overall strategic plans of the organization.” Mary (2018). “As organizational objectives and plans are deployed throughout the organization, each function fashions its own best way for contributing to the top-level goals and objectives.”

c. Consultancy Services

It has become standard to utilize specialists while presenting new quality practices and strategies, especially where the applicable abilities and skill are not accessible. Also, when new drives and upgrades are needed to help the current quality

framework, or maybe develop current assembling frameworks, the utilization of brief experts turns into a practical arrangement while designating significant assets. Donald (2009). There are different sorts of experts accessible on the lookout, most will have what it takes expected to work with progress exercises like Quality Management Systems (QMS), inspecting and procedural documentation composing. More experienced advisors are probably going to know about specific quality improvement exercises such as “CMMI, six sigma Measurement System Analysis (MSA), Quality Function Deployment (QFD), Failure Mode and Effects Analysis (FMEA), Advance Product Quality Planning (APQP).”

2.1.7 Factors Affecting Quality Assurance on Road Construction Projects in South-East Nigeria

It is obvious that quality assurance is an important role in all environments for the development of infrastructure, including time and cost. As a result, quality has emerged as a crucial component in evaluating the effectiveness of any construction project, particularly those involving roads. The majority of road building projects are of poor quality, which causes delays, cost overruns, and hazardous conditions. Jaideep (2009). But as PMI (2005) noted, there are three different kinds of costs related to quality. The first is appraisal costs, which include testing and service charges. The second is the cost of failure: the expense of redoing the work, and the third is the cost of preventative measures: the cost of upkeep and improved design.

Most times project managers are given the responsibility of achieving success in project delivery, but unfortunately they lack the necessary authorities to control the resources meant to plan and implement the projects as a result become frustrated. Akpan and Chizea (2007). In order to achieve success, it is necessary to expose the project managers and other project experts to critical factors that may threaten their quality assurance performance, especially in road construction projects. They include but not limited to

2.1.7.1 Project Funding Pattern

Abas, (2015) said that significant financial resources are needed for road development because the materials, machinery, and other inputs cost millions of naira. As a result, project leaders and contractors frequently have financial difficulties. “The desire to buy materials cheaper and pay less money to employees usually compromises the quality with adverse consequences.” However, PMI, (2005) have blamed lack of sufficient fund as one of the major reasons for poor quality performance of projects. The manner in which some clients release project fund that is characterized with delays, shortage of required payment and the difficulty in sourcing project funds have all contributed to poor project financing, especially in Imo State as posited by Anyamkpa, (2017). Clients do not express much confidence in contractors with bad records of project performance because no meaningful client will want to be cut up with failed or substandard projects after

committing a lot of resources. This seen as the major reason for low quality project delivery, especially road projects in Imo State.

2.1.7.2 Lack of Quality Control Metrics

According to Ikande (2018), “another problem often faced in road construction projects is weak quality control metrics” or total lack of any standard for measuring the quality level of road projects. As a result, there are instances where rapacious contractors purchase inexpensive and substandard materials for project implementation which delivers low quality projects that merely last for one year. The economic effects of this can only be imagined, as can be seen in the case of the people of Nekede and Obinze in Imo State. The situation also gets complicated by insufficient or lack of proper funding of the projects. Due the problem of funding, poor monitoring and control becomes difficult as no standard is set to assure the quality of these projects. Hence, corruption and indiscipline on the part of the Government are blamed for this. The monitoring of all construction-related procedures and materials does not actually take place or carried out properly since there no standard of measurement or assessment of quality output.

2.1.7.3 Political Influence/ Interference

The idea of settling friends and family members with government projects as witnessed in Imo State in the past recent years have been blamed for the spate of

poor project delivery that are littered around the State. Political interference and instability in Government is a key factor in level of quality seen in construction projects, especially road projects. Anyamkpa (2017). It is noteworthy that the State Governments in the South-east have undertaken numerous road construction projects to rescue the Zone from poverty and improve their economic wellbeing, but these efforts appear to be far from actualization due to political affiliations and or interference which does not support any meaningful development as opined by Ofor, (2018). Hence political interference does not allow quality assurance of projects, especially, road projects.

2.1.7.4 Attitude of Contractors to Quality Standard

Quality is a name that construction firms should possess. Unfortunately, the level of insincerity and corruption has relegated this to the background as most contractors in public sector projects have seen it as a nobody's business, hence quality output becomes a mirage that can only be envisaged. Government agencies or clients no longer consider quality performance records as a basis for awarding contracts, as a result contractors have become careless regarding quality assurance. However, Hassan & Bolaji, (2011) have warned that until project owners set standard for acceptance, contractors will keep delivering substandard products with no regards for quality assurance and acceptability. This is the experience in most States in the South-eastern zone of Nigeria. Due to lack of monitoring and

evaluation of projects, occasioned by political interference, contractors have no regards for quality assurance of their projects. Road projects are mostly affected due to the pressure pose on it by the users.

2.1.7.5 Inclement Weather Conditions

The bad condition of the weather coupled with the low standard of material inputs and workmanship, road projects can rarely withstand long period of time before getting worse. Climatic conditions seriously affect poorly delivered projects. Femi, (2014). Hence, quality should be the backbone of any project, especially road construction projects, due to the high pressure it is exposed to after delivery.

2.1.7.6 Unnecessary Bureaucratic Process

It might take a while to distribute material resources and get all the paperwork required to complete job. In cases where the original concept loses significance and the financing sources may well be lost due to delays and tedious treks between offices, intriguing ideas might not materialize (Samuels, 2015).

2.1.7.7 Level of Knowledge Base/ Competence

According to Ikande (2018), One of the biggest issues with road building is that seasoned engineers do not teach their successors new skills. The alignment of the road, the right way to test the soil, and how to install asphalt or rubble are all skills that new professionals lack. Additionally, builders must verify the quality of the

materials they are using. Counseling firms don't prepare experts in the turn of events and translation of drawings, so consistently the nature of street works deteriorates. More often than not, counseling associations draw in employed specialists yet don't permit youthful experts to take part in fostering the ventures. This prompts a colossal hole in information. Thusly, most alumni of designing preparing establishments in Nigeria don't have viable information. Present day techniques for development are additionally not completely utilized nowadays. Sadiya and Mohammad (2014). Subsequently, numerous streets don't relate to genuine prerequisites as far as time, cost and quality.

2.1.7.8 Quality of Materials/Equipment's

Rahman (2017) opined that quality of materials/equipment is one of the most crucial elements affecting the execution of road building projects. He continued by saying that bad materials procurement and inventory management systems were shown to be the most significant causes of low quality building materials and equipment. He also claimed that the origin or availability of construction materials was another significant factor.

2.1.8 Conceptual Framework

“A conceptual framework is defined as a presentation in graphical form of the relationship between the identified variables in a study.” Barasa, (2014). It

provides a graphic representation or visual representation of the important study variables. Mburu and Apiyo (2014). A dependent variable changes as a result of changes in other variables, while a predictor variables is that which causes a shift in a dependent variable, as according Saunders, Lewis, and Thornhill (2009). External variables are independent variables that are not crucial to the investigation's goal but might nonetheless have an effect on the dependent variable. Kothari, (2004). (2004). The independent variables in this research are things that make it difficult to provide quality control over projects to build roads; the dependent variable is the degree of quality control over those projects; and the irrelevant variable is the framework for quality control. Figure 2.4 depicts the theoretical framework used for this study.

Independent Variables

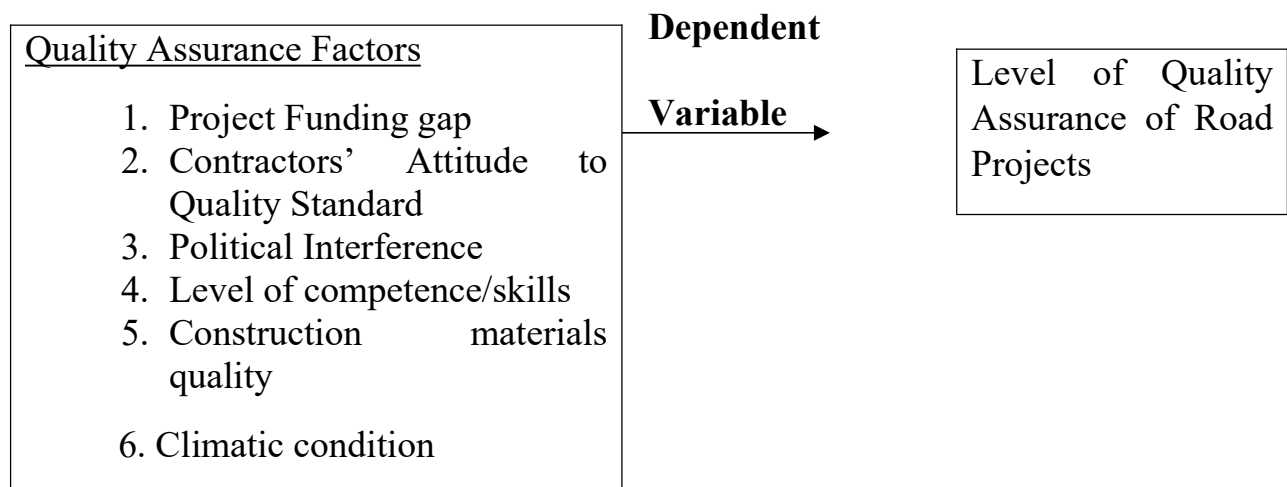


Figure 2.4: Conceptual Framework

Source: Table 3.3 Identified Quality Assurance Factors and Associated Authors using Content Analysis

2.2 Theoretical Review

There are several theories regarding quality assurance as it is defined in ISO 8402. The Joseph M. Juran trilogy, which describes the steps of quality planning, quality control, and quality assurance, is an approach to the theories of buildability assurance. Mitra, (2019). (2019). The Project Management Institute also uses this theory to describe the body of knowledge in managing projects. It proposes a trilogy with distinctions in quality process improvement and quality assurance. application of the trilogy—which consists of planning phase, quality assurance, and quality control—to the project. PMI, (2004). (2004). This research is based on Joseph Juran's theory of Total Quality Management (TQM). This is due to the fact that overall quality management offers a practical means of obtaining quality assurance. Organizations are endeavoring to embrace and execute various types of value the board frameworks like Worldwide Association for Normalization (ISO), English Guidelines (BS) and Absolute Quality Administration (TQM). Quality-based organizations have become trustworthy and draw in additional clients through the arrangement of more excellent administrations and items conversely,

with non-quality-based organizations Low and Teo, (2004). All out Quality Administration is a quality administration framework which seeks after greatness in consumer loyalty through ceaseless upgrades of items and cycle by the complete contribution and devotion of everybody engaged with the interaction or the items. Pursue (2001). McAdam and Kelly, (2002). When applied really, TQM empowers an organization to work on long haul connections, make an amicable cooperation, improve incredible skill and abilities in all circles of the business area, support open addressing of issues and assist with accomplishing the expected venture targets and advantages. Low and Peh, (2016). Different advantages to be acquired from TQM execution incorporates further developed clients, specialists and provider connection, decreased 'cost of value', on time and inside financial plan projection fruitions, decrease in postpones in development works, and expanded benefit. Love, (2000). Notwithstanding, other proof shows that numerous associations are frustrated trying to carry out TQM. A study of 500 American Chiefs showed something like 33% who accepted that their TQM program had a cutthroat effect. Etlie, (2017). TQM depends on ceaseless improvement. It is a continuous interaction, not a convenient solution, and associations that receive rewards from TQM typically do as such by progressing bit by bit and changing their technique as they get to the next level. This can be in a type of lessening the process duration (the all out time it takes to finish a cycle) or zeroing in on the

client and not on the actual association. Cautious preparation and immense measure of time and exertion are expected for fruitful reception and execution of TQM in an association. Lee, (2002). Once more, non-existent or wasteful quality administration strategies add to TQM execution disappointments. Arditi and Gunaydin, (1997); Martínez-Lorente, (2000); Martinez –Costa, (2009).

2.3 Empirical Review

Both in industrialized and emerging nations, several studies have been conducted to look at the elements that have a significant impact on quality management and assurance on construction projects. In a work conducted by Rizwan and Sarosh, (2008) on the critical factors that inhibits quality assurance level of construction projects in Netherland identified material prices escalation, power politics, lack of quality standard metrics, poor attitude of contractors to quality standards and bad climatic conditions, inflation, procurement selection of materials, lack of communication, expertise level of worker, and poor supervision. Rizwan and Sarosh (2008). Relative Importance Index (RII) was used to rank the nine (9) factors which indicates that poor supervision is the most critical factor that affect quality assurance of construction projects. Iyer (2006) in a related study on total quality management (TQM) of construction projects, identified bad weather condition, lack of project management skills, poor funding, intentional low contract

quotation, and perceived quality ignorance. The t-test result of the factors show that all the three (5) identified factors show high level of significance in TQM of construction projects in Nepal with intentional low contract quotation being the most significant factor that affect TQM in the area. However, on a similar study on quality assurance and its realization in construction projects in developing countries, Nigeria inclusive by Razak (2014) and Okoye (2012), “they identified availability of quality construction materials, political environment, site staff experience,” weather condition and record keeping and documentation as the factors that have bearing on quality assurance realization in construction projects. Further investigation, using RII show that political environment which surrounds construction projects is the most critical factor that inhibits the realization of quality assurance in most construction projects in developing countries.

Jha and Iyer (2016), concentrated on quality execution factors influencing development projects in India. Poll study was done and information gathered from huge development ventures. From the review, the basic variables got incorporates: project directors capability, top administration support and their skill, association between project members, proprietors ability and observing and input by project members, inappropriate funding, struggle among project members, threatening financial and climatic condition, obliviousness and absence of information and forceful rivalry at the delicate stage are found to influence the quality presentation

of activities antagonistically. After their analyses with Factor Analysis and RII, they discovered that factors such as project managers capability, top administration support and their ability, connection between project members, checking and criticism are the elements having positive commitments to accomplishing the ideal quality level while struggle among project members, absence of information, antagonistic financial and climatic circumstances are the variables that unfavorably influences the quality presentation of activities, particularly, development projects.

Ahzahar, Karim, Hassan and Eman (2017) led a review to track down the elements to street development quality disappointments and deformities in development industry. The investigation discovered that disappointments and deformities are normal in development which rises cost, length and assets. The recognized variables are climatic circumstances, area of building, development materials, subsidizing nature, support, broken plan and absence of oversight. Sadiya and Mohammad (2014) did a distinguishing proof of the elements influencing quality in building development projects in Gaza Strip. The review was embraced to decide the fundamental elements influencing nature of building development projects in Gaza Strip. They identified substandard materials inputs, low level of workmanship, high cost of quality materials, political intervention, irregular funding pattern and, poor climatic conditions. Gatugu (2014) established the factors affecting construction projects, using a case of Anglican Church of Kenya,

St Andrew's Cathedral Archdeaconry, Thika, Kiambu County. The factors identified by him include lack of quality measurement metrics, improper funding arrangement, cost of construction materials, insincerity, poor skilled workers, and, lack of adequate planning. The t-test result and factor ranking show that low level of skilled labour accounted most as a contributory factor to poor delivery of the church building.

Teena (2014), done a poll based study which was utilized to figure out the mentality of workers for hire and specialists towards factors influencing nature of development projects in India.

Shobana and Ambika (2016), uncovered that the critical variables influencing quality administration in Istanbul are absence of event of meeting, natural dangers, working hours, material postponement and work lack, coordination, checking stock level, asset deferral and wellbeing safety measures.

Consequently, for a good performance in the quality assurance of construction projects, Samuel (2015) listed the following quality related factors in construction project delivery in Senegal according to their level of importance to include; joint working relationship, common goal, no fault culture, presenting quality affirmation measures/strategies, compelling administration of task group by project workers, disposal of organization and political obstruction. Additionally, absence of trust

with provider, unfortunate preparation framework and correspondence hole among project members are factors adding to the accomplishment of value affirmation in development projects Gunaydim, (1997).

2.4 Research Gaps

Numerous renowned authors have worked in the area of quality performance of different construction projects in many geographical areas. However, to the best of my knowledge, none of these studies focused on factors affecting quality assurance on road construction projects in the South-east, Nigeria.

No author have been able to ascertain the individual and collective effects of the factors in the achievement of quality road construction.

These authors have not been able to apply the multivariate technique of Multiple Regression Analysis (MRA) model in analyzing the effect of constraining quality assurance factors in road construction project delivery.

This study seeks to bridge these gaps through an empirical evaluation of these identified with respect to level of quality assurance achieved in road construction project delivery within the South-east geopolitical zone.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

The study adopted a survey technique designed to be descriptive as well as inferential. Survey design enabled the researcher to observe the quality level of most road construction projects within the research area. This was done in order to have a better understanding of the quality assurance level and the factors associated with the quality standard of the projects surveyed.

Based on this, the study problem was stated and objectives for the study set. Then, questionnaire was designed for collecting the information regarding the identified quality assurance factors and their effects on the level of quality assurance achieved in road construction projects in the South-east, Nigeria.

The inferential design allows the researcher to analyze the collected data using Analysis of Variance, Multiple Regression Analysis model involving the t-test, correlation, and F-test. Lastly, conclusions were drawn based on the analyses and

recommendations made for improved quality assurance performance in road construction projects, especially, in the South-East, Nigeria.

3.1.1 Restatement of Hypothesis

The formulated hypothesis were restated to capture the individual factors.

H₀₁: There is no significant deviation between actual quality of road construction projects and quality plan.

H₀₂: The collective effect of all the identified quality factors does not significantly affect the realization of quality assurance in the construction of road projects.

H₀₃: Funding gap has no significant effect on the quality assurance of road construction projects.

H₀₄: Contractors attitude to quality standard have no significant effect on the quality assurance of road construction projects.

H₀₅: Political interference have no significant effect on the quality assurance of road construction projects.

H₀₆: Level of competence/skills have no significant effect on the quality assurance of road construction projects.

H₀₇: Construction materials quality have no significant effect on the quality assurance of road construction projects.

H₀₈: Climatic conditions cannot significantly affect the quality assurance of road construction projects.

3.2 Study Population

“Target population is a well-defined and specified set of people, group of things, households, firms, services that are being investigated.” Ngechu, (2006). This study was based in the South-east, Nigeria. The study population is estimated to be six hundred (600) direct participants in road projects in the Southeast Nigeria. They comprise of quality management experts, construction engineers, road contractors, road users, State project monitoring and evaluation staff of the five States in the Ministry of Works and Transport in the South-eastern region.

The selected road projects for study include the following as shown in Table 3.1;

Table 3.1 Selected Road Construction Projects in the South-east States

S/No.	State	Selected Road Project	Contractor	Estimated Population
1	Abia	Emergency Repairs of Failed Section in Umuahia-Ariam-IkotEkpene Road	Desak Construction Coy Nigeria Limited	120
2	Anambra	Emergency Repairs of Ihiala-Orlu-Umuduru Road	Samchase Nigeria Limited	120

3	Ebonyi	Emergency Repairs of Abakalike-Oferekpe Road Due To Erosion	Kemmasphere Reality Company Nigeria Limited	120
4	Enugu	Umulungbe-Umuoka-AmokwulkedimkpeEgede-OjieiAwhum Road C/No.6459	IDC Construction Limited	120
5	Imo	Repairs of Owerri-Okigwe Road	Lion Unisco Limited	120
		Total		600

Source: Field Study

3.3 Sampling Size and Sampling Procedure

This study adopted multistage and cluster sampling techniques in the selection of road construction projects and target respondents. In conducting this research work, the use of questionnaire to get information from the respondents was of paramount importance to the researcher. Questionnaire was therefore, administered to the selected respondents involved in the study population.

A sample size (n) was arrived at by calculating the target population of 600 with a 95% confident level and an error of 0.05 using the Taro Yamane formula below;

$$n = \frac{N}{(1 + Ne^2)}$$

Where; n= Size of the sample

N = Size of the population,

e = Acceptable error and given as 0.05,

Hence,

$$n = \frac{600}{(1 + 600 * 0.0025)}$$

$$n = \frac{600}{(2.5)} = 240$$

Therefore, $n = 240$ is the sample size for the study. However, the questionnaires were distributed based on judgmental sampling technique in order to capture those that are directly involved in the road construction projects.

3.4 Method of Data Collection

The study made use of both the secondary and primary sources of data collection in collecting the necessary data for analysis in the study. The secondary data were obtained from, the internet, journals, periodicals, and other relevant sources that were available.

“Primary data was gathered utilizing questionnaires from the respondents. A questionnaire is a pre-figured composed group questions to which respondents record their answers, more often than not inside rather firmly characterized options, which is extremely important technique for gathering an extensive variety of data from respondents.” (Sekaran, 2006). Kothari (2007) “terms the questionnaire as the most proper instrument because of its capacity to gather a lot of data in a sensibly fast traverse of time. It ensures privacy of the source of data through obscurity while guaranteeing institutionalization.” Chandran, (2010). “It is for the above reasons that the source is picked as a suitable instrument for this study.” The

questionnaire was structured to provide respondents with easy fill-in the data. The questionnaire had two sections.

3.4.1 Pilot Study

The preliminary study was conducted in Owerri, Imo State. The drafted questionnaire (data collection instrument) was administered to twenty five (25) respondents from the respondent group and other quality experts in the area. Their responses were collected and the result were used in conducting the validity and reliability tests.

3.4.1.1 Validity of Research Instrument

Gillham, (2013) said that the test items' coverage of information and abilities should be indicative of the subject's overall knowledge and skill set. It was requested that experts comment on the representativeness and applicability of the questions and make improvements to the design of the research tools. This enhanced the content validity of the information that was gathered. By seeking the supervisor's, lecturers', and other experts' input on whether the questionnaire was sufficient, content validity was gained. Their responses confirm the validity of the questionnaire in data collection.

3.4.1.2 Reliability Test

Instrument dependability is the degree to which it consistently measures whatever it is trying to measure. Bell, (2010). (2010). For the reliability test, Cronbach's alpha coefficient approach is used. For this investigation, a develop composite unshakable quality co-productive (Cronbach alpha) of 0.6 or higher is deemed sufficient for each of the builds. Rousson, Gasser and Seifer, (2012). The research instrument was evaluated utilizing the Cronbach's alpha (α) which is computed as follows:

$$\alpha = \frac{k}{k} - 1 \times \left[\frac{1 - \Sigma(s^2)}{\Sigma s^2 sum} \right]$$

Where:

α = Cronbach's alpha

k = Number of responses

$\Sigma(s^2)$ = Variance of individual items summed up

$\Sigma s^2 sum$ = Variance of summed up scores

A Cronbach alpha coefficient (α) of 0.86 confirms the reliability of the research instrument in collecting relevant data for analysis.

3.4.2 Nature of Questionnaire Distribution to the Selected Respondents Category

The questionnaire administration to the respondents were shown in Table 3.2;

Table 3.2 Questionnaire Distribution

Responden	South-Eastern States	Tota
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Categories	Emergency Repairs of Failed Section in Umuahia-Ariam-IkotEkpen Road, Abia	Emergency Repairs of Ihiala-Orlu-Umuduru Road, Anambra	Emergency Repairs of Abakalike -Oferekpe Road Due To Erosion, Ebonyi	Umulungbe-Umuoka-AmokwuledimkpeEgede-OjieiAwhum Road C/No.6459.Enugu	Repairs of Owerri - Okigwe Road, Imo	Total
Quality managers	9	5	6	8	11	39
Engineers	14	9	7	8	14	52
Contractors	13	7	11	6	24	61
Staff of State project & evaluation	9	5	6	7	11	38
Road users	10	10	10	10	10	50
Total	55	36	40	39	70	240

Source: Field Study

3.5 Content Analysis Procedure

Table 3.3 Content Analysis of Literature Review for Factor Identification

Associated Author (s)	Country	Quality Related Factors
Rizwan and Sarosh(2008).	Netherland	Material prices escalation, power politics, lack of quality standard metrics,lack of communication, understanding of the specified quality standards and bad climatic conditions, inflation, procurement selection of materials, , expertise level of worker, and poor supervision
Iyer (2006)	Nepal	Bad weather condition, lack of project management skills, poor funding, intentional low contract quotation, and perceived quality ignorance.
Jha and Iyer (2016),	India	Project chiefs ability, top administration support and their capability, connection between project members, proprietors skill and checking and criticism by project members, ill-advised funding, struggle among project members, antagonistic financial

		and climatic condition, obliviousness and absence of information and forceful rivalry at the delicate stage.
Razak (2014) and Okoye (2012),	Nigeria	Availability of quality construction materials, political environment, stakeholders attitude towards quality, site staff experience, weather condition and record keeping and documentation
Ahzahar, Karim, Hassan and Eman (2017)	Nigeria	Climatic circumstances, area of building, development materials, subsidizing nature, upkeep, defective plan and absence of oversight
Sadiya and Mohammad (2014)	Gaza Strip	Substandard materials inputs, low level of workmanship, high cost of quality materials, political intervention, irregular funding pattern and, poor climatic conditions, negligence of quality specifications.
Gatugu (2014)	Kenya	Lack of quality measurement metrics, improper funding arrangement, cost of construction materials, insincerity, poor skilled workers, and, lack of adequate planning.
Teena (2014)	India	Conformance to codes and standards, materials, labour and financial problems.
Shobana and Ambika (2016)	Istanbul	Environmental dangers, working hours, labor shortages and material delays, coordination, inventory level checks, resource delays, and safety procedures are all factors.
Samuel (2015)	Senegal	Joint working relationships, shared goals, a blame-free culture, the use of quality assurance tools and techniques, contractor management of projects that is successful, the removal of political and bureaucratic red tape, and a casual attitude toward quality.
Ikande, (2018)		Extension of deadlines, Insufficient funding, Poor Quality Control, Unfinished Projects, Low Knowledge Base, Poor Maintenance, and Bureaucracy.

Source: Field Study

To do this, a critical analysis was made to isolate the major factors that were cited by many authors which a general dimension to quality assurance in most countries.

This was done as shown in Table 3.3.

Table 3.4 Identified Quality Assurance Factors and Associated Authors

Quality Assurance Factors	Associated Authors
---------------------------	--------------------

Project Funding gap	Abas (2015), Anyamkpa, (2017), Jha and Iyer (2016), Ahzahar, Karim, Hassan and Eman (2017), Sadiya and Mohammad (2014), Gatugu (2014), Teena (2014), Ikande, (2018)
Contractors' Attitude to Quality Standard	Ikande (2018), Rizwan and Sarosh (2008), Razak (2014), Sadiya and Mohammad (2014), Jha and Iyer (2016), Samuel (2015)
Political Inclination and Interference	Anyamkpa, (2017), Ofor, (2018), Rizwan and Sarosh (2008). Sadiya and Mohammad (2014), Samuel (2015)
Level of competence/skills	Ikande (2018), Rizwan and Sarosh (2008), Iyer (2006), Jha and Iyer (2016), Razak (2014) and Okoye (2012), Sadiya and Mohammad (2014), Gatugu (2014)
Construction materials quality	Rahman (2017), Rizwan and Sarosh (2008), Razak (2014) and Okoye (2012), Ahzahar, Karim, Hassan and Eman (2017), Sadiya and Mohammad (2014), Gatugu (2014), Teena (2014), Shobana and Ambika (2016)
Inclement weather conditions	Femi, (2014), Jha&Iyer (2006), Rizwan and Sarosh (2008), Iyer (2006), Razak (2014) and Okoye (2012), Ahzahar, Karim, Hassan and Eman (2017), Sadiya and Mohammad (2014).

Source: Table 3.3 Content Analysis for Factor Identification

Among the numerous factors highlighted by the related authors, the following factors have been identified as critical in the quality assurance of road construction project in the South-eastern geopolitical zone of Nigeria. The factors identified for analysis base on the content analysis are project funding gap, quality of construction materials, political party inclination, contractors' attitude to quality standards, and inclement weather condition. This is because they are the major factors that appear to have global implications with respect to quality of projects delivered.

3.5.1 Variable Definition

The following acronyms were used to represent the identified variables/factors that influence the quality assurance of road construction projects in the South-east, Nigeria as shown in Table 3.3;

Table 3.5 Acronyms for the Identified Quality Assurance Factors

S/No.	Identified Quality Assurance Factors	Acronyms
1	Project Funding Gap	X ₁
2	Contractors' Attitude to Quality Standard	X ₂
3	Political Interference	X ₃
4	Level of competence/skills	X ₄
5	Construction materials quality	X ₅
6	Inclement weather condition	X ₆
7	Level of Quality Assurance of Road Projects	Y

3.5.2 Decision Rule for Testing Hypotheses

F – Test:

Accept the null hypothesis (H₀) if $F^* < F_{1-\alpha; k, n-k-1}$ degree of freedom, otherwise the null hypothesis (H₀) is rejected. $F_{1-\alpha; k, n-k-1}$ is the critical value obtainable from the standard F – distribution table, and α = the chosen level of significance, which for the purposes of this study is 5%.

The F-Statistic will test the joint hypothesis that:

$$H_0: b_1=b_2=b_3.....b_k = 0$$

H_A : not all β_k are equal to zero.

t - Test

The null hypothesis (H_0) i.e. $\beta = 0$ is accepted at α level of significance and $n-k-1$ degree of freedom, if $t^*_{cal} < t_{1-\alpha, n-k-1}$ degree of freedom. Otherwise, the null hypothesis (H_0) is rejected. $t_{1-\alpha, n-k-1}$ is the critical value obtainable from the standard t – distribution table, and $\alpha =$ the chosen level of significance, which for the purposes of this study is 5%.

3.6 Method of Data Analysis

Data obtained from the field in raw form were arranged, coded and inputted into the computer for analysis. The study adopted descriptive statistics, Analysis of Variance (ANOVA), Multiple Regression Analysis model and correlation analysis in analyzing the data collected via questionnaire. One way ANOVA was used in testing hypothesis one in a bid to achieve research objective one. Multiple Regression Analysis was adopted in testing hypotheses two and three to achieve objective two. Regression analysis was conducted to show how the quality related factors influence quality assurance of road construction projects in the South-east, Nigeria. The regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

Where: Y = Quality of Road Construction projects;

β_0 = Constant Term;

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 = Beta coefficients which indicate the effect of X_1, X_2, X_3, X_4, X_5 , and X_6 respectively on Y ;

X_1 denotes funding gap, X_2 denotes contractors' attitude to quality standard, X_3 denotes political interference, X_4 denotes level of competence/skills of contractors, X_5 denotes construction materials quality, and X_6 denotes climatic conditions;

ε = Error Term.

While Pearson's Correlation analysis model was adopted in testing hypothesis three (H_{03}) in order to achieve research objective three.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Results from Analysis of Data

These identified constraining factor were used as the basis for designing the questionnaire for collecting the primary data for analysis on the effects of the factors on quality assurance of road construction projects in the South-east, Nigeria.

The data collected from the respondents are presented and analyzed as follows:

4.1.2 Analysis of the Data Collected From the Respondents

The questionnaire distribution and data collected for analysis were shown below in

Table 4.2.

Table 4.2: Statistics of Questionnaire Distributed and Returned.

Respondent categories	South-Eastern States	Total
------------------------------	-----------------------------	--------------

	Abia	Anambra	Ebonyi	Enugu	Imo	
Quality managers	9	5	6	8	11	39
Engineers	14	9	7	8	14	52
Contractors	13	7	9	6	23	58
Staff of State project & evaluation	7	3	4	5	11	30
Road users	10	7	8	9	10	44
Total	53	31	34	36	69	223

Two hundred and forty (240) questionnaires were distributed to the respondents, two hundred and twenty three (223) were returned representing 92.92% of the total population. This indicates high response rate. Therefore, two hundred and twenty-three (223) of the respondents form the basis of our data presentation and analysis in this study.

Appendix II presents the summary of the two hundred and twenty-three respondents, on their assessment of the effects of the factors militating against quality assurance of road construction project delivery in the South-east, Nigeria.

Tables 4.3 and 4.4 below illustrates how Appendix II, which summarizes the scores of 223 respondents, were generated.

Table 4.3: Scores for X_1 to X_5 for Respondent 1

FACTORS	1	2	3	4	5	TOTAL
X1	4	3	2	3	1	13
X2	4	1	3	4	4	16
X3	2	2	3	4	3	14
X4	3	4	3	3	2	15

X5	2	2	3	3	2	12
X6	4	5	3	3	2	17

For example in the questionnaire (Appendix 1), each respondent was to indicate the degree of agreement or disagreement with five statements related to the independent variable, “project funding pattern” (X₁). The first respondent scored 4, 3, 2, 3, 1 for each of the five statements, giving a total score of 13. This is based the Likert summated scale in which the maximum score for each independent factor is 25 and minimum score is 5.

Table 4.4: Level of Quality Assurance in Road Construction Project Delivery for Respondent 1.

DEPENDENT VARIABLE	QUESTIONS/SCORES										Total
	1	2	3	4	5	6	7	8	9	10	
Y	5	4	3	5	4	4	5	3	4	5	42

Table 4.4 has a maximum score of 50 and a minimum score of 10 based on Likert’s 5 point scale. The statements from where the scores were derived are in the questionnaire, in Appendix I. Ten statements on the factors militating against quality assurance of road construction project delivery in the South-eastern geopolitical zone were considered adequate.

4.1.3 Descriptive Statistics for each of the Factors (Y, X₁ to X₆)

The descriptive analysis result is shown in Table 4.5 below:

Table 4.5 Descriptive Statistics Scores of the Factors (223 Respondents)

Variables	Mean	Std. Deviation	N
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Y	31.1076	4.27301	223
X1	19.1300	3.83302	223
X2	17.7668	4.22768	223
X3	19.8323	3.26707	223
X4	18.7399	3.15152	223
X5	18.9184	4.79132	223
X6	18.1928	4.45829	223

The descriptive statistics reveal that the average level of quality assurance in the delivery of road construction projects in the South-east, Nigeria is 31.1076 as a result of the influence of identified factors namely; Project Funding Gap, Contractors' Attitude to Quality Standard, Political Interference, Level of competence/skills, Construction materials quality, and Inclement weather conditions. Political interference appears to have the strongest influence on quality assurance of road projects in the South-eastern zone of Nigeria.

4.1.4 Test of Multicollinearity Using the Correlation Matrix

The correlation analysis table (Table 4.6), indicates the degree of relationship between quality assurance performance of road projects and each of the six (6) identified quality influencing factors. The correlation matrix also shows the coefficient of simple correlation between each pair of variables.

Multicollinearity test was done to determine the degree of independence or dependence of the factors among each other in the study analysis. However, the closer the correlation is to one (1), the more dependent the factors and vice versa.

Table 4.6 Test of Multicollinearity

		Y	X1	X2	X3	X4	X5	X6
Pearson Correlation	Y	1.000	.308	.023	-.616	.238	-.271	-.060
	X1	.308	1.000	.108	-.334	.153	.061	-.206
	X2	.023	.108	1.000	.147	.002	-.355	.250
	X3	-.616	-.334	.147	1.000	.027	-.141	.110
	X4	.238	.153	.002	.027	1.000	.212	-.066
	X5	-.271	.061	-.355	-.141	.212	1.000	-.217
	X6	-.060	-.206	.250	.110	-.066	-.217	1.000
Sig. (1-tailed)	Y	.	.000	.369	.000	.001	.001	.188
	X1	.000	.	.054	.000	.011	.182	.000
	X2	.369	.054	.	.014	.427	.000	.000
	X3	.000	.000	.014	.	.346	.018	.050
	X4	.001	.011	.427	.346	.	.004	.162
	X5	.001	.182	.000	.018	.004	.	.001
	X6	.188	.000	.000	.050	.162	.001	.
N	Y	223	223	223	223	223	223	223
	X1	223	223	223	223	223	223	223
	X2	223	223	223	223	223	223	223
	X3	223	223	223	223	223	223	223
	X4	223	223	223	223	223	223	223
	X5	223	223	223	223	223	223	223
	X6	223	223	223	223	223	223	223

Table 4.6 indicates high degree of correlation existing between the quality assurance performance of road projects and each of the identified constraining

factors. The highest correlation (-0.616) exists between political interference and quality assurance level of road construction projects. What this means is that the level of political interference may have been so high that it negatively affected the level of quality assurance in the delivery of road construction projects in the study areas. The least correlation (0.002) exist between Level of competence/skills (X_4) and Contractors' Attitude to Quality Standard (X_2). This indicates that level of competence/skills may have also been so low that it affected the contractors' attitude to quality standard. This indicates that the low level of competence/skills affected the contractors' attitude to quality standard. This is the situation in the South-eastern States as almost road all the road projects lack quality probably due to high rate of political interference. There is no doubt that this interference attracts wrong award of road projects to incompetent contractors with little or no regard for quality assurance as long as they fulfill the desires of their political allies.

Since the highest correlation is -0.616, the problem of multicollinearity does not arise. The identified factors are independent and can stand alone the analysis.

4.1.5 Analysis of Unstandardized Beta Coefficients

To do this, Table 4.7 which shows the result of the Multiple Regression analysis is useful.

Table 4.7 Multiple Regression Coefficients

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
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		B	Std. Error	Beta		
1	(Constant)	32.765	3.348		10.980	.000
	X1	-.616	.077	-.014	-4.513	.001
	X2	.125	.072	.025	.354	.724
	X3	-.684	.090	-.011	-5.157	.000
	X4	.326	.093	.019	3.283	.035
	X5	.483	.062	.094	4.345	.017
	X6	-.277	.069	-.080	-1.116	.266

a Dependent Variable: Y

From Table 4.7, the following equation was generated for assessing the quality of road construction projects given the influence of 6 identified factors:

$$Y = 32.765 - 0.616X_1 + 0.125X_2 - 0.684X_3 + 0.336X_4 + 0.483X_5 - 0.277X_6 \dots\dots \text{(Eqn.4.1)}$$

Based on this equation, the study can estimate the level of quality assurance performance in road construction projects (Y) given the values of the six identified variables. The coefficients represent the increase or decrease in Y, if each factor is increased or decreased by one unit, while holding all the other factors constant. Three out of the six factors (X₁, X₃ and X₆) exhibited negative influences on the quality assurance of these road construction projects in the South-east Nigeria, meaning that as these factors increase, the level of quality assurance of road projects decrease.

Illustrating this: if X₁ = -0.616, it means that the level of quality assurance of road construction projects (Y) decreases by 0.616 for each one unit increase in funding

gap (X_1), when all the other factors are held constant. We can make similar arguments for X_3 and X_6 .

The factors that exhibit positive influence on quality assurance of road construction projects in Imo State include Contractors' Attitude to Quality Standard (X_2), Level of competence/skills (X_4), and Construction materials quality (X_5). It means that as these factors improve, quality assurance of road construction projects also improve. For example, a one (1) unit increase in Contractors' Attitude to Quality Standard (X_2) will increase quality assurance of road construction projects by 0.125.

Table 4.8 Analysis of Correlation Coefficient (r) and Coefficient of Determination (r^2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.795(a)	.724	.603	.27934	2.782

a Predictors: (Constant), X6, X1, X3, X4, X5, X2

b Dependent Variable: Y

The multiple correlation coefficient (r) of 0.795 indicates a very strong positive relationship between quality assurance of road construction projects and the six identified predetermined factors. While the multiple coefficient of determination (r^2) indicates the proportion of the variance in the level of quality assurance achieved in road construction projects explained by all the six independent

variables. So, an r^2 value of 0.724 in Table 4.8 indicates that the six identified factors jointly accounted for 72.4% of the variance in the quality of road construction projects in the South-east, Nigeria.

4.1.6 Testing the Significance of the Inclusion of All the Independent Variables in the Model

The F-statistic provided by the regression analysis is suitable for such test. It was used to test the significance of the collective effects of all the independent variables (X_1 to X_6) on the quality of road construction projects (Y) as shown in the derived model (equation 4.1).

That is:

H₀: The collective effect of all the identified quality factors do not significantly affect the realization of quality assurance in the construction of road projects.

$$H_0: b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = 0$$

$$H_A: \text{not all } b_k = 0; K = 1, 2, 3, 4, 5, 6.$$

Table 4.9 Analysis of Variance (ANOVA) For Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	497.863	6	82.977	4.531	.011(a)
	Residual	3955.554	216	18.313		
	Total	4453.417	222			

a Predictors: (Constant), X6, X1, X3, X4, X5, X2

b Dependent Variable: Y

From the ANOVA table above, the F-ratio is 4.531 and this is significant at a p-value of 0.011, implying that at 0.05 level of significance, it is significant. Therefore, we reject H_0 , and accept H_A , and conclude that the collective effect of all the identified quality factors do significantly affect the realization of quality assurance in the construction of road projects.

Hence, the inclusion of the six independent variables in the model is significant. So the model (4.1) is significant in predicting the level of quality assurance of road construction projects while considering the identifying constraining factors.

4.1.7 Hypotheses Testing

ANOVA, t-test statistics and correlation analysis, were used for the hypothesis testing as shown below;

H_{01} : There is no significant deviation between actual quality of road construction projects and quality plan.

Table 4.10 ANOVA Result for Deviation between Actual Quality of Road Construction Projects and Quality Plan

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	391.696	20	19.585	2.000	.009
Within Groups	1977.883	202	9.791		
Total	2369.578	222			

From Table 4.10, an F-value of 2.000 is significant at a p-value of 0.009. This implies that at 0.05 level of significance, the actual quality of road projects significantly deviated from the planned quality. We therefore reject the null hypothesis and accept the alternative hypothesis and conclude that there is significant deviation between actual quality of road construction projects and quality plan.

The t-test values in Table 4.7 modified to Table 4.11 were used in the testing of hypothesis on the effect of the individual factors on road construction projects.

Table 4.11 t-test Result of Multiple Regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32.765	3.348		10.980	.000
	X1	-.616	.077	-.014	-4.513	.001
	X2	.125	.072	.025	.354	.724
	X3	-.684	.090	-.011	-5.157	.000
	X4	.326	.093	.019	3.283	.035
	X5	.483	.062	.094	4.345	.017
	X6	-.277	.069	-.080	-1.116	.266

H₀₃: Funding gap has no significant effect on the quality assurance of road construction projects.

From t-value of -4.513 in Table 4.11 is significant at 0.001 based on the p-value, this means that Project Funding gap (X_1) is negatively significant to quality assurance of road construction projects at 0.05 level of significance. The study therefore, reject the null hypothesis and accept the alternative hypothesis with a conclusion that funding gap has significant effect on the quality assurance of road construction projects.

H₀₄: Contractors attitude to quality standard have no significant effect on the quality assurance of road construction projects.

From t-value of 0.354 in Table 4.11 is significant at 0.724 based on the p-value, this means that contractors attitude to quality standard (X_2) is not significant to quality assurance of road construction projects at 0.05 level of significance. Therefore, the study accept the null hypothesis and reject the alternative hypothesis with a conclusion that contractors attitude to quality standard have no significant effect on the quality assurance of road construction projects.

H₀₅: Political interference have no significant effect on the quality assurance of road construction projects.

The t-value of -5.157 in Table 4.11 is significant at 0.000 level of significance, implying that at 0.05 level of significance, political interference (X_3) is significant

to quality assurance standard of road construction projects in the Southeast States. Hence, the study reject the null hypothesis and conclude that political interference have significant effect on the quality assurance of road construction projects.

H₀₆: Level of competence/skills have no significant effect on the quality assurance of road construction projects.

The t-value of 3.283 in Table 4.11 is significant at 0.035 level of significance. This implies that at 0.05 level of significance, level of competence/skill of the personnel(X₄) is critical to quality assurance standard of road construction projects. Hence, the study reject the null hypothesis and conclude that the level of competence/skills have significant effect on the quality assurance of road construction projects.

H₀₇: Construction materials quality have no significant effect on the quality assurance of road construction projects.

From t-value of 4.345 in Table 4.11 is significant at 0.017 based on the p-value, this means that the quality of construction materials (X₅) is significant to quality assurance of road construction projects at 0.05 level of significance. Therefore, the study reject the null hypothesis and reject the alternative hypothesis with a conclusion that construction materials quality have significant effect on the quality assurance of road construction projects.

H₀₈: Climatic conditions cannot significantly affect the quality assurance of road construction projects.

The t-value of -1.116 in Table 4.11 is significant at 0.266 level of significance. This implies that at 0.05 level of significance, climatic condition (X₆) is not significant to quality assurance standard of road construction projects. Hence, the study accept the null hypothesis and conclude that climatic conditions cannot significantly affect the quality assurance of road construction projects.

4.1.8 Ranking the Level of Priority of the Factors

The priority ranking of the factors was done based on their level of effect on the quality assurance of road construction projects considering their t-test values.

Table 4.13 Priority Ranking of the Factors

S/No.	Identified Militating Factors	t-calculated Values	p-Value	Ranks
1	Project Funding gap	-4.513	.001	2 nd
2	Contractors' Attitude to Quality Standard	.354	.724	6 th
3	Political Interference	-5.157	.000	1 st
4	Level of competence/skills	3.283	.035	4 th

5	Construction materials quality	4.345	.017	3 rd
6	Climatic conditions	-1.116	.266	5 th

From the above tests and analyses, we observed that political interference exert the greatest effect on quality assurance of road construction projects in Imo state, followed by project funding gap, construction materials quality, etc. This not unconnected to the high level of political interference and instability witnessed in the South-eastern geopolitical zone of Nigeria, where politicians that who are not construction experts determine the quality of road they can afford to their unqualified available contractors. This is followed by the inadequate and improper funding arrangements experienced by these government contractors which force them to opt for low quality construction materials, hence the quality of road projects delivered and living standard of the people suffers.

4.2 Discussion of Findings

The study has been able to empirically analyze the factors behind poor quality assurance witnessed in road construction projects within the South-eastern Nigeria.

Therefore, the following can be inferred, based on the study hypothesis tested:

Hypothesis One (H₀₁) There is no significant deviation between actual quality of road construction projects and quality plan.

There is significant deviation between actual quality of road construction projects and quality plan (see Table 4.10). This not surprising as most road projects seen in most States in the Zone do not last long before deteriorating. This deviation equally account for the high level of time and cost overrun cannot support projects with good quality assurance. In line with this, Sadiya and Mohammad, (2014) complained that “many roads do not correspond to actual requirements in terms of time, cost and quality.” It is however, evident that most of these road projects experienced fatigue as their time, cost and quality specification are hardly met. Evidences are seen all over States in the South-east, Nigeria and its environs.

Hypothesis Two (H₀₂) The collective effect of all the identified quality factors does not significantly affect the realization of quality assurance in the construction of road projects.

The key factors that affect quality of road construction projects in the South-east Nigeria include; Project Funding gap, Contractors’ Attitude to Quality Standard, Political Interference, Level of competence/skills, Construction materials quality and, Inclement weather condition (see Table 2.2). These factors in one way or the other inhibited the realization of quality road project delivery. Hence, many relevant authors supported these factors, like Ikande, (2018), Sadiya and Mohammad (2014), Razak (2014) and Okoye (2012), etc.

The analysis of the factors revealed that the main factor stalling the quality of road projects in the Zone, and probably the other geopolitical zones of Nigeria is political interference which triggered the effect of the other factors. Also funding problem was very critical, and caused by political interference. These funds may not come at the appropriate time to make it possible for the contractors to follow the intended timeline, which may have led to increases in project length. What was strangely unexpected was the inability/reluctance of the Government of the South-eastern States to promptly release funds for the road projects they awarded. This is the major problem that led to poor quality performance of the road construction projects in the study area and other areas in the State.

However, Project Funding gap, Political Interference and Climatic conditions exhibited negative influences on the quality assurance of the road construction projects in the South-eastern States while Contractors' Attitude to Quality Standard, Level of competence/skills, and Construction materials quality have positive influence on quality of road projects (see Table 4.7). This depicts reality because as political interference, improper funding and climatic conditions increase, quality assurance of road projects decrease and vice versa for those factors with positive influence. When this happen, Contractors' Attitude to Quality Standard, Level of competence/skills, and Construction materials quality are compromised thus hampering the quality of road projects Razak, (2014) and Okoye, (2012). That is

the reason why the development of South-east, Nigeria have been stagnated for long and is still stagnating because most road projects in the States are poorly executed thus, hampering economic development.

Hypothesis Three (H₀₃) Funding gap has no significant effect on the quality assurance of road construction projects.

Project funding gap (X_1) is negatively significant to quality assurance of road construction projects at 0.05 level of significance (see Table 4.11). The implication therefore is that the higher the funding gap, the lower the quality assurance achieved in road construction projects in the Southeast, Nigeria. This is true of the situation on ground because most of these roads like the Umuahia-Ariam-IkotEkpene Road project suffered adequate funding according to a discussion with the contractor and this frustrated their timely completion of the project. However, there is no doubt that the contractor, in a bid to complete her work may have compromised quality. This explains reason behind the sudden dilapidation of the road. Jha and Iyer (2016), also complained that poor funding frustrated their project work which prevented them from achieving the desired quality.

Hypothesis Four (H₀₄) Contractors attitude to quality standard have no significant effect on the quality assurance of road construction projects.

From Table 4.11, the study discovered that contractors' attitude to quality standard is not significant to quality assurance of road construction projects at 0.05 level of

significance. What this means in practical terms is that with proper funding and adequate supervision and monitoring, the attitude of contractors to quality will not prevail. The finding in this study differs from the findings of Ikande (2018) and Razak, (2014). Contrary to the general believe, Contractors' Attitude to Quality Standard should be critical to quality of road projects, but the case is different in this study. It is ideal that contractors who are involved in construction projects such as road projects, should be quality oriented in order to deliver quality projects regardless of the nature of funding and supervision.

Hypothesis Five (H₀₅) Political interference have no significant effect on the quality assurance of road construction projects.

Political interference is negatively significant to quality assurance standard of road construction projects in the Southeast States. This is because the high level of political inclination to contract award is co in the wheel of quality assurance in most construction projects in Nigeria, especially, in the Southeast. The worst is that as political favoritism increases, it negatively affect the delivery of construction project according to quality specification. Anyamkpa, (2017) and Ofor, (2018) agree with this findings. It is should be noted that most of the road projects studied were awarded on political grounds and as a result failed quality tests even after late completion. Ikande (2018) supports this finding and warned that unless politicians

consider quality achievement as a criterion for measuring contractors' performance and deviate from awarding contracts based on political consideration, the issue of quality of projects will remain a problem in most developing countries.

Hypothesis Six (H₀₆) Level of competence/skills have no significant effect on the quality assurance of road construction projects.

The level of competence/skill of the personnel is critical to quality assurance standard of road construction projects. This is true as it is difficult for one to give what he/she do not have. Samuel (2015) in his study complained that most contracts because of political influence are awarded to low level contractors based on party loyalty. This explains why contracts are not awarded to high level contractors in the Southeastern States. Until construction projects are awarded to competent and qualified contractors, the quality of construction project will keep suffering and economic development will keep declining. Hence, there is the need to revert the current trend, if development of the zone will be realized.

Hypothesis Seven (H₀₇) Construction materials quality have no significant effect on the quality assurance of road construction projects.

From t-value Table 4.11, the quality of construction materials is significant to quality assurance of road construction projects. The implication is that if the quality of input is poor, the output cannot be of high quality (garbage in, garbage out). The truth is that most of these contractors in the Southeast, due to their

political inclination to the “powers that be”, will always lower quality of inputs to make more profit with the idea that nobody will probe their activities. Razak (2014), had the same view and warned that contractors should not undermine quality by using substandard materials for construction purposes.

Hypothesis Eight (H₀₈) Climatic conditions cannot significantly affect the quality assurance of road construction projects.

Climatic condition is not significant to quality assurance standard of road construction projects (see Table 4.11). This is a surprise because weather condition have influence on construction projects, especially road construction projects. However, this finding did not support the views of Ahzahar, Karim, Hassan and Eman (2017). In their study they have strongly suggested that construction projects should be done when level of rain is minimal due to its drastic effect on the quality of construct work. This finding may be true in the sense that competent contractors who apply quality equipment and materials plan their construction work in such a manner that inclement weather condition will not affect their construction activities. Only the unqualified contractors with low quality materials are cut up in the bad weather condition, hence affecting the quality of their project delivery.

This also result depicts reality given the situation on ground in the Southeastern State. Bad road attracts low economic activities and low standard of living meaning that current state of poor economic development of South-eastern States

can be attributed to the low level of quality assurance performance witnessed in most road construction projects. This view is supported by Ikpo (2016), that the level of quality delivery of road construction projects determines the level of economic activities and development that take place in the area. In line with the result findings and discussions, conclusion and recommendations can be made.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Road construction project is the driver of economic and social development of any nation. Quality assurance in road projects ensure longevity and durability in the use of delivered projects. There is a general believe that corruption and indiscipline have grown to a level that almost everything is done for selfish reasons without consideration for the wellbeing of the populace.

However, from the findings and discussions of the analyzed data, the following conclusions can be:

(a.) Although political interference may be needed to attract road projects, their influence must not override the duties of experts who have the requisite knowledge needed to realize quality construction road projects. The interference should be more of oversight function to ensure that contractors perform according to specification as opposed to the situation where politicians detect the location and quality of projects based on selfish reasons.

(b.) Appropriate and timely release of project funds facilitate quality achievement and project success. Unfortunately, most clients, especially Government agencies and parastatals, due to bureaucratic bottleneck delay disbursement of funds which negatively affect quality assurance of projects, especially road projects. Funding gap forces road contractors to compromise quality in order to complete projects and recover their expenses.

(c.) Level of competence/skills of the participating personnel in road construction projects should be enough to assist them plan and implement quality project. Unfortunately, due to the funding pattern and corruption which disregards quality considerations, any person can be recruited by contractors at cheap rate, thereby employing the services of unqualified personnel which does not allow quality assurance in road project delivery.

(d.) The quality of materials input to a greater extent determines the quality of the output, but most times the quality of construction material appear to be substandard which in most cases is a result of corruption and funding gap that characterize many road construction projects in Nigeria, especially, the South-eastern States. The Government and other stakeholders in road projects in the South-east geopolitical zone should set standards and ensure that project specification is strictly adhered to for quality project delivery. It is ideal that contractors who are involved in construction projects such as road projects, should be quality conscious in order to deliver quality projects regardless of the nature of prevailing condition.

(e.) Bad road attracts low economic activities and low standard of living. The current state of poor economic development of the South-eastern States can be attributed to the low level of quality assurance performance witnessed in most road construction projects. This is based on the major role that good quality road projects play in the economic networking, especially, in the trade and industrial sector of the economy.

(f.) Since political interference exert the greatest effect on quality assurance of road construction projects in Imo state, it should be used to ensure prompt release of funds to encourage contractors to procure quality materials needed to deliver quality road projects. Qualified personnel are necessary to ensure that those with

quality oriented attitude are employed when it comes construction projects, especially road projects needed for improved economic development of the State.

5.2 Recommendations

The following recommendations are made to improve the future quality assurance performance of road construction projects in the South-east, Nigeria and other parts of the country:

(a.) The interference of politicians should not unnecessarily impose low quality construction projects, especially, road project on contractors for selfish gains, rather it should be more of oversight function to ensure that contractors perform according to approved specification as opposed to the current situation witnessed in most States in the South-east.

(b.) Timely and adequate funding of road construction projects should be maintained throughout the project life cycle in order to bridge the funding gap experienced in most road construction projects and facilitate smooth delivery of quality road projects in the Geopolitical Zone.

(c.) Qualified and experienced contractors with good level of competence/skilled staff strength should be enlisted and awarded road contracts given its level of importance to economic development. To achieve this, transparency and honesty is needed in the award of construction projects, especially road construction projects.

(d.) There is need for proper materials management which ensure proper inspection of materials for quality assurance. This can be done by adopting a standard quality metrics for checking the quality of the construction materials before acceptance and usage. It is ideal that contractors who are involved in construction projects such as road projects, should be quality conscious in order to deliver quality projects that will thrive the needed economic development of the South-eastern States and other States in Nigeria and beyond.

(e.) Political interference should be channeled towards ensuring that road projects are awarded to qualified contractors with good quality assurance records, facilitating the release of funds, ensuring the procurement and usage of quality construction materials in order guaranty quality assurance in the delivery of road construction projects. Qualified personnel are necessary to ensure that those with quality oriented attitude are employed when it comes road construction projects needed for improved economic development of the States.

5.3 Contributions to Knowledge

The study has statistically determined the average quality assurance of road construction projects in the South-eastern States to be 31.11 and identified factors contributory to such abysmal quality performance to aid in road project quality

planning and control decisions in subsequent road construction project implementation.

The collective and individual effects of the quality assurance have been ascertained by this study for management decisions.

The study has been able to empirically show that high level of political interference is the major problem facing quality assurance performance of road construction projects in the South-eastern States, Nigeria.

It has also established the fact that “climatic condition” and “contractors’ attitude to quality” are not the problem of quality assurance in projects performance. This contrary to what the political leaders are saying that salty rain and harsh climatic conditions are the problem of affecting quality assurance in the South-east States.

REFERENCES

- Abas, M. (2015) Evaluation of Factors Affecting the Quality of Construction Projects.
- Abe. S (2012) Role of Monitoring and Controlling in Total Quality Management. A Journal on Problems and Perspectives in Management.
- Akpan, E.O.P. and Chizea, E.F. (2002): Characteristics of a Project, *Project Management: Theory and Practice; 3rd Edition*; FUTO Press Ltd, Owerri, pp.4.
- Akpan, E.O.P. and Chizea, E.F. (2007): Project Lifecycle, *Project Management: Theory and Practice; 4th Edition*; FUTO Press Ltd, Owerri, pp.7.
- Akpan, E.O.P., Echeme, I.I. and Ubani, E.C. (2017) Situational Analysis of Time and Cost Performance of World Bank-assisted Local Empowerment and

- Environmental Management Project (LEEMP) in Imo State, Nigeria, *Project Management World Journal*, Vol. VI, Issue III, www.pmworldjournal.net, March, pp. 12.
- Alexander, A. (2009) Structural Factors Associated with Poor Quality Assurance in Industries. *Journal of Quality Assurance and Project Management*. South Africa. Vol.2, 351-357.
- Alugbuo, C.C. (2002), B.A Practical Guide to Project Writing. Owerri: *Credo Publication*.
- Amadi, T.N. (2007) Aspects of Project Management. Enugu: *Vougasen Publications*.
- Anyamkpa, S.E. (2017) The Economic Effect of Poor Road Construction Projects in Imo State, A Situational Study, *Journal of Development Studies*, 2(5), pp.34
- Anyanwu, K.U (2007) Quality Management. Umuahia: *Rossy Publications*.
- Anyanwu, K.U (2008) Understanding the Percepts of Quality. Portharcourt: *Zoch Publications*.
- Apiyo, R. O. and Mburu, D. K. (2014) 'Factors affecting procurement planning in county governments in Kenya: A case study of Nairobi City County', *International Journal of Economics, Commerce and Management*, II(11).pp. 1-34
- Ardit, O and Gunaydim, H.M.(1997) Perceptions of Process Quality in Building Projects.
- Bernstein, K.L (2012) Issues in Quality Management. *AdatoJournal of Management*. New York. Vol 3, No. 2, pp.107-109.
- Barasa, H. W. (2014) 'Procurement Practices Affecting Effective Public Projects Implementation in Kenya: A Case Study of Kenya Civil Aviation Authority', *European Journal of Business and Management*, 6(6), pp. 49-67.
- Bell, L. (2010) *The Principle of Educational Leadership and Management*.

- Boin, H. (2009) Quality Assurance and Corporate Poverty Reduction Strategies. *Journal of Economics and Public Management. New York. Vol. 5, pp.49-54.*
- Brown, (2014) The Management of Project Management: A Conceptual Framework of Project governance.
- Brown, C.C. (2009) Quality Management: Concept and Principles. Jos: *Ahmed Publications*
- Bruno, A.I. (2009) Elements of Management. Owerri *Crown Publications.*
- Caltrans (2017) Caltrans Project Management Handbook, 5th edition, Office of Project Management Process Improvement, www.dot.ca.gov/hq/projmgmt, Sacramento, pp.33-38.
- Carol, B,M (2008) Total Quality Management, Revised Third Edition.
- Chase. R. (2001) Evaluation Tools of Total Quality Management in Business Organisations.
- Dale, T.G (1998) An Introduction to second Language Research Methods Design and Data. Second Edition.
- Daniel, B.I. (2002) Corporate Socio-Economic Status as a Risk Factor for High Quality Assurance. *Journal of Quality Assurance and Project Management, South Africa. Vol. 2. pp.401.*
- Dogbegah, R. Owusu-Manu, De-Graft, Omoteso, K. (2011) A Principal Component Analysis of Project Management Competencies for the Ghanaian Construction Industry.
- Dueñas and Izquierdo, (2016) Characteristics of the Xen Project Code Review Process.
- Eduardo, V.C. (2011) Evaluating the Unintended Managerial Consequences of Reduced Project Quality. *Journal of International Policy Research Institute. Washington D.C. Vol. 4, pp 88.*
- Eman, K. (2017) Factors Affecting Completion of Road Construction Projects.
- Femi, A.A. (2014) Corruption and Indiscipline in the Construction Industry: The Way Forward, *Journal of Nigerian Institution of Estate Surveyors and Valuers, 31(2); July-October, pp.42.*

- Frankel, P.U. (2010) Evaluating Quality Management Issues. *Grameen Foundation, Washington D.C. Vol. 2, pp 53.*
- Fyodor, C.C. (2009) The Implications of Poor Quality Assurance Schemes in Organizations. *Journal of Quality Development. Ukraine. Vol. 3, pp 106.*
- Gatugu (2014) factors influencing completion of construction projects by church organization: case of anglican church of kenya, standrew's cathedral archdeaconry, thika, kiambu county
- Gillham, P. (2013) Resource Mobilization Theory.
- Goldman, (2014) Model of Emotional Intelligence for dealing with Problems in Project Management.
- Goldman, T.T. (2007) The Impact of Quality Assurance on Efficient Project Execution in Europe. *International Policy Research Institute Journal. Washington, D.C. Vol. 4, pp 52.*
- Hansen, M.E. (2008) Improving the Quality of Project Execution in Africa. *Journal of Project Management. New York. Vol. 4, pp 78.*
- Hart, V.V. (2006) Why Strict Quality Based Organizations are Strong. *Journal of Project Management. New York. Vol. 4, pp 40*
- Hart, W (2016) A Participatory Project Management Cycle
- Hassan, E.R. and Bolaji, O.D. (2011) Activities of Contractors in the Execution of Construction Projects in Nigeria and its Effect in National Development, *International Journal of Science and Technology, Vol. 13, Issue 5, pp.51.*
- Hellsloot. I. (2007) Review of the Politics of Crisis Management
- Ikande. S. (2018) The Potential Life Cycle Management for Project Performance in the Construction Industry.
- Ikpo, S. (2016) The Problem Confronting Construction Projects in the South-East Geopolitical Zone of Nigeria, *Journal of Construction Technology and Management, 3(1)*, Federal Polytechnic, Unwana, Ebonyi State, pp. 11.
- Iwunna, E.T. (2008) Quality Management and Assurance in Nigeria. Lagos: *Excellent Publications.*
- Jaideep, L. (2009) Disposal of High Level Radioactive Wastes in a Geologic Repository at Yucca. *Journal of Project Management. U.S.C pp 4321.*

- James, E.T (2009) Trends in Project Quality Management. *Journal of Technological Advancement. Washington D.C.Vol. 1, pp 88.*
- Jha and Iyer (2016) Critical Factors Affecting Quality Performance in Construction Projects.
- Janette, R.B. (2010) A Consistent Long Linear Relationship between Quality Assurance and Effective Project Execution. *Grameen Foundation. Washington D.C. Vol. 2, pp 52.*
- Juran. J, Godfrey, A.B (1998) Juran's Quality Handbook. Fifth Edition.
- Kaplan, O. (2010) Strategic Quality Assurance Principles. *U.S Department of Energy Journal, Vol. 5, No. 7, pp 310.*
- Kenny, D.E (2010) Introduction to Management. Owerri: *Crown Publications.*
- Kezner, H. (2009), *Project management; A systems approach to planning, Scheduling, and controlling.* John wiley& sons, Inc, New Jersey.
- Kothari, C. R. (2004) Research Methodology, Methods &Technique:. New Delhi: New Age International Publishers
- Lamberton, T.O. (2009) The Role of Environmental Factors in Susceptibility to and Development of Quality Management. *Journal of Economics and Public Management. New York, Vol. 5, pp 78.*
- Lee, C.V. (2002) Total Quality Management in Small Manufacturers: A Explanatory Study in China. International Quality and Reliability Management.
- Lewis, K.O. (2010) The Role of Research: Advancing the Course of Quality Assurance. *Excellent Journal of Research and Development. Cambridge. Vol. 2, pp 74.*
- Low and Teo, G.J. (2004) Implementing Total Quality Management in Construction Firms.
- Low, S.P and Peh, L.C. (2010) Research Design and Methodology
- Lowry, I.E (2012) Incidence of Project Abandonment in Developing Countries. *Gomez Academic Journal for Professionalism.UK. Vol. 6, pp 220.*

- Martinez-Lorente (2010) Relating Total Quality Management, Marketing and Business Performance: An Explanatory Study.
- Martinez-Lorente and Costa. M, (2019) Does Quality Management foster or hinder innovation? An Empirical Study of Spanish Companies.
- Mary, S. (2018) Challenges of road construction in Nigeria.
- Mc Adam, R and Kelly. B. (2002) Investigation of Relationship between Total Quality and Innovation: A Research Study involving small organisations. European journal of innovative management.
- Mei, P. (2009) Advancing the Course of Quality Assurance. Prospects and Challenges. *Journal of Technological Advancement Washington D.C. Vol. 1, pp 119.*
- Metcalf, U. (2007), “The Implications of Poor Quality Control Strategies in the Third World”. *U.S. Environmental Protection Agency Journal. Washington D.C, Vol. 4, 301-311.*
- Ministry of Works, Housing and Transport, Owerri Imo State
- Mitroff, E. (2008), “Quality Assurance Requirements for Nuclear Facility Applications”. *US Department of Energy Journal, Vol. 5, No. 7, 302-308*
- Montes. L, Fuentes.C (2005). Quality Management Implementation across different scenarios: An Empirical Investigation.
- Montgomery D.C (2009) Introduction to Statistical Quality Control.
- Nabris K, (2002) Monitoring and Evaluation. Palestinian Academic Society for Study of International Affairs (PASSIA)
- New York office of Technology (2015) Project Management Processes towards Total Quality Management, www.officeoftechnology.org/projects. Retrieved on 9/11/2020
- Njoku, K.N. (2004), Planning. Umuahia: *Rossy Publications*.
- Nwachukwu, R.B. (2006), “Impediments to Quality Assurance in Nigeria” in [Http://itknowledgeexchange.techtarget.com](http://itknowledgeexchange.techtarget.com).
- Nwaneri; L.A. (2009), “Quality Assurance and Construction Industry” in [Http://itknowledgeexchange.techtarget.com](http://itknowledgeexchange.techtarget.com).

- Nworuh, G.E. (2001), *Fundamentals of Applied Quantitative Techniques for Management Decisions*. Owerri; *Bon Associates Publications*.
- Ofor. J. (2018) *A Process Oriented Quality Assurance and Organizational Performance. A Conceptual Approach*.
- Ohanu, A.E. (2009), *Basic Quality Management*. Umuahia: *Chudex Publications*.
- Okoro, N.U. (2006), *Introduction to Architectural Design*. Jos: *Musa Publications*.
- Okoye, N. (2012) *The Role of Construction Materials in Building Collapse in Nigeria*.
- Omachonu and Ross (2014) *Principles of Total Quality*. 3rd edition.
- Project Management Book of Knowledge (2005), “Definition of Project Management”. *U.S.A. Project Management Institute in www.pmi.org*.
- PMNetwork (2012) *Quality Management Processes, Inputs, Tools/techniques and Output*, *PMNetwork, Vol.16, No.2*, pp. 12.
- Rahman, H.A. (2017) *Influential Factors for Effective Material Management in Construction Projects*.
- Rakowitz, C. (2010), “A New Way to Look at Quality Assurance Practices”. *Jurban Business Vol. 1, P. 59-72*.
- Razak, B.I. (2014) *An Investigation of the status of Malaysian Construction Industry*.
- Richard, E. I. (2003), “Socio-Demographic Factors Associated with Poor Quality Control”. *The Scholarly Journal Archive 48 (2) 92-101*.
- Rizwan, U. F and Sarosh.M (2008) *Cost Overrun factors in Construction Industry of Pakistan*.
- Roberts, H.C. (2009), *Quality Management in England and Wales. Best Management Journal. Vol. 4, P. 311-313*.
- Roberts, T.T. (2011), “Economic Benefits of Quality Management”. *Journal of Project Management. New York, Vol. 4, 59-63*.

- Rudolf, H.P. (2006), "Beyond the Looking Glass Self. Quality Enhancement and Social Structure". *The Scholarly Journal Archive* 46 (2): 77-88, JSTOR 3033844.
- Sadiya and Mohammad (2014) Critical Success Factors for Sustainable Construction Project Management
- Samuel (2015) Cost Model for Unit Rate Pricing of Concrete in Construction Projects
- Saunders, M., Lewis, P. and Thornhill, A. (2009) Research methods for business students. 5th edn. England: Pearson Education Limited.
- Sekaran, U. (2006) Research Methods for Business. A Skill Building Approach.
- Schwalbe, K. (2008): Project Phases and the Project Life Cycle; *Information Technology Project Management, 4th edition*, Cengage Publishing Ltd, New Delhi, pp. 55.
- Shobana and Ambika (2016) Evaluation of factors affecting quality in construction projects
- Sholar, K.R. (2010) "Understanding the Principles of Project Control" in [Http://itknowledgeexchange.techtarget.com](http://itknowledgeexchange.techtarget.com).
- Shrivastava, A. N. (2009), Historical Strikes in Quality Assurance Improvement *International Journal of Management and Economics Gambia, Vol. 2, 23-27*.
- Smith, I.C. (2010), Time and Quality Management. NJ: *Prentice Hall*.
- Stern, O.G. (2009), "Exploring the Role of Economic Empowerment in Sustaining Project Quality". *Journal of Quality Development, Ukraine. Vol. 3, 89-94*
- Suneel, R.N. (2011), "A Time Determination of Quality Assurance Strategies". *Concern Worldwide, Malawi. Vol. 3, 117-119*.
- Teena (2014) Complexity and Project Management: A General Overview
- Trewatha, C.A. (2009), Aspects of Management and Information Science. *Texas: Bekok Publishing Company*.
- Turnow, D.I. (2010), "Managing Quality in Project Execution" In [Http://itknowledgeexchange.techtarget.com](http://itknowledgeexchange.techtarget.com).

Urwick, K. (2008), "Quality Control and Assurance: Prospects and Challenges in Europe". *Journal of Economic Management. Ukraine. Vol. 3, P. 87-96.*

Velopi (2014) Dive into Risk and Project Management

Venette, H.U. (2006), "The Challenges of Quality Determination in Project Evaluation". *Gomez Academic Journal of Professionalism. UK. Vol. 6, 208-210*

Ward, P. (2009)" Why Projects Fail" in www.curofound.europa.html.

Warner, C.E. (2008), "Measuring the Impact of Quality Management on Economic Growth: Taking Stock of What we Know". *Grameen Foundation. Washington D.C. Vol. 2, 32-36.*

Womark, F.U. (2008), Quality Assurance, Man and Society". *Journal of Business and Management. New Jersey, Vol. 1, 200-204.*

Wren, O.O. (2004), "Quality Assurance; A Tool for Sound Project Delivery". *US. Environmental Protection Agency. Washington D.C. Vol. 4, P. 201-206.*

Zornoza, Cruz& González, (2017) Project Management and Engineering Researc

APPENDIX I QUESTIONNAIRE

QUESTIONNAIRE RESPONSE

Respondent,

I am Ajoku, Chidiebere Onu Chisomaga, an M.Sc candidate studying Projects Management Technology in the Federal University of Technology, Owerri, Imo State. We are currently working on the topic: “Factors affecting quality assurance in road construction project delivery in South-eastern Nigeria”.

I earnestly solicit your cooperation in assisting us with honest response in the completion of the questionnaire. Your response will be strictly used for the purpose of completing this study.

Thanks, in anticipation of a favourable response.

Yours Sincerely,

Ajoku, Chidiebere Onu. C.

APPENDIX I (contd.)

1.) Instruction: Please indicate the level of deviation in the actual quality of road construction project delivered from the planned quality in the South-east, Nigeria. Indicate by ticking the appropriate box that suits your response. Your response is expected to be based on direct experience on the quality of road projects which you participated in its construction and delivery.

Very much deviation (VMD) = 1, Much Deviation (MD) = 2, Moderate Deviation (MoD) = 3, Little Deviation (LD) = 4, and No Deviation (ND) = 5.

Question	VMD	MD	MoD	LD	ND
To what extent does the actual quality of road construction project deviate from the quality plan?					

2.) Consider the road construction projects you have participated in the South-east, Nigeria. Using the Likert 5-point scale provided below, please circle or tick the box that indicated the extent to which you agree or disagree with the statement as they relate to the event that occurred in the road construction project(s) which you are reporting. The values attached to the scale are as follows:

- SD = Strongly Disagree = 1 Point
- D = Disagree = 2 Points
- N = Neutral = 3 Points
- A = Agree = 4 Points
- SA = Strongly Agree = 5 Points.

Factor 1: Project Funding Pattern		SD	D	N	A	SA
1	Inadequate fund allocation affected quality performance of road construction projects.					
2	Delay due to bureaucratic problem negatively contributed to cost and time overrun which affected the quality realization of the projects					
3.	Contractor's financial difficulties compromised the quality performance of the road construction projects in Imo State.					
4.	Client's financial difficulties					
5.	Funding gap is a major issue to be considered in quality evaluation of projects, especially road construction					

projects.					
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Factor 2: Contractors Attitude towards Quality Standards		SD	D	N	A	SA
1	Contractors' inability to adhere to quality assurance methods affected quality standard of road construction projects.					
2	Government interference and kickbacks affected the quality standard of road construction projects.					
3.	Use of substandard materials affected the quality standard of road construction projects.					
4.	Poor training system and communication gap contributed to poor quality of road construction projects					
5.	Quality assurance is a major issue to be considered in road construction projects					

Factor 3: Political Interference		SD	D	N	A	SA
1	Frequent government interference in road construction projects create uncertainty and make it difficult to achieve cost, time and quality constraints in project implementation.					
2	The low level of infrastructure provided by the government, contributes to high cost of project implementation and time variations.					
3.	Political interference interrupt construction project plan, thus creating unnecessary hitches during project planning and implementation.					
4.	The affected road projects creates hardship to the people by affecting the economic activities of the area and other nearby areas.					
5.	Government policies and regulatory activities do not really promote the rapid development of the economy through proper project delivery, especially road construction projects.					

Factor 4: Level of Competence/Skills		SD	D	N	A	SA
1	Lack of relevant skills and technical know-how affected the quality performance of road construction projects					
2	Favoritism and nepotism affects quality of projects especially road construction projects					
3.	Lack of awareness about quality management system contributed to poor quality of road construction					
4.	Improper planning, lack of training and improper use of materials affects road construction projects.					
5.	Poor quality of materials affected the quality performance of road construction projects.					

Factor 5: Construction Materials Quality		SD	D	N	A	SA
1	Poor quality of materials affected the quality performance of road construction projects					
2	Low bids due to excessive competition affected the quality of materials used in road construction projects.					
3.	Material price escalation and inflation adversely affected the quality of materials used in road construction projects.					
4.	Kickbacks affected the material quality used in road construction projects.					
5.	Quality of materials is a major issue to be considered in quality evaluation of projects especially road construction projects					

Factor 6: Inclement Weather Conditions		SD	D	N	A	SA
1	Heavy rainfall makes equipment operation difficult and more costly and may cause stoppage of work.					
2	Weather affects the materials being used and this adversely affects quality of road construction work					
3.	Rain during all seasons continue to be the leading cause of delays on road construction.					
4.	Poor weather causes delay in road construction making it difficult to achieve cost and time constraints in project implementation.					
5.	Climatic condition affects the estimated completion time of projects especially road construction projects					