A

Dissertation Report on

Performance Evaluation of Township Projects with and without the implementation of Project management consultancies

Submitted

in partial fulfilment of the requirements for the degree of

Master of Technology
in
Civil Construction Management

by
Mr. Akhil Sanjay Awate
(Roll No. 2227017)

Under the Supervision of
Dr. S. S. Sayyad

Department of Civil Engineering
K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur) 2023-2024

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

CERTIFICATE

This is to certify that, Mr.Akhil Sanjay Awate (Roll No- 2227017) has successfully completed the dissertation work and submitted a dissertation reporton "Performance Evaluation of Township Projects with and without the implementation of Project management consultancies" for the partial fulfilment of the requirement for thedegree of Master of Technology in Construct- Tion Management from the Departmentof Civil Engineering., as per the rules and regulations of Rajarambapu Institute of Technology, Rajaramnagar, Dist: Sangli.

Date:

Place: RIT, Rajaramnagar

Dr. S. S. Sayyad

Name and Sign of Supervisor

Dr. S. S. Sayyed

Name and Sign of External Examiner

Name and Sign of Head of Program

Dr. S. S. Kumbhar

Name and Sign of Head of Department

Dr. S. S. Gawade

Name and Sign of PG Convener

DECLARATION

I declare that this report reflects my thoughts about the subject in my own words. I have sufficiently cited and referenced the original sources, referred to orconsidered in this work. I have not misrepresented, fabricated, or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute.

Place: RIT, Rajaramnagar Name of Student: Awate Akhil

Date: Roll No: 2227017

ACKNOWLEDGEMENTS

I would like to express deep and immense gratitude towards my project guide, Dr. S. S. Sayyad, for the guidance, encouragement and advice he has provided throughout my time as his student. I have been extremely lucky to have a super- visor who cared so much about my work, and who responded to my questions and queries so promptly.

I am also very thankful to Dr. S. S. Kumbhar (Head of Depart- ment, Civil Engineering) and Prof. S. S. Sayyad (Head of Programme, Construct- Tion Management) for their valuable suggestions, and critical examination of work during the progress, I am indebted to them.Additionally, I also want to express my gratitude to my friend Mr. Ranveer Chandrashekhar Hajare for his assistance in finishing the project work.

I would also like to thank all the teaching and non-teaching staff of the Civil Engineering Department at Rajarambapu Institute of Technology, Rajaramnagar, Sangli for their support and help. I acknowledge with thanks to Central library staff and colleagues. I sincerely thank Dr. Kadole (Director, RIT), for supporting me to do this work and I am very much obliged to her. The people with the greatest indirect contribution to this work are my parents and my friends, who constantly encouraged me during this period.

Place: RIT, Rajaramnagar

Date:

Name of Student: Awate Akhil

Roll No: 2227017

ABSTRACT

This thesis explores the impact of Project Management Consultancy (PMC) on township construction projects, with a focus on improving various critical parameters that affect project success. The analysis reveals that PMC implementation leads to substantial enhancements in quality assurance, project planning, labor and resource management, financial oversight, and communication among project participants. Notable improvements include a 31.18% reduction in design defects, a 31.28% improvement in site installation procedures, and a 25.24% enhancement in contractors' financial management. These findings underscore the effectiveness of PMC in mitigating common issues encountered in construction projects, ultimately leading to higher project quality, efficiency, and stakeholder satisfaction. However, the analysis also identifies areas requiring further attention, such as the involvement of the owner during construction and the impact of poor weather conditions. Overall, the study reinforces the value of professional project management practices in achieving successful construction project outcomes.

Keywords:*PMC,Key Indicators,RII,AHP etc.*

Content

List of Figures

List of Tables

Chapter-1
Introduction

1.1. Background of the Study

In order to achieve a better and modernized living standard for their citizens, most developing countries concentrate their resources on improving their economic, social, and technological statuses. Over the recent past, the fight against low-income rates, illiteracy, high number of infant mortality, short life expectancy, and other signs of low socioeconomic development has taken on a new urgency. Several approaches and integrations have been made to eradicate, or at least to minimize, these unfavorable conditions. In view of achieving these goals, the construction industry plays a great role. According to Fred & Janet (1975), the construction industry contributes to economic development by satisfying some of the basic objectives of development including output generation, employment creation, income generation and re-distribution, and satisfying basic physical and social needs. It opens the door to improved education, health systems, transportation, agriculture, trade and so on. It is a way to facilitate and help advance the several aspects of development.

Hillebrandt (2000) pointed out that the construction industry throughout the world, by its nature and as it involves several stakeholders, has many special problems and requirements. On top of that, this sector faces several issues and challenges, especially in developing countries. These factors influence the industry negatively, and rarely in a positive way. Ofori (2000) stated that a number of nations with varying levels of socioeconomic development have recently acknowledged the significance of taking action to improve the performance of the construction industry. With this recognition, countries have been forming an agency that administers the continuous improvement of the industry. The establishment of an agency does not, however, ensure the success of the development of the construction industry due to the nature of the needs and difficulties of the sector and the resource limitations in many developing nations. Therefore, those involved in the construction industry need to develop a consistent process through which

they should be able to monitor their performance and the outcome to identify the areas where sustainable upgrading is required and where improvement is needed.According to James and Dr. Naomi (2021), it is when the Independent Evaluation Group(IEG) of the World Bank approved M&E usage in 1973 that the need for M&E procedures was established. Mackay (2007) reaffirmed that since that time, the World Bank has begun to help government initiatives in developing nations by enhancing their M&E processes.

In light of the above, monitoring and evaluation are very important in examining and tracking the development of a particular organization's aims and objectives. Data is gathered as part of the M&E process to track how well a project or program is doing at attaining the predetermined goals and objectives. The process of M&E helps organization in making an informed decision on how to improve a project or program through enhancing the positive practices and demoting ones that are not.

Monitoring is the routine, methodical gathering and evaluation of data to determine how well a program is being implemented in relation to established goals and targets. Clarifying program objectives, tying activities and resources to objectives, turning objectives into performance indicators and setting targets, routinely gathering data on these indicators, contrasting actual results with targets, communicating progress to managers, and adjusting them in response to issues are all important aspects of monitoring.

A project, program, or policy's aim, as well as its design, implementation, and outcomes, are all assessed in a process called evaluation. The purpose of evaluation is to examine why intended results were or were not achieved, to assess the specific casual contributions of activities to results, to examine the implementation process, to investigate unintended results, to provide lessons, to highlight significant accomplishments or program potential, and to make recommendations for improvement.

Upon conducting M&E, there are five key steps to be strictly followed. First, a starting point needs to be agreed upon. These specifics should be stated, including if the M&E system is a pilot or a rollout, operating at the national or subnational level, and whether it is a short, medium, or long term intervention. Then it will be determined who the main implementers are, who the main beneficiaries are, who finances the project, who supplies the M&E resources, and who is qualified and available to carry out the M&E activity.

The second step is to identify the approach and secure the budget. To put together a formal approach and the required budget, it is necessary to choose the appropriate indicators, tools and instruments for data collection and analysis, clear time frames with milestones,

identify people and other resources for undertaking the M&E, and agree on the overall M&E approach and methodology.

The third step is to implement the M&E plan. Here, one has to identify the key tasks for implementing the M&E plan. Then a clear way forward has to be set on how the data is to be recorded. Afterwards, mechanisms for reporting the findings shall be determined for use of the results.

Fourth step is to analyze the M&E findings. To fulfill the inform and learn functions of M&E, data gathered from the M&E operations must be continually examined. Tools used for analysis depend on the adopted research methodology, instruments used for collecting data and volume and appearance of data.

The last step is communicating M&E findings. A crucial aspect of M&E's primary function, which is to support informed decision-making and corrective action, is regular dissemination of its findings. This helps in developing institutional thinking and improved policy making.

1.2. Information of PMC

Project Management Consultancy (PMC), established in 2009, is a renowned consulting firm specializing in providing comprehensive project management solutions across various industries. Since its founding, PMC has carved out a reputation for delivering top-notch consultancy services, helping organizations achieve their project goals efficiently and effectively.

Over the years, PMC has built an impressive portfolio, assisting clients in sectors such as construction, IT, healthcare, and finance. The firm has been instrumental in managing complex projects, offering services that include project planning, risk assessment, quality management, and stakeholder communication. PMC's team of experienced consultants is dedicated to ensuring that projects are completed on time, within budget, and to the highest standards.

One of the hallmark achievements of PMC was its involvement in the innovative Green Urban Development Project, which focused on sustainable building practices and environmental conservation. Additionally, the firm played a crucial role in the implementation of a nationwide healthcare IT infrastructure upgrade, which significantly improved patient data management and streamlined hospital operations.

PMC's commitment to excellence and its proactive approach to project management have made it a trusted partner for organizations looking to optimize their project outcomes. The

firm's ability to adapt to the evolving needs of the industry and its emphasis on continuous improvement have cemented its status as a leader in the project management consultancy field. As PMC continues to grow, it remains dedicated to delivering innovative solutions and exceeding client expectations.

1.3 Problem Statement

The objective of this research is to study the influence of project management consultancies for performance measurement. This study aims to evaluate the effectiveness, efficiency, and overall outcomes of township projects. This study will ultimately provide valuable insights into the role of PMC in ensuring quality and accountability within the construction and development sector.

By examining key performance indicators, cost-effectiveness, and stakeholder satisfaction can address the criticality of PMC employment. It can help in determining the success and sustainability of township projects, offering evidence-based recommendations for project management and oversight practices in the industry.

1.4 Proposed Objectives

Following are the objective of the proposed work

- To select important/ key performance measurement factors for townships.
- To collect data by developing a questionnaire and interviewing various organizations.
- To evaluate key performance parameters with help of Relative Importance Index (RII) method.
- To designate the importance of performance factors for the organizations with and without the employment of PMC.

1.5 Significance of the Study

The significance of this thesis study lies in its focused exploration of performance measurement in township projects, specifically addressing the influence of key performance factors and the role of Project Management Consultancy (PMC). By selecting important performance measurement factors, the study aims to establish a comprehensive understanding of the critical elements that drive the success of township

developments. The methodological approach, which includes developing a questionnaire and conducting interviews with various organizations, ensures the collection of rich, empirical data that accurately reflects the industry's current landscape. Utilizing the Relative Importance Index (RII) method, the study quantitatively evaluates these key performance parameters, providing an objective ranking that can inform industry best practices. Furthermore, by comparing the importance of these performance factors in organizations with and without the involvement of PMCs, the research offers valuable insights into the added value that PMCs can bring to project management. This comparative analysis not only underscores the practical implications of employing PMCs but also contributes to a deeper understanding of how their involvement can optimize project outcomes. Ultimately, the study's findings will be instrumental in guiding both practitioners and academics, enhancing the strategic approaches used in managing township projects and highlighting the critical factors that contribute to their success.

1.6 Scope of the Study

The scope of this thesis study encompasses a comprehensive examination of performance measurement factors in township projects, with a focus on understanding the role and impact of Project Management Consultancy (PMC). The study begins by identifying and selecting key performance measurement factors that are critical to the success of township developments. This involves an extensive review of relevant literature and industry practices to compile a list of the most pertinent factors. The scope further extends to the collection of primary data through the development and distribution of a carefully crafted questionnaire, complemented by interviews with representatives from various organizations. This approach ensures that the data gathered reflects a wide range of perspectives and experiences.

Subsequently, the study employs the Relative Importance Index (RII) method to quantitatively evaluate and rank these key performance parameters. This analytical approach allows for a precise determination of the relative significance of each factor, providing valuable insights into their prioritization within the industry. Additionally, the scope includes a comparative analysis of the importance of these performance factors in organizations that utilize PMC services versus those that do not. This aspect of the study is crucial for understanding the added value of PMCs and how their involvement influences project outcomes. Overall, the study's scope covers a detailed exploration of both theoretical and practical aspects of project management in township projects, aiming

to contribute to the body of knowledge and offer actionable recommendations for industry practitioners.

1.7 Organization of the Research Report

Chapter one of the research is Introduction that focuses on background of the study, statement of the problem, objectives, and scope of the study. Chapter two includes review of literatures comprising theoretical and empirical reviews. Chapter three is about research design and methodology used. This chapter revolves around the data collection and methods used to collect, organize, and analyze the data. Chapter four discusses the data presentation, analysis, and interpretation of findings. Finally, the last chapter, Chapter five presents the summary of the research, conclusion of findings and recommendations.

1.8 Closer

In conclusion, this research investigates the role of Project Management Consultancies (PMCs) in the performance measurement of township projects. By identifying key performance factors, evaluating them through the Relative Importance Index (RII), and comparing organizations with and without PMC involvement, the study aims to provide valuable insights for optimizing project outcomes. The findings will offer practical recommendations to enhance project management practices, contributing to the success and sustainability of township developments while advancing academic understanding in this field.

Chapter 2

Literature Review

2.1 Introduction

In this chapter number of research papers were studied to understand project management consultancy, RII , Correlation Coefficient analysis method & monitoring-evaluation method.

2.2 Literature Review

2.2.1 Tsegay Gebrehiwet (2017) Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study .

The occurrence of a delay in the construction projects is common and significantly affects by enormous ways. This study investigates the typical causes of delay at different stages of construction and its effect in the Ethiopian construction projects. Using a questionnaire with 52 causes and 5 effects of delay, data were collected from 77 participants' selected based on purposive sampling from the different contracting organizations.the average/overall is highly related, construction stage is the second related, post-construction stage is the third related and pre-construction stage is far part of all stages. As far as, overall/average causes of delay are comparable to all stages. So from the overall, the influential causes of delay investigated are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documents, slow delivery of materials, late in approving and receiving of complete project work, poor site management and performance, late release budget/funds, and ineffective project planning and scheduling successively as unique to the Ethiopian construction project. The critical effects of delay investigated are cost overruns, time overrun, termination of contract, arbitration, and litigation sequentially. Although, the research is conducted on the Ethiopian construction projects, but it can also apply to other countries and further study.

2.2.2 D.Aydin (2018) Causes and Effects of Construction Project Delays: A Local Case Study in Edirne City Centre

Delays in construction projects are experienced today with various known and/or unknown factors and will continue to be experienced in future periods. Therefore, it is necessary to predict and to analyse the causes of the delays carefully in order to take precaution and to control delays. An investigation on the causes and effects of delays for local and small-scale projects is crucial as it provides a positive contribution to the national development of the construction industry. The fact that the time management is not done properly in the provinces like Edirne, where the construction activities are progressing rapidly, will affect the investments of the sector negatively. This will help to minimize the time and cost overruns, especially by taking the necessary precautions at the first stage of the project and by preparing the project schedule plans. Thus, it may be possible to get rid of time and cost overruns.

2.2.3 Bilal Ahmad Sheikh (2021) Study of Modern Construction Methods and Strategies Using Relative Importance Index (RII)

This research paper presents study of Modern construction methods (MCM) in India in terms of adaptation in construction sector. It analyses the various factors like; advantages, disadvantages along with strategies to modern construction methods in India. MCM has several benefits over conventional construction method which are analyzed and ranked by using the Relative Importance Index (RII). The study investigates the various parameters of MCM- cost, quality, time, risks. The study also analyzed the various forms of MCM adopted in India construction sectors. The current study is a quantitative one in which a survey was used to collect data. This method was chosen because quantitative analyses offer quantifiable data in a numerical format that can be used to generalize research results using statistics. Workers in the construction industry were chosen from a variety of registered construction firms and data was collected using a standardized questionnaire. Since the study's aim was to look into the efficiency and speed of modern construction methods in the construction industry, this method was chosen.

2.2.4 D. Huljenić (2023) Project Management in Research Projects

Project Management (PM) is a set of activities which enables successful implementation of a project, where a project may be defined as involving a group of inter related activities that are planned and then executed in a certain sequence to create a unique output (product or service) within a specific time frame. Research projects differ in many ways from development projects, the most significant being (lack of) clear requirements and (in)ability to plan an output from the start of the project. In terms of outputs, evaluation criteria for a research project must take into account such, we well as other “particularities”; for

example, that proving that something can not be done may represent a positive result for a research project. This article describes particularities of research projects, and proposes adequately adjusted project management process and practices. It also gives examples and evaluation of successful application thereof in practice, in joint projects between academia and industry over the past five years.

2.2.5 Lalić (2019) Future Challenges In Project Management

This chapter reviews current research and future challenges in the area of project management. The business environment is evolving rapidly, and the recent economic crisis has significantly influenced the future development of global industry and the way that projects are managed. In the beginning of this chapter, we give a short history and current business trends. Following this, we provide a summary of the current problems and the need for research in project management. The last part pre sents future trends of project management theory development.

2.2.6 Rahul Rao (2023) Delay Analysis of Road Construction Projects using RII Method

This paper is to propose and recommend a tool for contractors before the bidding stage to calculate the effect of delay in road construction projects by finding the relative importance index (RII) method. Through a rigorous literature search and interviews with road construction professionals, 95 delay causes were discovered and classified into 9 broad groups for this purpose. The relative importance index approach was used to calculate the relative relevance of delay factors and groups. The ranking of these factors and groups were illustrated in terms of their impact on delay. The factors and groups that are most and least responsible for the delays were explored.

2.2.7 Ms. Keerti S. Badihaveli et al. (2019) construction quality attributes for benchmarking them for improving project management delivery and performance.

A total of 19 construction quality attributes were identified from literature and were used for questionnaire development. The data analysis includes ranking of attributes. Fuzzy preference relationship was used for analysis of data. The results shows that the five most important attributes are ‘Inadequate site supervision and site decision and Inadequate site meetings’, ‘Adequate project planning and use of appropriate technology’, ‘Efficient teamwork’, ‘Lack of documentations and audits of quality system for majority of contracts’, ‘Site organization and Installation of equipment’. This study is limited to benchmarking of construction quality attributes. Further study can be extended to

development of framework of indices for evaluating construction quality of township project.

2.2.8 David Joaquin Delgado-Hernandez et. al. (2008) states that Research on quality in the construction industry has become a major concern

Since everybody is a customer of the industry, improvements in the sector can help to increase the quality of life. Hence, construction companies require practical advice and support for adopting and implementing initiatives for continuous quality improvement. Total Quality Management 1025 Practitioners, researchers and governments have developed models, frameworks and methodologies aimed at improving performance. While some initiatives tried to improve communication and flow management others endeavoured to enhance say briefing, designing or tendering activities . They either addressed only one or two quality issues, e.g. communication, role definition ,were limited to one stage of the construction process, e.g. tendering or dealt with only one sector in the industry, e.g. affordable housing. Therefore, it was felt that a more comprehensive approach was necessary to overcome these limitations.

2.2.9 K. N. Jha & K. C. Iyer et. al. (2008) compliance with quality specifications is an important performance measure of any construction project

The repercussions and consequences of poor quality can be a loss in productivity; additional expenditure by way of rework and repair; loss of reputation, leading to loss in market share; and eventually being put out of business. The importance of performing work to the expected quality level has been recognized since ancient times. It has become even more relevant in the context of a barrier-free world .

2.2.10 Tas Yong Koh, Sui Pheng Low et. al. (2010) The TQM, at its fundamental level, can be viewed as having its own sets of philosophy, principles, and intervention

Eight elements had been identified to operationalize the TQM spirit. The research data had shown that the implementation of these elements vacillated around the medium level. Close scrutiny of the data had, however, indicated that the elements were somewhat implemented at different levels within the medium band; customer and process management, and top management leadership were implemented at a “moderately high” level, supplier management moderately, while the remaining four elements of people management, continual improvement, and organizational learning were implemented at the lower level with quality information management implemented at the lowest level.

2.2.11 Itai Kabonga (2019) Principles and Practice of Monitoring and Evaluation: A Paraphernalia for Effective Development

This article discusses the principles and practice of monitoring and evaluation and emphasises that monitoring and evaluation (M and E) is paraphernalia for effective development. This growing importance has been caused by the growing voice of the civil society's scrutiny on good governance, and a demand for efficient public administration. At the same time, a plethora of development funders demand that M and E be implemented as a platform for learning and accountability. Despite growing importance of M and E, there seems to be a lack of clarity on the principles of M and E. The article finds its value in locating how M and E, augmented by appropriate principles, leads to effective development. Underlined by qualitative data collection methods, the article discusses relevant principles such as learning, accountability, participatory approaches, quality assurance, and reporting in monitoring and evaluation.

2.2.12 Gaurav Vasantrao Patil (2020) Project Management Challenges

The primary purpose of this paper concentrates on to find and describe the challenges faced in the project management. A wide-ranging literature analysis on project management challenges molded a theoretical groundwork of this research paper. A model is created based on review centric research. The research does have some limitations. The research does not represent all the project management challenges and it may skip some minor challenges which may bug the project manager repeatedly. The developed model will suggest some key points which may be taken as a guideline in order to avoid these challenges. The paper shows how some factors affects project management and effects on projects efficiency.

2.2.13 Moses Jeremiah Barasa Kabeyi (2020) Project and Program Evaluation Consultancy With Terms of Reference, Challenges, Opportunities, and Recommendations

The use of consultants in evaluation comes along with desired independence and professionalism in proect evaluation. specific To spells out an evaluation consultant's re uirements and epectations related to an evaluation, review, or similar study. The evaluator should at the end of evaluation produce an evaluation report which will facilitate accountability, lessons learnt, and improvement of the proect or program being evaluated. The evaluation report should be credible, relevant, and verifiable and above all acceptable

to sta eholders while respecting independence of the evaluator. The consultants' recommendations should be bac ed by results of evaluation. valuation should ta e care of the sta eholder interests and ade uately address them. ecommendations should be supported by specific findings. Trust needed is for successful evaluation and evaluators should give actionoriented recommendations that are specific, practical, and with clear indication .

2.2.14 John McGrath (2020) Project Management Trends and New Challenges 2020

This study explores how the discipline of project management is currently approached within organizations and examines how the discipline will need to adapt to remain relevant in an era of constant change and the growth in project-based organizations. The data for this qualitative research study was collected from project management experts who participated in panel discussions at a conference held on 7th of November 2019 in Dublin, Ireland (The PMO Road Show – International Project Management Day). This study is also based on a literature review of project management trends presented in the last three years. Results suggested that in the technology driven world of the future, project managers will require a different set of skills. The study found there is also a significant increase in more successful project outcomes when project teams develop more bespoke hybrid mythologies tailored to unique project environments.

2.2.15 Rosine Mukamwiza (2021) The Role Of Monitoring And Evaluation On Effective Project Implementation A Case Of Global Help To Heal's Project

This study was conducted for establishing the role of M&E for effective project implementation. To the first objective The study concludes that Global Help to Heal's clearly define goals, reporting systems are set indicators for evaluation are formulated and reviewed prior conducting monitoring and evaluation of the project, monitoring framework is well set prior carrying out monitoring and evaluation planning. There were positive correlation between monitoring and evaluation plan and strategy alignment, process alignment, and resource allocation. This shows that an improvement in monitoring and evaluation plan leads to an increase effective implementation of project by 0.168 units. To the objective the study concludes that Global Help to Heal's defined mission and vision of the project, established core values, carried SWOT analysis. There were positive correlation between M&E strategic plan and strategy alignment, process alignment, resource allocation, operational implementation were statistically significant given that the p values were < 0.05 and < 0.01.

2.2.16 Mukhtar A. Kassem (2020) Using Relative Importance Index Method for Developing Risk Map in Oil and Gas Construction Projects

The objective of this research is to classify risk factors and their ranking in terms of their probability and impact on construction projects in the oil and gas sector, to test the relationship between the causes and effects of risk factors and then develop the risk map to facilitate the planning of risk response strategies. To achieve this objective, researchers invited practitioners and engineers who are comprising a statistically representative sample of oil and gas sector population to joining a structured questionnaire survey. A total of fifty-one (51) factors were short-listed to be made part of the questionnaire survey. The survey was conducted with 357 participants of construction project teams as a sampling of populations from all oil and gas sectors in Yemen. The relative importance index (RII) method was applied to prioritize the project risk factors. RII analysis and risk map shown the most critical risk factors effected on project success. There is a significant contribution expected from this research, especially for companies operating in the oil and gas and other organizations that plan to invest in this field, in addition to expected benefits for the governments and researchers in this field due to lack of research in this field.

2.3 Closer

This chapter number of research papers were studied to understand project management consultancy, RII , Correlation Coefficient analysis method & monitoring-evaluation method.

Chapter-3

Methodology

3.1 General

In the previous chapter, the Literature Review on PMC in the construction industry is being studied. Now in this chapter, we can concentrate on the methodology for the project work execution and explains the effective use of methods for measuring labor productivity, collection of data. In addition, the chapter also details the method used for the critical analysis of factors affecting productivity on the construction site.

3.2 Project Survey Planning

The basic aim of the survey is collecting information on various factors affecting labor productivity in kolhapur region construction industry. At the time of the survey, research purpose was fully explained to the respondents. Also, Instruction and guideline were provided, to reduce errors.

3.3 Methodology

The following methodology was adopted for critical analysis of factors and suggestionsfor improvement of labor productivity.

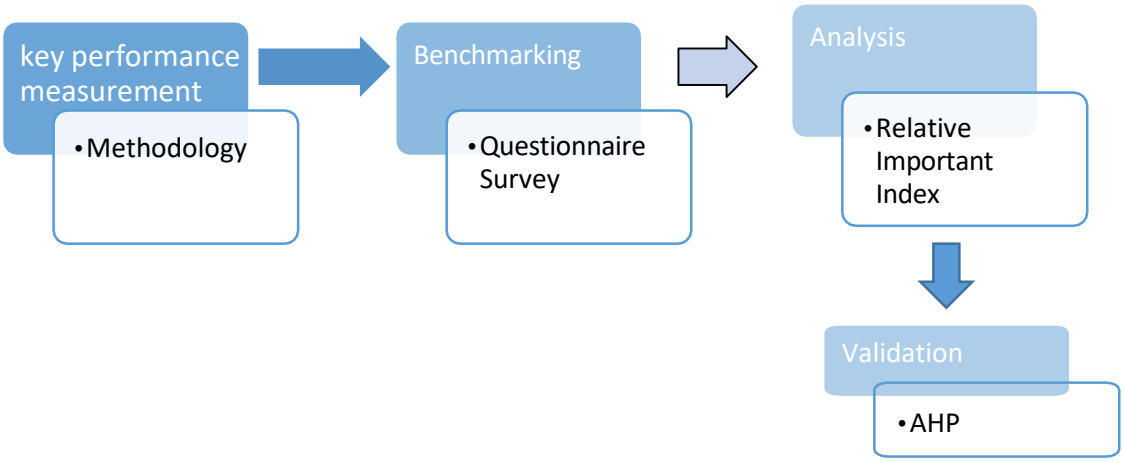


Figure 3.1- Projects Work Methodology Plan

1) Identifying the key performing factors for evaluation of township projects.
2) Data collection through interviewing some of the elite real estate developers and studying the implementation of the key performance factors.
    - The builders and developers will be interviewed about and inquire about the various practices and parameters they follow on their respective projects to adhere the required quality of various procedures. The questionnaire developed will be based on obeying to above considered key factors.
    - The identified parameters will be distributed into categories based on the category of respondents.
    - Collection of secondary data will be concluded through the above procedure.
3) Evaluation of the key performance factors for the organizations with the help of Reliability analysis method.
    - Importance of the performance factors for organizations will be described after the evaluation of the parameters is done.
4) After testing the responses for reliability and internal consistency, the less reliable parameters would be excluded from further study and the selected parameters would be put up for One- way Anova Test. Anova Test is a statistical test used to evaluate the difference between the means of more than two groups.
5) Relative Importance Index (RII)will be used to analyse the obtained factors and calculate weightage factor and rank the parameters accordingly.
6) Top 10 parameters from both the datasets would be taken into consideration and possible causes for the parameters to occur would be found out. Root cause analysis method will be used to determine the causes.
7) And to conclude, a framework consisting of guidelines and remedial solutions for the parameters would be prepared which would be applicable for further studies and projects.

3.4 Closer

In conclusion, this chapter outlines the methodology adopted for evaluating labor productivity and the critical performance factors in township projects. The approach includes data collection through interviews with developers, followed by the evaluation of key performance factors using the Relative Importance Index (RII) method. The findings are further validated using the Analytic Hierarchy Process (AHP), providing a

comprehensive analysis for improving productivity and performance in the construction industry.

Chapter-4

Questionnaire Survey Design

To effectively evaluate the performance of township projects with and without the implementation of Project Management Consultancies (PMCs), it is essential to develop a comprehensive questionnaire and conduct interviews with various organizations involved in these projects. The questionnaire should be designed to gather detailed information on key performance metrics, such as project timelines, budget adherence, quality of work, and stakeholder satisfaction. It should include both quantitative and qualitative questions to capture a holistic view of the project outcomes. Additionally, questions specific to the role and impact of PMCs should be incorporated to understand their contributions to project success. Alongside the questionnaire, conducting interviews with key stakeholders—including developers, project managers, contractors, and residents—will provide deeper insights and contextual understanding. These interviews will help clarify responses, uncover underlying issues, and gather personal experiences that may not be captured in the survey. By combining quantitative data from the questionnaire with qualitative insights from interviews, a robust and comprehensive evaluation of the township projects can be achieved, enabling a meaningful comparison of projects with and without PMC involvement.

4.1 selecting important/ key performance measurement factors for townships

4.1.1 Low level of skill and labour experience

When evaluating the performance of township projects, the level of skill and experience of the labor force can significantly impact project outcomes. In projects without the implementation of Project Management Consultancies (PMCs), there may be a noticeable lack of coordination and quality control due to the limited experience and lower skill levels of the labor force. This can result in delays, cost overruns, and substandard work, as less experienced workers may require more supervision and training. On the other hand, projects with PMCs often benefit from a more structured approach to labor management.

4.1.2 Labour turnover

Labor turnover can be a critical factor in the performance evaluation of township projects, significantly affecting timelines, quality, and cost. In projects without the implementation of Project Management Consultancies (PMCs), high labor turnover rates can disrupt workflow, as new workers may need time to acclimate to the project's requirements and may lack the necessary skills and experience. This can lead to frequent delays, inconsistent work quality, and increased costs due to the need for additional training and supervision.

4.1.3 Poor labour remuneration

Poor labor remuneration is a significant factor contributing to labor turnover in township projects, affecting overall project performance. In projects without Project Management Consultancies (PMCs), inadequate compensation often leads to higher turnover rates as workers seek better-paying opportunities elsewhere. This frequent loss of labor can disrupt project continuity, leading to delays, compromised quality, and increased costs associated with recruiting and training new workers. In contrast, projects with PMCs generally experience lower turnover rates due to better-managed compensation structures and more transparent wage policies.

4.1.4 Inadequate site supervision

Inadequate site supervision is a critical issue that can severely impact the performance of township projects. In projects without the implementation of Project Management Consultancies (PMCs), the lack of experienced and skilled supervisors often leads to poor oversight of daily operations, resulting in quality control issues, safety hazards, and delays. Without proper supervision, there is a higher likelihood of mistakes and inefficiencies, as workers may not receive the necessary guidance and support. This can lead to rework, cost overruns, and missed deadlines.

4.1.5 Poor level of commitment to quality improvement among project participants

A poor level of commitment to quality improvement among project participants can significantly hinder the performance of township projects. In projects without the involvement of Project Management Consultancies (PMCs), the absence of a structured approach and dedicated leadership often results in a lack of focus on quality standards. Participants may not prioritize quality improvement due to inadequate training, unclear quality expectations, or a lack of accountability. This can lead to subpar construction

practices, frequent defects, and increased maintenance costs, ultimately compromising the project's long-term value and reputation.

4.1.6 Poor site installation procedure

Poor site installation procedures can significantly impact the success of township projects. In projects without Project Management Consultancies (PMCs), inadequate planning and oversight often lead to improper installation practices, resulting in issues like misaligned structures, faulty electrical wiring, and substandard plumbing. These deficiencies can cause costly rework, safety hazards, and delays, undermining the overall quality and efficiency of the project. Conversely, projects with PMCs benefit from their expertise in establishing and enforcing proper installation protocols. PMCs ensure that all installations adhere to industry standards and project specifications, providing detailed guidelines and regular inspections.

4.1.7 Poor project planning

Poor project planning is a critical factor that can undermine the success of township projects. In projects without the implementation of Project Management Consultancies (PMCs), the lack of thorough planning often leads to inadequate resource allocation, unrealistic timelines, and unclear project objectives. This can result in frequent delays, budget overruns, and miscommunication among stakeholders, ultimately compromising the project's quality and completion. In contrast, projects with PMCs benefit from their structured and comprehensive planning processes. PMCs typically conduct detailed project assessments, establish clear timelines, and allocate resources efficiently.

4.1.8 Contractors’ poor technical knowledge

Contractors' poor technical knowledge can be a significant drawback in the execution of township projects. In projects without the involvement of Project Management Consultancies (PMCs), this deficiency often leads to improper construction practices, inadequate problem-solving, and a lack of adherence to technical specifications. These issues can result in structural flaws, increased maintenance needs, and project delays, ultimately compromising the quality and safety of the project. In contrast, projects managed by PMCs typically experience fewer technical issues, as PMCs bring in skilled professionals who provide oversight and guidance.

4.1.9 Inadequate site meetings

Inadequate site meetings are a critical factor that can adversely affect the performance of township projects. In projects without Project Management Consultancies (PMCs), the lack of regular and structured site meetings often leads to poor communication, misalignment among stakeholders, and unresolved issues. This can result in misunderstandings, delays, and a lack of coordinated efforts, ultimately compromising the project's quality and progress. On the other hand, projects with PMCs typically benefit from frequent and well-organized site meetings, where key project details, challenges, and updates are discussed.

4.1.10 Lack of quality assurance

A lack of quality assurance is a crucial factor that can significantly impact the performance of township projects. In projects without the implementation of Project Management Consultancies (PMCs), the absence of a structured quality assurance framework often leads to inconsistent standards, subpar materials, and inadequate workmanship. This oversight can result in defects, safety hazards, and increased maintenance costs, compromising the overall durability and reliability of the project.

4.1.11 Poor inspection and testing

Poor inspection and testing are critical performance factors that can significantly undermine the success of township projects. In projects without the implementation of Project Management Consultancies (PMCs), insufficient inspection and testing procedures often result in unnoticed construction defects, non-compliance with safety standards, and the use of substandard materials. These oversights can lead to structural issues, costly rework, and long-term safety concerns, ultimately compromising the quality and durability of the project. In contrast, projects managed by PMCs typically benefit from rigorous inspection and testing protocols.

4.1.12 Non-identification of non-conforming work

The non-identification of non-conforming work is a key performance factor that can significantly impact township projects. In projects without Project Management Consultancies (PMCs), the lack of systematic oversight often leads to missed detection of work that doesn't meet specifications, resulting in quality issues and potential safety risks. Conversely, projects with PMCs benefit from their rigorous quality control processes, which ensure that non-conforming work is promptly identified and rectified, maintaining high standards and ensuring project integrity.

4.1.13 Quality audits not carried out

The failure to carry out quality audits is a key performance factor affecting township projects. In projects without Project Management Consultancies (PMCs), the absence of regular quality audits often leads to undetected issues, poor workmanship, and deviation from standards. This oversight can result in compromised project quality and increased long-term costs. In contrast, PMCs typically ensure regular and thorough quality audits, identifying and addressing potential issues early, thereby upholding high standards and ensuring the project's success.

4.1.14 Design defects

Design defects are a critical performance factor in township projects, significantly affecting project outcomes. In projects without Project Management Consultancies (PMCs), inadequate oversight can lead to overlooked design flaws, resulting in construction challenges, increased costs, and potential safety issues. Conversely, projects with PMCs benefit from thorough design reviews and expert input, minimizing the likelihood of defects and ensuring that the final product meets quality standards and functional requirements.

4.1.15 Flaws in design specification

Flaws in design specifications are a key performance factor that can critically impact township projects. In projects without Project Management Consultancies (PMCs), these flaws often go unnoticed, leading to construction errors, delays, and increased costs due to necessary redesigns. However, projects with PMCs typically benefit from thorough reviews and expert oversight, which help identify and correct specification issues early, ensuring smoother project execution and adherence to quality standards.

4.1.16 Design changes

Design changes are a key performance factor in the evaluation of township projects. In projects without Project Management Consultancies (PMCs), managing design changes can be chaotic, leading to miscommunication, cost overruns, and delays. Conversely, PMCs provide structured processes for handling design modifications, ensuring that changes are well-documented, evaluated, and implemented efficiently, minimizing disruptions and maintaining project quality and timelines.

4.1.17 Unrealistic constraints of project time

Unrealistic project time constraints are a critical performance factor in township projects. Without Project Management Consultancies (PMCs), such constraints often lead to rushed work, compromised quality, and increased risk of errors and rework. PMCs, however, provide realistic scheduling and time management, balancing project scope with achievable timelines, thereby ensuring more efficient workflows and better-quality outcomes.

4.1.18 Unrealistic constraints of project cost

Unrealistic constraints on project costs are a key performance factor in evaluating township projects. In projects without Project Management Consultancies (PMCs), tight budget constraints can lead to cost-cutting measures that compromise quality and result in delays or incomplete work. In contrast, PMCs help establish more realistic budgets through detailed planning and cost control measures, ensuring that financial constraints are managed effectively while maintaining project quality and scope.

4.1.19 Poor quality of material delivered to site

Poor quality of materials delivered to the site is a key performance factor in township projects. In projects without Project Management Consultancies (PMCs), inadequate material quality control can lead to defects, safety issues, and additional costs for replacements. PMCs typically ensure rigorous quality checks and supplier oversight, minimizing the risk of receiving substandard materials and ensuring that project specifications are met, thus maintaining high standards and reducing overall project risks.

4.1.20 Contractors' poor financial management

Contractors' poor financial management is a key performance factor in the evaluation of township projects. In projects without Project Management Consultancies (PMCs), ineffective financial oversight can lead to budget overruns, cash flow problems, and incomplete work. PMCs provide robust financial management practices, including budgeting, forecasting, and cost control, ensuring that funds are managed efficiently and project expenses are kept under control, which helps achieve better financial outcomes and project success.

4.1.21 Poor communication among participants

Poor communication among participants is a critical performance factor in township projects. In projects without Project Management Consultancies (PMCs), lack of effective

communication can lead to misunderstandings, delays, and coordination issues. PMCs facilitate clear and consistent communication channels, ensuring that all stakeholders are aligned, issues are promptly addressed, and project objectives are met efficiently, thus improving overall project performance and outcomes.

4.1.22 Unfriendly atmosphere and trust among participants

An unfriendly atmosphere and lack of trust among participants are key performance factors in township projects. In projects without Project Management Consultancies (PMCs), poor interpersonal relations can lead to conflicts, reduced collaboration, and diminished project efficiency. PMCs foster a positive work environment and build trust through effective mediation and team-building practices, promoting better cooperation, smoother project execution, and improved overall outcomes.

4.1.23 Making site decisions on cost and not value of work

Making site decisions based solely on cost rather than the value of work is a key performance factor in township projects. In projects without Project Management Consultancies (PMCs), cost-driven decisions can lead to compromised quality and long-term inefficiencies. PMCs emphasize value-based decision-making, ensuring that cost considerations are balanced with quality and long-term benefits, resulting in better overall project outcomes and sustainability.

4.1.24 Poor reports and record-keeping

Poor reports and record-keeping are critical performance factors in township projects. In projects without Project Management Consultancies (PMCs), inadequate documentation can lead to gaps in project tracking, unresolved issues, and lack of accountability. PMCs ensure thorough and accurate record-keeping, providing detailed reports that facilitate effective project management, issue resolution, and transparent communication, thereby enhancing overall project performance and accountability.

4.1.25 Effect of code and standards on quality

The effect of code and standards on quality is a key performance factor in township projects. In projects without Project Management Consultancies (PMCs), adherence to codes and standards may be inconsistent, leading to quality issues and potential regulatory non-compliance. PMCs ensure rigorous adherence to relevant codes and standards,

incorporating them into project planning and execution to maintain high quality, safety, and compliance throughout the project lifecycle.

4.1.26 Inadequate involvement of the owner during construction works

Inadequate involvement of the owner during construction works is a key performance factor in township projects. Without Project Management Consultancies (PMCs), limited owner engagement can result in misaligned expectations, delayed decision-making, and unresolved issues. PMCs facilitate better owner involvement through regular updates and consultations, ensuring that the owner's preferences and requirements are addressed promptly, leading to improved project alignment, satisfaction, and outcomes.

4.1.27 Low level of appropriate technology

A low level of appropriate technology is a key performance factor in township projects. In projects without Project Management Consultancies (PMCs), outdated or inadequate technology can hinder efficiency, accuracy, and quality, leading to increased costs and delays. PMCs typically ensure the integration of advanced and suitable technologies, enhancing project management, improving construction practices, and achieving better overall project outcomes.

4.1.28 Poor weather conditions

Poor weather conditions are a key performance factor in township projects, affecting construction timelines and quality. In projects without Project Management Consultancies (PMCs), inadequate planning for weather-related disruptions can lead to significant delays and increased costs. PMCs typically incorporate weather contingency plans and adapt project schedules accordingly, minimizing the impact of adverse weather and ensuring more consistent progress and quality.

4.2 Questionnaire Survey Design (Data Collection)

The factors identified above were developed into a questionnaire survey. A preliminary pilot study aimed at providing information for the questionnaire which was conducted in the form of structured interviews with professionals in the industry. The respondents include three architects, two engineers, a quantity surveyor and a builder. The average number of years of experience of these professionals was 13; on average they had handled more than 25 projects as at February 2019. The questionnaire was refined a number of

times, based on the professionals' feedback, before it was finally used for the survey at the data collection stage.

While designing the Questionnaire survey form, special measures wereconsidered that are listed below

- The preliminary text was introduced for explaining the survey project to therespondent.
- Easy way of Communication for the respondents, to give their review andsuggestions about the conduct.
- Logical questions were avoided to procure responses and reduced drop-rate time.
- Care was taken that initial questions do not influence negative impact onsubsequent questions.

The following figure showed a snap of questionnaire surveyfrom Google forms that were shared with construction industry professionals.

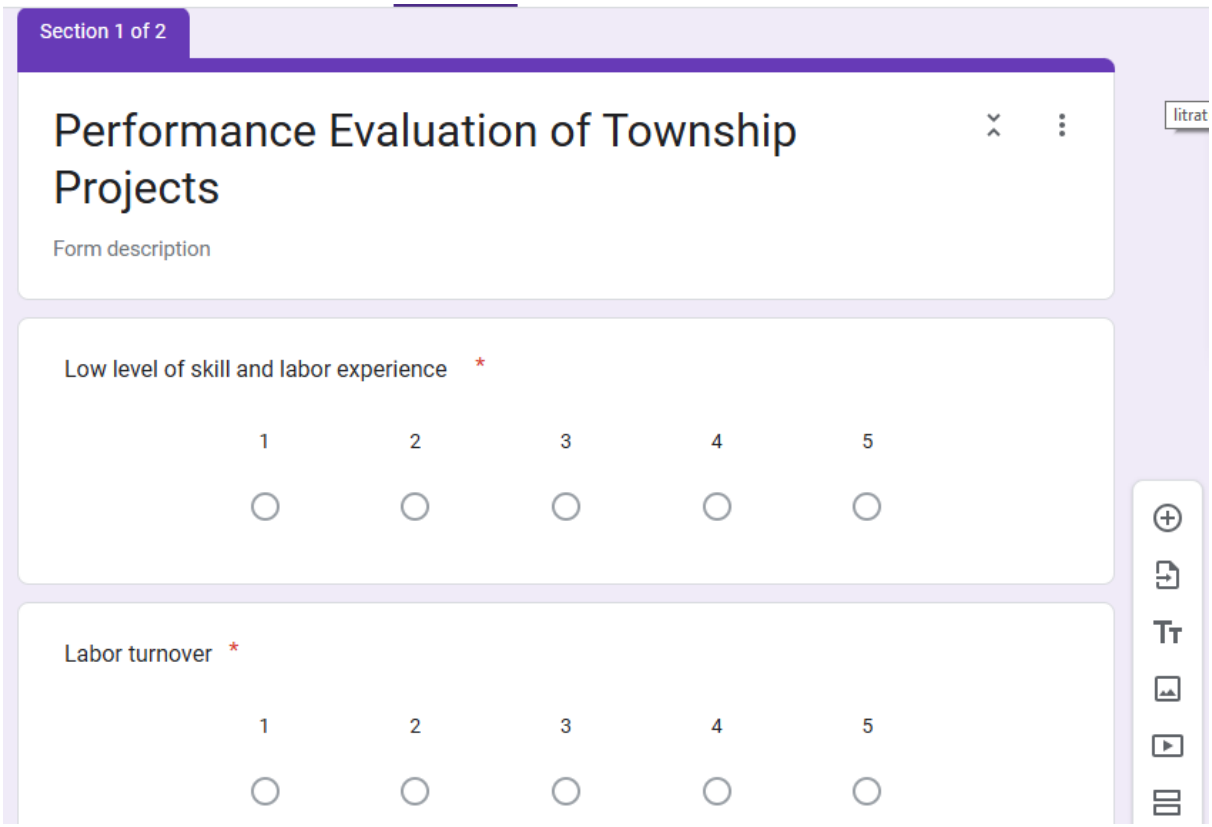


Figure 4.1- Google form Snap

Evluation were achieved by examining the accuracy and completeness of the related questions, taking into consideration the previous studies. Great care was taken to assure respondents get precise duration to respondto the questionnaire.

The average time required to complete the questioner is 5 to 7 minutes. Max. Duration of 10 days was allocated to complete the questionnaire. The questionnaireis simple and easy to understand for the respondents. The survey was sent to nearly100 professionals. Out of which 64 responses were valid and complete. We classifythese responses into four groups depending on the type of building construction, they were as follows.

4.3 Closer

In conclusion, the questionnaire survey design was carefully crafted to evaluate the performance of township projects with and without the implementation of Project Management Consultancies (PMCs). Key performance factors such as labor skills, turnover, site supervision, quality assurance, and planning deficiencies were identified and integrated into the survey. A pilot study involving industry professionals helped refine the questionnaire, ensuring its relevance and clarity. The final survey, distributed to 100 professionals, garnered 64 valid responses, offering comprehensive insights into the factors influencing project performance. The survey design successfully balanced quantitative and qualitative data collection, allowing for a robust evaluation of PMC contributions to township project outcomes.

Chapter-5
Statistical Analysis

5.1 Relative Importance Index

According to (Aibinu & Jagboro 2002), the Relative Importance Index (RII) approach used to describe the relative importance of the specific causes and effects based on the likelihood of occurrence and effect on the project using the Likert scale of five scales. In addition, the higher value of the index of relative importance (RII) is the critical cause or impact component and is determined by equation (1)

$$RII = \Sigma W / A*N$$

Where:

RII – is Relative Importance Index

W –is the weight given to each factor by the respondents from 1, 2, 3, 4 and 5 for very low, low, moderate, high and very high, respectively

A – is the highest weight (i.e., 5 in this case)

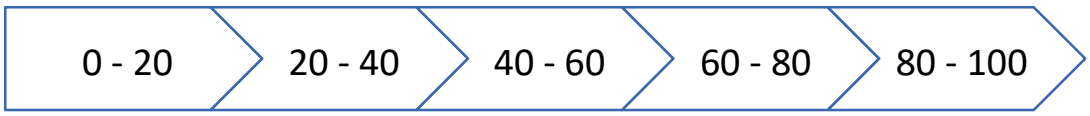
N – is the total number of respondents

The results of the analysis on factors affecting labor productivity were obtained using the Relative Important Index. The factors discussed in the earlier point were drawn into a questionnaire survey with a metric scale. The range lies from 1-4 dissipating its importance shown in table () The questionnaire survey was sent to the construction industry, to get responses and feedback from the professionals.

The relative importance index (RII) for all factors was calculated. Meanwhile, the group index was calculated by taking the average of factors in each group. The maximum value of the RII is 100 when all respondents answered “very high effect” and the minimum value of the index is 0 when all respondents answered, “affects with a little degree”. Since the

results are obtained as decimal numbers instead of integer numbers, a specific scale should be established. Thus, 5 expressions are defined by the intervals of 20 to classify the affected level (see Table 5.1).

Table 5.1: Scale used for Data Measurement



little effect (L)	some effect (S)	average effect (A)	high effect (H)	very high effect (VH)

Relative Importance Index	Non-identification of non-conforming work	Design changes	Inadequate involvement of the owner during construction works	Poor project planning	Labour turnover	Inadequate site meetings	Low level of appropriate technology	Poor labour remuneration	Lack of quality assurance	Flaws in design specification
WITHOUT PMC	1.01	0.97	0.844	0.91	0.94	0.87	0.767	0.87	0.94	0.84
WITH PMC	0.784	0.806	0.861	0.856	0.803	0.763	0.676	0.732	0.836	0.643

Poor inspection and testing	Unfriendly atmosphere and trust among participants	Poor quality of material delivered to site	Making site decisions on cost and not value of work	Contractors' poor financial management	Poor level of commitment to quality improvement among project participants	Poor weather conditions	Poor site installation procedure	Design changes	Poor reports and record-keeping	Poor site supervision
0.91	0.84	0.87	0.91	0.87	0.9	0.77	0.84	0.91	0.914	0.906
0.787	0.781	0.716	0.738	0.701	0.796	0.79	0.643	0.809	0.778	0.836

Low level of skill and labour experience	Unrealistic constraints of project time	Effect of code and standards on quality	Unrealistic constraints of project cost	Poor communication among participants	Design defects
0.81	0.909	0.844	0.877	0.844	0.914
0.756	0.821	0.775	0.72	0.683	0.695

Table 5.2-RII for performance factor

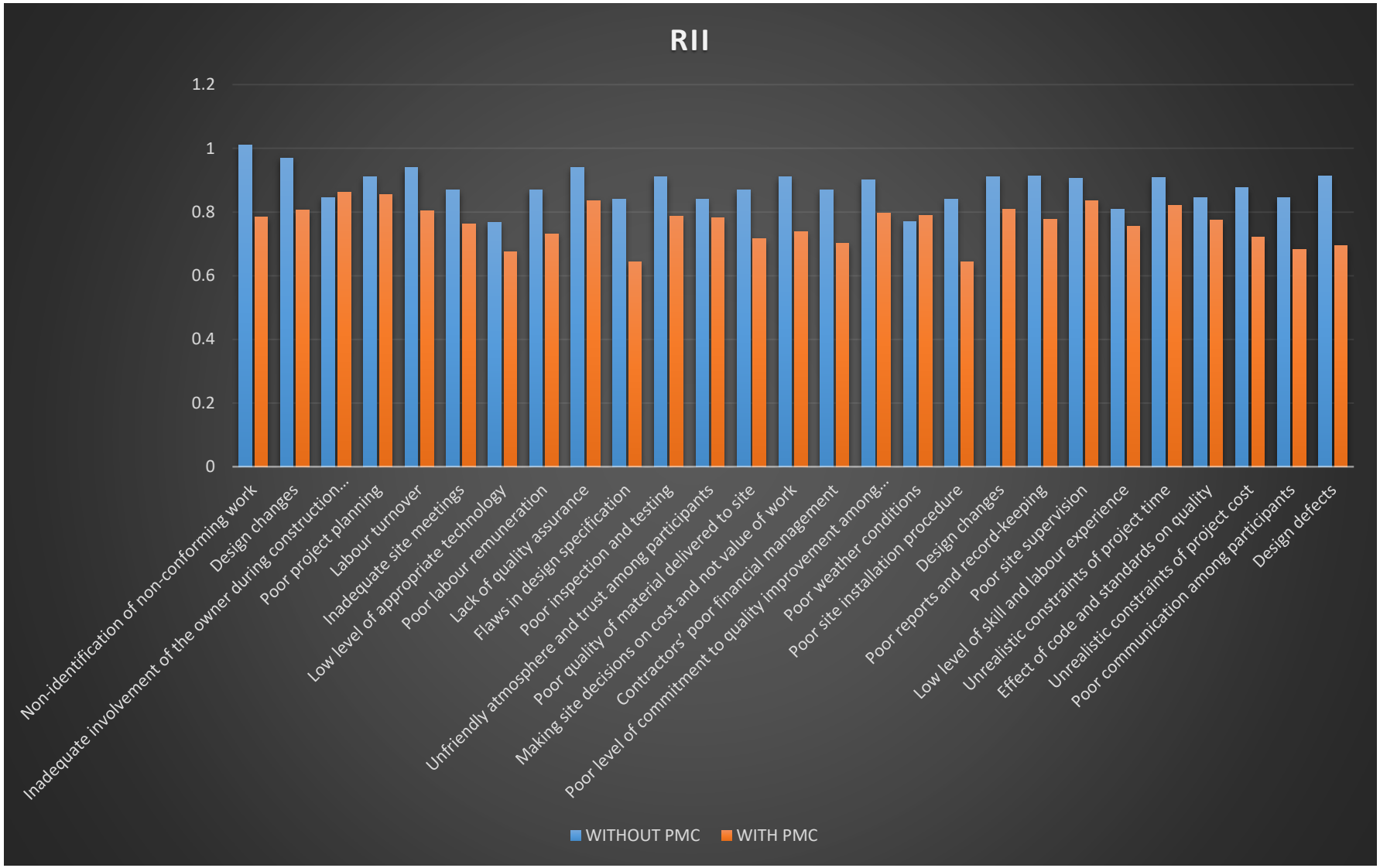


Figure 5.1-Comparative analysis of RII

The graph displays the Relative Importance Index (RII) for various factors affecting the performance of township projects, comparing projects with and without the implementation of Project Management Consultancies (PMCs). The RII values are represented on the y-axis, ranging from 0 to 1.2, while the x-axis lists the different factors influencing project performance.

In general, the blue bars represent projects without PMCs, and the orange bars represent projects with PMCs. Across all factors, the RII is consistently higher for projects without PMCs, indicating that these issues are more significant in projects lacking PMC involvement. Notable factors with the largest discrepancies include "Non-identification of non-conforming work," "Inadequate involvement of the owner during construction," "Design changes," and "Poor inspection and testing." These factors show a marked reduction in RII when PMCs are involved, suggesting that PMCs play a crucial role in mitigating these issues.

The lower RII values in projects with PMCs demonstrate the positive impact of PMC involvement in reducing the severity of these factors, leading to better quality control, improved communication, and more effective project management. The overall trend highlights the importance of PMCs in ensuring project success by addressing key challenges and maintaining higher standards throughout the project lifecycle.

5.2 Closer

In conclusion, the analysis using the Relative Importance Index (RII) reveals significant insights into the factors affecting project performance in township developments, particularly when comparing projects with and without Project Management Consultancies (PMCs). The results indicate that projects without PMC involvement face more severe issues, such as non-conforming work, design changes, and poor inspection, with consistently higher RII values. However, the presence of PMCs significantly reduces these challenges, improving overall project management, communication, and quality control. This highlights the critical role of PMCs in enhancing project success by effectively mitigating key performance factors.

Chapter 6

Results And Discussion

6.1 General

The previous Chapter studied the calculations of RII and discussion of the respondent's feedback. In this chapter, we can discuss the results, and also discuss the top factors which affect by PMC.

6.2 Influence on construction of PMC

6.2.1 Non-identification of non-conforming work

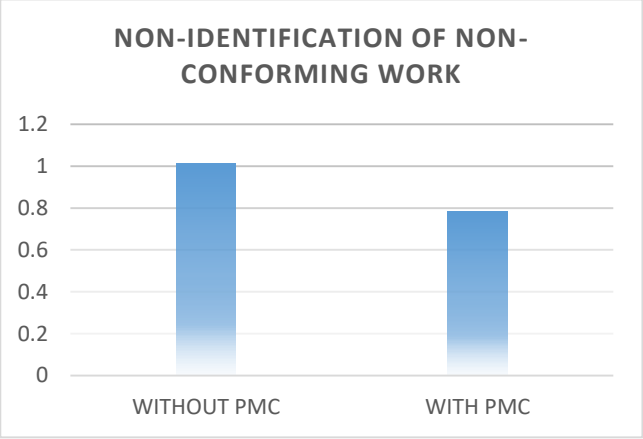


Figure 6.1- Non-identification of non-conforming work

The graph illustrates the Relative Importance Index (RII) for the issue of "Non-identification of non-conforming work" in township projects, comparing projects with and without the implementation of Project Management Consultancies (PMCs). The RII is 1.01 for projects without PMCs and 0.784 for projects with PMCs. This indicates that the non-identification of non-conforming work is a more significant issue in projects without PMCs, suggesting less effective oversight and quality control. In contrast, the presence of PMCs is associated with a lower incidence of such issues, highlighting their role in ensuring better adherence to quality standards and identification of non-conforming work.

6.2.2 Design changes

The graph highlights the Relative Importance Index (RII) for the issue of "Design changes" in township projects, contrasting the impacts between projects with and without the

involvement of Project Management Consultancies (PMCs). In projects without PMCs, the RII stands at 0.97, suggesting that design changes are a prevalent and significant issue. This high value indicates frequent or substantial alterations to the design, likely leading to disruptions, increased costs, and delays due to inadequate management and coordination. Conversely, in projects with PMCs, the RII is 0.806, reflecting a lower incidence and impact of design changes. This difference implies that PMCs are effective in managing and mitigating the challenges associated with design changes. Their involvement typically includes better planning, improved communication, and more efficient decision-making processes, which help to minimize the disruptions caused by design alterations. Overall, the graph underscores the vital role PMCs play in reducing the frequency and severity of design changes, thereby ensuring smoother project execution and fewer interruptions.

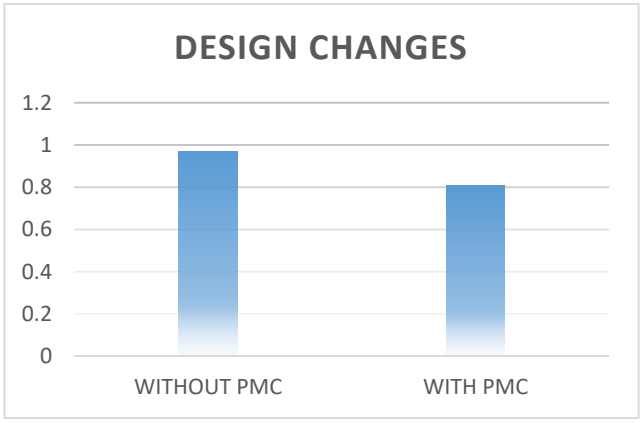


Figure 6.2- Design changes

6.2.3 Inadequate involvement of the owner during construction works

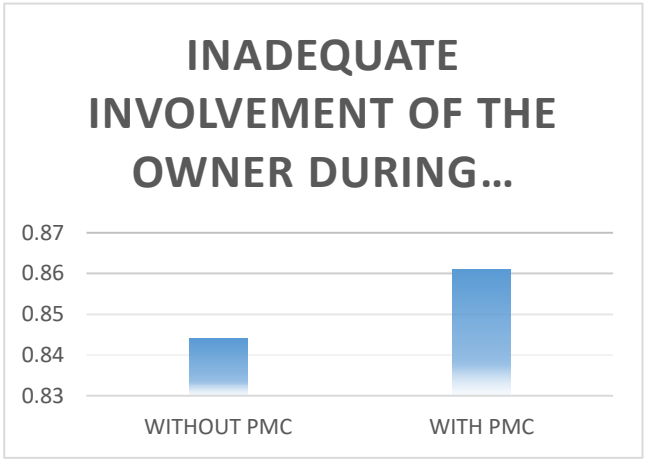


Figure 6.3-Inadequate involvement of the owner during construction works

The graph illustrates the Relative Importance Index (RII) for the issue of "Inadequate involvement of the owner during construction works," contrasting projects with and

without Project Management Consultancies (PMCs). In projects without PMCs, the RII is slightly below 0.845, indicating that inadequate owner involvement is a relatively common concern. This suggests a potential gap in communication and engagement, often leading to misaligned expectations and delays in decision-making. Conversely, in projects with PMCs, the RII is slightly below 0.865**,** a higher value compared to those without PMC involvement. This seemingly counterintuitive result may indicate that, while PMCs typically foster better owner involvement, the structured processes and reporting systems they implement also lead to a more frequent identification and acknowledgment of owner-related issues. In summary, the presence of PMCs generally enhances communication and owner involvement. However, the higher RII in projects with PMCs may reflect a more nuanced understanding and thorough documentation of these issues, highlighting the complexities and challenges in maintaining active owner engagement.

6.2.4 Labour turnover

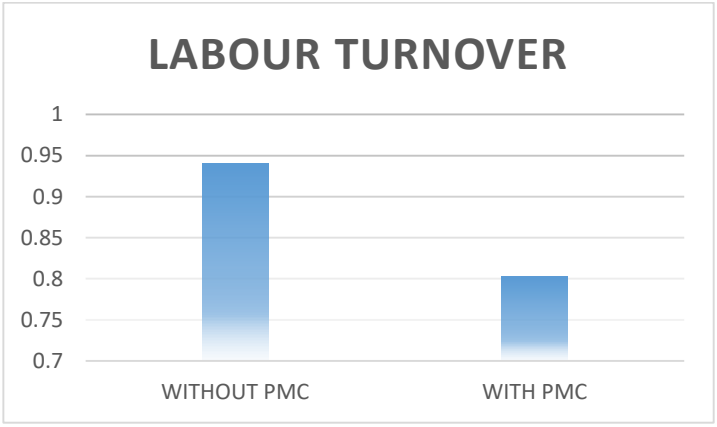


Figure 6.4- Labour turnover

The graph compares the Relative Importance Index (RII) for the issue of "Labour turnover" in township projects, distinguishing between projects with and without Project Management Consultancies (PMCs). The RII for projects without PMCs is 0.94, while for projects with PMCs, it is.803 .This disparity indicates that labour turnover is a more prominent issue in projects that do not utilize PMCs. A higher RII suggests that such projects experience frequent or significant labour turnover, which could be due to factors like poor working conditions, inadequate management, or lack of job security. In contrast, the lower RII in projects with PMCs implies that these issues are less severe, likely due to better management practices, clearer communication, and more structured work environments. PMCs typically implement policies and procedures that help retain workers by providing a more stable and satisfying workplace. Thus, the involvement of PMCs

appears to effectively reduce labour turnover, contributing to a more consistent and experienced workforce, which can lead to better project outcomes.

6.2.5 Inadequate site meetings

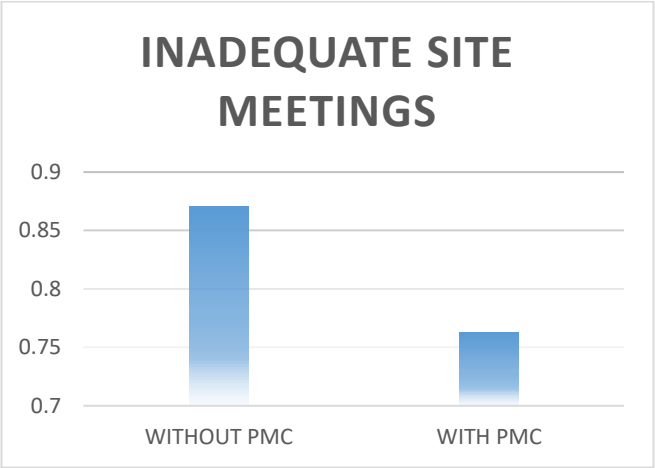


Figure 6.5- Inadequate site meetings

The graph compares the Relative Importance Index (RII) for the issue of "Inadequate site meetings" in township projects, highlighting differences between projects with and without the involvement of Project Management Consultancies (PMCs). In projects without PMCs, the RII is 0.87, indicating that inadequate site meetings are a significant concern. This high value suggests that the lack of regular and effective site meetings leads to issues such as poor coordination, communication breakdowns, and delayed decision-making, which can negatively impact project outcomes.In contrast, projects with PMCs have a lower RII of 0.763 for inadequate site meetings. This reduction suggests that PMCs play a crucial role in organizing and facilitating more frequent and productive site meetings. The structured approach and professional oversight provided by PMCs help ensure that all relevant stakeholders are well-informed and that critical issues are promptly addressed. Consequently, the lower RII indicates fewer instances of inadequate site meetings, reflecting better project management and coordination. Overall, the graph underscores the importance of PMCs in improving site meeting practices, which can lead to more efficient project execution and better alignment among project participants.

6.2.6 Low level of appropriate technology

The graph compares the Relative Importance Index (RII) for the issue of "Low level of appropriate technology" in township projects, contrasting projects with and without the involvement of Project Management Consultancies (PMCs). In projects without PMCs, the RII is 0.767, indicating that the lack of appropriate technology is a more pronounced issue.

This higher value suggests that these projects often suffer from outdated or insufficient technology, which can hinder efficiency and quality.

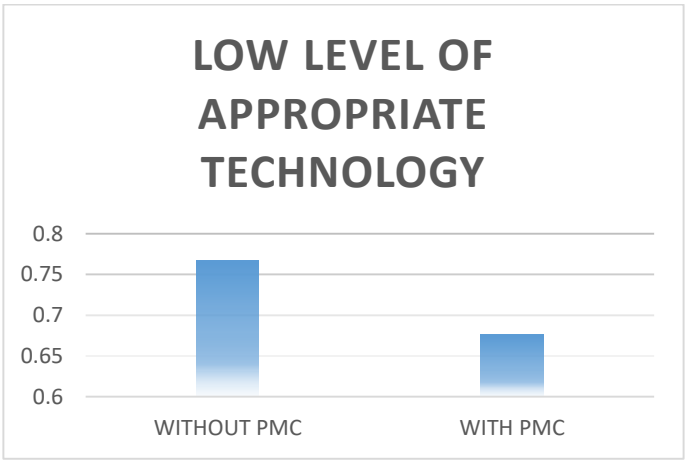


Figure 6.6- Low level of appropriate technology

In projects with PMCs, the RII is lower at 0.676, suggesting that the issue of inadequate technology is less significant. This reduction reflects the role of PMCs in facilitating the adoption of more modern and suitable technologies, thereby improving project outcomes. Overall, the graph highlights that PMCs contribute to a more effective implementation of appropriate technologies, reducing the negative impacts associated with technological deficiencies in construction projects.

6.2.7 Poor labour remuneration

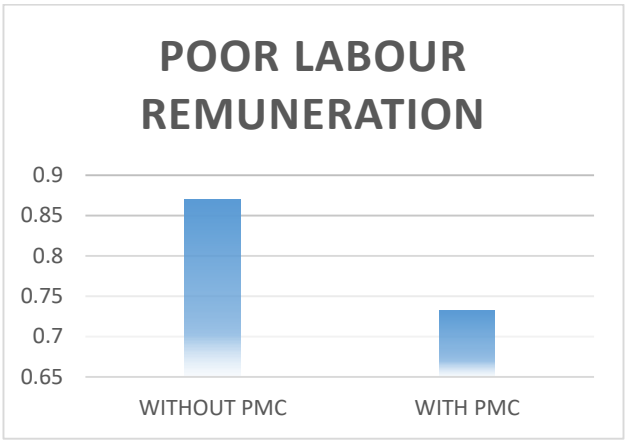


Figure 6.7- Poor labour remuneration

The graph illustrates the Relative Importance Index (RII) for the issue of "Poor labour remuneration" in township projects, comparing projects with and without Project Management Consultancies (PMCs). In projects without PMCs, the RII is 0.87, indicating that poor labour remuneration is a significant issue. This high value suggests that inadequate pay is a prevalent concern, potentially leading to low worker morale and high

turnover.In contrast, projects with PMCs have a lower RII of 0.732, indicating that poor labour remuneration is less of a problem. The involvement of PMCs likely contributes to better wage management and fairer compensation practices, helping to address remuneration issues more effectively. Overall, the graph suggests that PMCs play a crucial role in ensuring better pay structures, which can lead to a more satisfied and stable workforce.

6.2.8 Lack of quality assurance

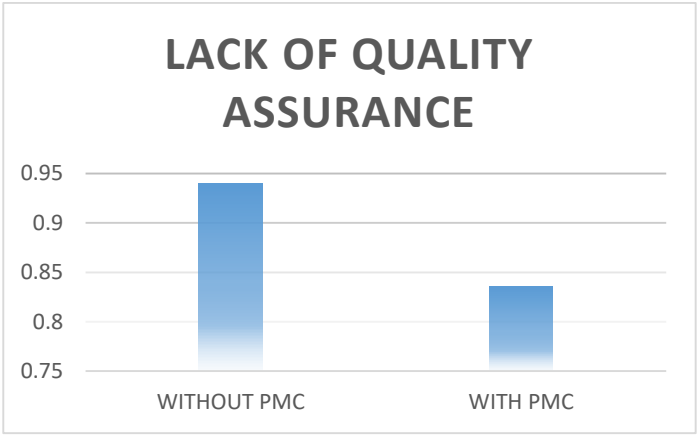


Figure 6.8- Lack of quality assurance

The graph compares the Relative Importance Index (RII) for the issue of "Lack of quality assurance" in township projects, highlighting the difference between projects with and without the involvement of Project Management Consultancies (PMCs). In projects without PMCs, the RII is 0.94, indicating that the lack of quality assurance is a significant concern. This high value suggests that these projects often struggle with maintaining consistent standards, leading to potential issues with construction quality and reliability.In projects with PMCs, the RII is lower at 0.836, showing a reduced concern regarding quality assurance. This reduction reflects the positive impact of PMCs in implementing robust quality control measures and standards. PMCs likely contribute to more systematic and effective quality assurance processes, ensuring better adherence to specifications and minimizing construction defects. Overall, the graph underscores the importance of PMCs in enhancing quality assurance, leading to higher quality outcomes in construction projects.

6.2.9 Flaws in design specification

The graph illustrates the Relative Importance Index (RII) for the issue of "Flaws in design specification" in township projects, comparing the impact in projects with and without the involvement of Project Management Consultancies (PMCs). For projects without PMCs,

the RII is 0.84, indicating that flaws in design specifications are a significant concern. This high value suggests frequent issues with design accuracy and clarity, which can lead to construction errors, rework, and project delays.

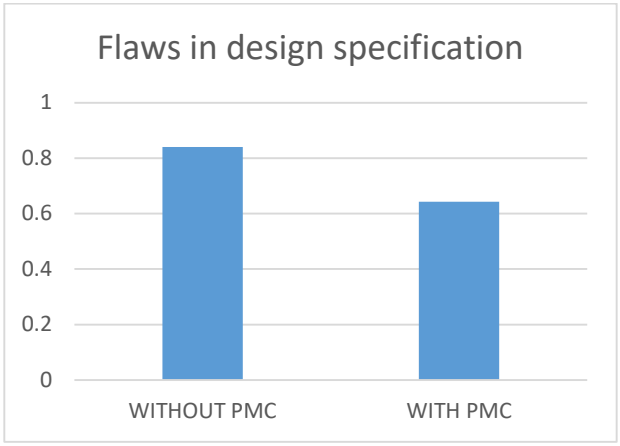


Figure 6.9- Flaws in design specification

In contrast, projects with PMCs show a much lower RII of 0.643**,** indicating that the incidence and impact of design specification flaws are substantially reduced. The involvement of PMCs likely contributes to more thorough design reviews, better communication between designers and contractors, and more rigorous adherence to project specifications. As a result, the graph highlights the role of PMCs in minimizing design-related issues, thereby improving overall project quality and efficiency.

6.2.10 Poor inspection and testing

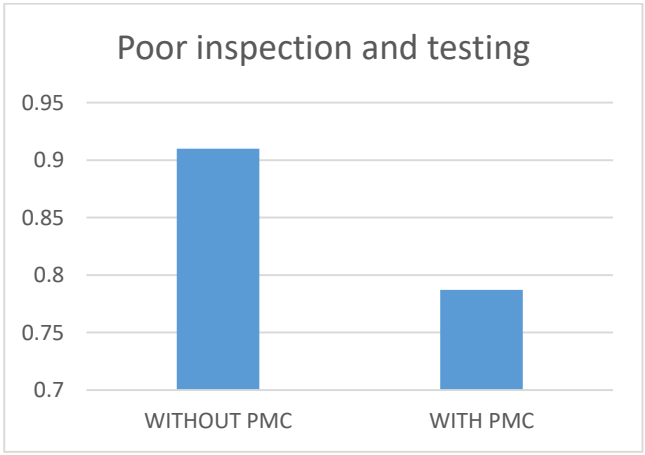


Figure 6.10- Poor inspection and testing

The graph depicts the Relative Importance Index (RII) for the issue of "Poor inspection and testing" in township projects, contrasting projects with and without Project Management Consultancies (PMCs). In projects without PMCs, the RII is 0.91, indicating that poor inspection and testing are a significant issue. This high value suggests frequent inadequacies in quality control processes, leading to potential defects and deviations from

project specifications.For projects with PMCs**,** the RII is lower at 0.787**,** showing a reduced concern regarding inspection and testing quality. The involvement of PMCs likely enhances the rigor and frequency of inspection and testing procedures, ensuring better adherence to standards and identifying issues early. Overall, the graph underscores the importance of PMCs in improving the quality assurance processes, thereby contributing to higher project standards and reducing the likelihood of errors.

6.2.11 Unfriendly atmosphere and trust among participants

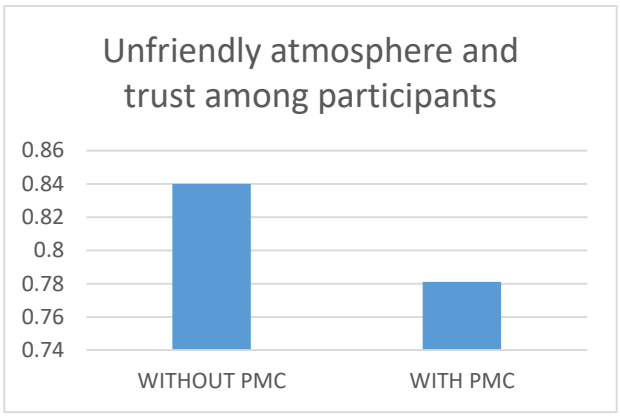


Figure 6.11- Unfriendly atmosphere and trust among participants

The graph compares the Relative Importance Index (RII) for the issue of "Unfriendly atmosphere and lack of trust among participants" in township projects, differentiating between projects with and without Project Management Consultancies (PMCs). In projects without PMCs**,** the RII is 0.84, indicating that a lack of trust and an unfriendly atmosphere are significant issues. This high value suggests that poor interpersonal relationships and communication barriers are more prevalent, potentially leading to conflicts and inefficiencies.In projects with PMCs, the RII is lower at 0.781, suggesting that these issues are less pronounced. The presence of PMCs likely facilitates better communication, conflict resolution, and collaboration among project participants. PMCs often implement structured processes and foster a more professional work environment, which helps build trust and improve the overall atmosphere. Thus, the graph highlights the role of PMCs in creating a more positive and cooperative project environment, which can enhance teamwork and project success.

6.2.12 Poor quality of material delivered to site

The graph compares the Relative Importance Index (RII) for the issue of "Poor quality of material delivered to the site" in township projects, contrasting projects with and without Project Management Consultancies (PMCs). In projects **without PMCs**, the RII is **0.87**,

indicating that the delivery of poor-quality materials is a significant problem. This high value suggests that issues related to material quality are more common, potentially leading to construction defects, rework, and increased costs.

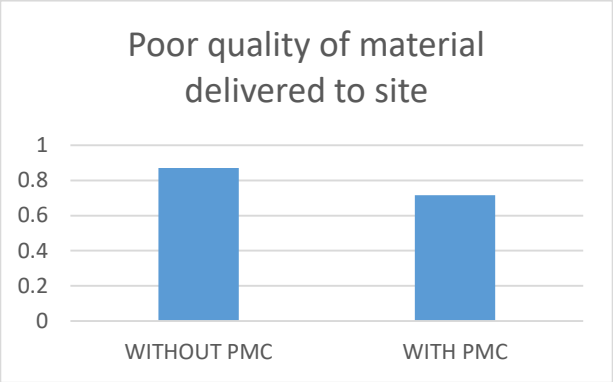


Figure 6.12-Poor quality of material delivered to site

In projects with PMCs, the RII is lower at 0.716, showing a reduced occurrence of poor-quality material deliveries. The involvement of PMCs likely contributes to better procurement practices, more stringent quality checks, and improved supplier management. As a result, the graph demonstrates that PMCs play a crucial role in ensuring the quality of materials delivered to the site, thereby enhancing the overall quality and reliability of the construction project.

6.2.13 Making site decisions on cost and not value of work

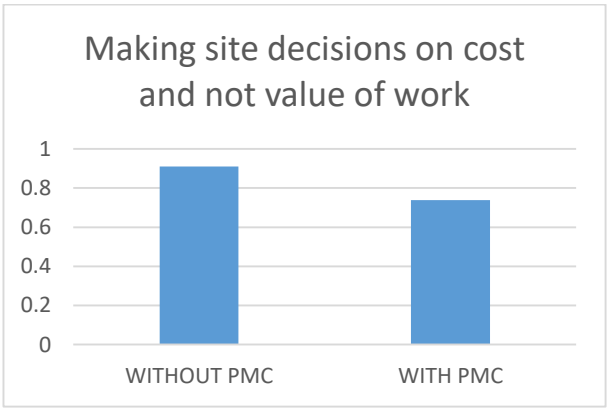


Figure 6.13- Making site decisions on cost and not value of work

The graph illustrates the Relative Importance Index (RII) for the issue of "Making site decisions based on cost rather than the value of work" in township projects, comparing projects with and without Project Management Consultancies (PMCs). In projects without PMCs**,** the RII is 0.91**,** indicating that decisions prioritizing cost over value are a significant concern. This high value suggests that such decisions are frequently made, potentially leading to compromised quality, reduced project value, and short-term thinking.

In contrast, projects with PMCs have a lower RII of 0.738, indicating a lesser focus on cost-only decisions. The involvement of PMCs likely fosters a more balanced approach, emphasizing the overall value and long-term benefits of work rather than solely focusing on immediate cost savings. This can result in better quality outcomes and more sustainable project decisions. Overall, the graph highlights the positive impact of PMCs in promoting value-based decision-making, which can enhance project quality and effectiveness.

6.2.14 Contractors' poor financial management

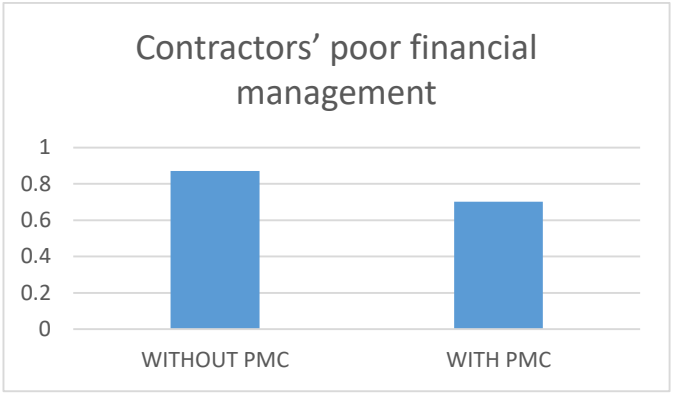


Figure 6.14-Contractors' poor financial management

The graph shows the Relative Importance Index of "Contractors' poor financial management" with and without the presence of a Project Management Consultant (PMC). Without a PMC, the index is 0.87, indicating that poor financial management by contractors is considered a highly significant issue. With a PMC involved, the index drops to 0.701, suggesting that the PMC's oversight reduces the perceived severity of the problem. This indicates that the PMC's involvement mitigates the impact of poor financial management by contractors.

6.2.15 Poor level of commitment to quality improvement among project participants

The graph illustrates the Relative Importance Index for "Poor level of commitment to quality improvement among project participants" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.9, reflecting a high concern about the lack of commitment to quality improvement. When a PMC is present, the index decreases to 0.796, indicating that the PMC's involvement alleviates some of the concerns regarding commitment to quality improvement. This suggests that the PMC's role helps improve the focus on quality among project participants.

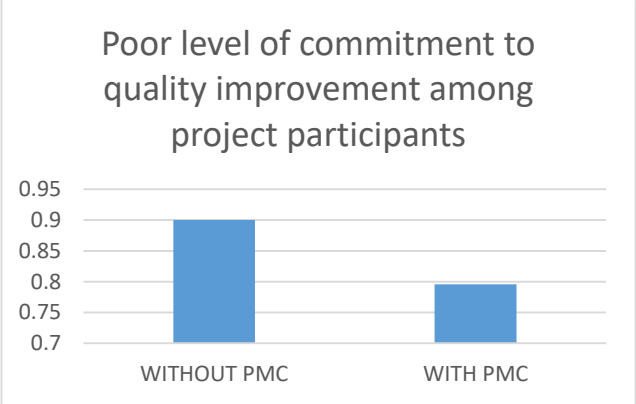


Figure 6.15- Poor level of commitment to quality improvement among project participants

6.2.16 Poor weather conditions

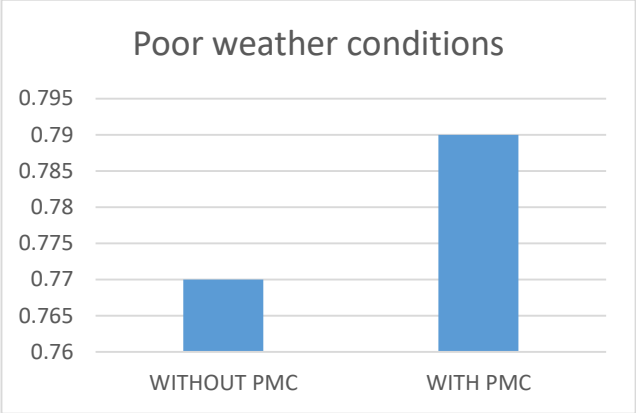


Figure 6.16- Poor weather conditions

The graph displays the Relative Importance Index for "Poor weather conditions" with and without the presence of a Project Management Consultant (PMC). Without a PMC, the index is 0.77, suggesting that poor weather conditions are seen as a moderately significant issue. With a PMC, the index increases slightly to 0.79, indicating that the PMC's involvement makes poor weather conditions slightly more impactful. This could imply that the PMC may contribute to a heightened awareness or management of weather-related challenges, thereby making them a more prominent concern.

6.2.17 Poor site installation procedure

The graph shows the Relative Importance Index for "Poor site installation procedure" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.84, indicating that poor site installation procedures are viewed as a significant issue. With a PMC, the index drops to 0.643, suggesting that the PMC's involvement reduces the perceived severity of this problem. This indicates that the PMC's oversight or management improves site installation procedures, thereby lessening their impact on the project.

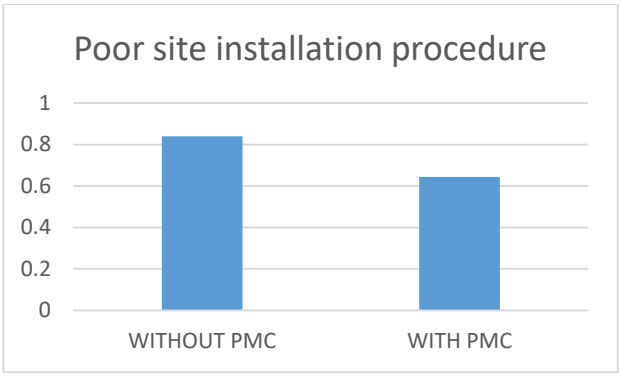


Figure 6.17- Poor site installation procedure

6.2.18 Design changes

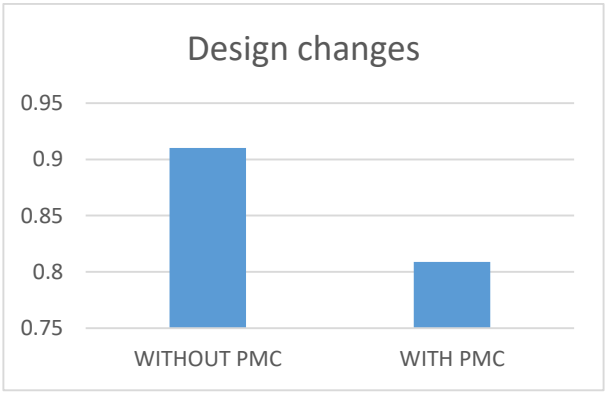


Figure 6.18- Design changes

The graph presents the Relative Importance Index for "Design changes" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.91, signifying that design changes are considered a major concern. With a PMC, the index decreases to 0.809, indicating that the PMC's involvement reduces the perceived impact of design changes. This suggests that the PMC's oversight or management helps to mitigate the issues associated with design changes, making them less problematic for the project.

6.2.19 Poor reports and record-keeping

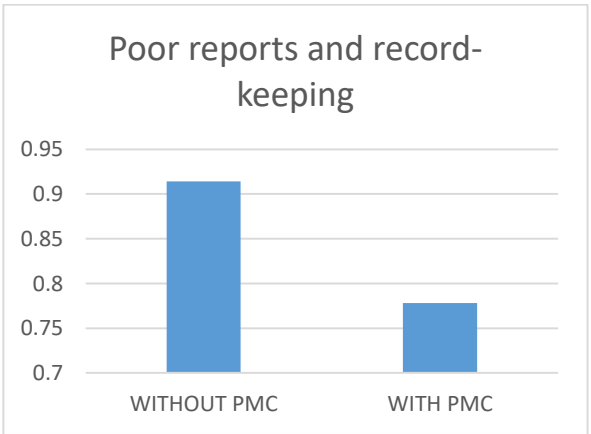


Figure 6.19-Poor reports and record-keeping

The graph illustrates the Relative Importance Index for "Poor reports and record-keeping" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.914, indicating that poor reports and record-keeping are viewed as a significant issue. With a PMC, the index decreases to 0.778, suggesting that the PMC's involvement alleviates some of the concerns related to documentation and record-keeping. This implies that the PMC's presence improves the quality of reports and record-keeping, thereby reducing its impact on the project

6.2.20 Poor site supervision

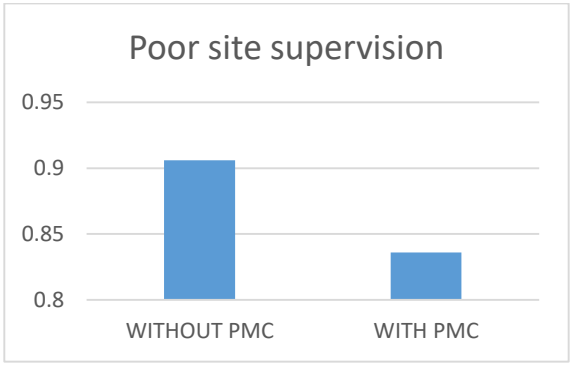


Figure 6.20-Poor site supervision

The graph shows the Relative Importance Index for "Poor site supervision" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.906, indicating that poor site supervision is seen as a significant issue. With a PMC, the index decreases to 0.836, suggesting that the PMC's involvement helps to mitigate the problems associated with poor site supervision. This reduction implies that the PMC's presence improves site oversight, thereby lessening the impact of poor supervision on the project.

6.2.21 Low level of skill and labour experience

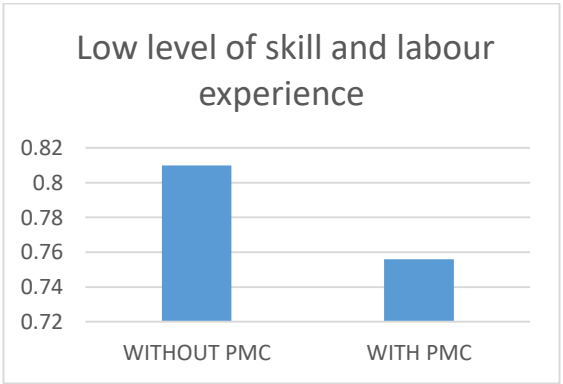


Figure 6.21- Low level of skill and labour experience

The graph displays the Relative Importance Index for "Low level of skill and labour experience" with and without a Project Management Consultant (PMC). Without a PMC,

the index is 0.81, indicating that low skill and experience among labor is a notable concern. With a PMC, the index decreases to 0.756, suggesting that the PMC's involvement slightly alleviates the impact of this issue. This implies that the PMC's management or oversight helps to address or mitigate the challenges related to skill and experience, making them somewhat less problematic for the project.

6.2.22 Unrealistic constraints of project time

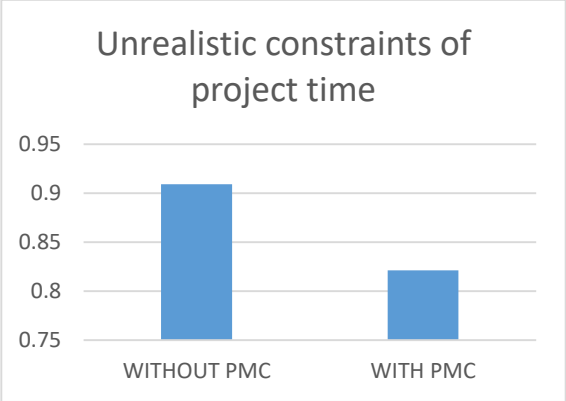


Figure 6.22- Unrealistic constraints of project time

The graph illustrates the Relative Importance Index for "Unrealistic constraints of project time" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.909, indicating that unrealistic project time constraints are considered a major concern. With a PMC, the index drops to 0.821, suggesting that the PMC's involvement helps to mitigate the impact of unrealistic time constraints. This reduction implies that the PMC's management or planning improves the handling of project timelines, making time constraints less problematic.

6.2.23 Effect of code and standards on quality

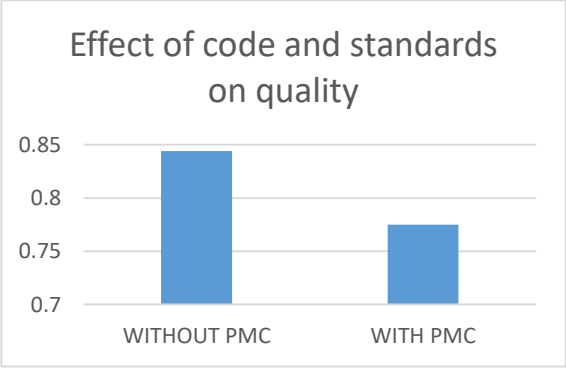
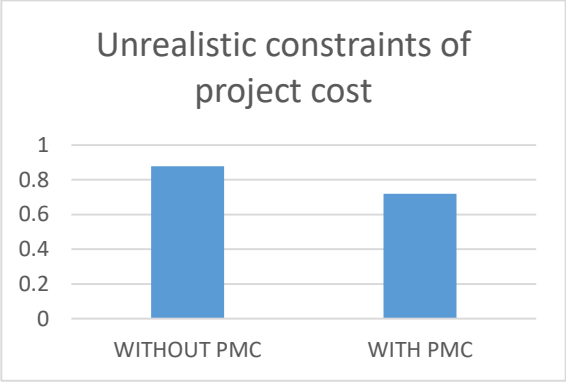


Figure 6.23- Effect of code and standards on quality

The graph shows the Relative Importance Index for the "Effect of code and standards on quality" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.844, indicating that the impact of codes and standards on quality is a significant concern. With a PMC, the index decreases to 0.775, suggesting that the PMC's involvement helps to lessen the perceived impact of these codes and standards on quality. This implies that the PMC's oversight or management helps to better navigate or address the influence of regulations on project quality, reducing their overall impact.

6.2.24 Unrealistic constraints of project cost



The graph displays the Relative Importance Index for "Unrealistic constraints of project cost" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.877, indicating that unrealistic cost constraints are viewed as a significant issue. With a PMC, the index drops to 0.72, suggesting that the PMC's involvement helps to alleviate some of the concerns related to cost constraints. This decrease implies that the PMC's management or oversight improves the handling of project budgets, making unrealistic cost constraints less problematic.

6.2.25 Poor communication among participants

The graph shows the Relative Importance Index for "Poor communication among participants" with and without a Project Management Consultant (PMC). Without a PMC, the index is 0.844, indicating that poor communication is considered a significant issue. With a PMC, the index decreases to 0.683, suggesting that the PMC's involvement helps to improve communication among participants. This reduction implies that the PMC's oversight or management enhances communication, making it a less critical concern for the project.

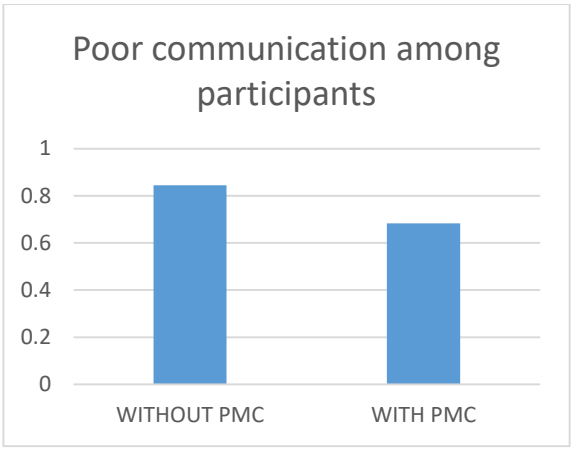


Figure 6.25- Poor communication among participants

6.2.26 Design defects

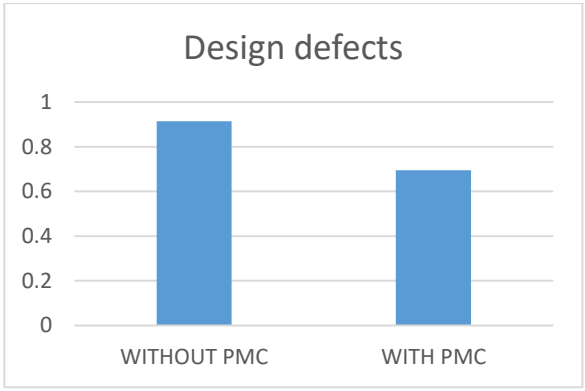


Figure 6.26- Design defects

The graph compares the Relative Importance Index for "Poor communication among participants" and "Design defects" with and without a Project Management Consultant (PMC). Without a PMC, the index for poor communication is 0.914, indicating it is a major concern, while design defects are not shown. With a PMC, the index for poor communication drops significantly to 0.695, suggesting that the PMC's involvement significantly improves communication among participants. This implies that the PMC's presence lessens the impact of poor communication, making it a less pressing issue.

6.3 Comparison of RII

Table 6.1- Comparison of RII

Parameters	Without PMC	With PMC	Change in Percentage of RII
Non-identification of non-conforming work	1.012987	0.784	29.20753
Design changes	0.970779	0.806	20.44407

Inadequate involvement of the owner during construction works	0.844156	0.861	-1.95635
Poor project planning	0.911688	0.856	6.505644
Labour turnover	0.945455	0.803	17.74029
Inadequate site meetings	0.877922	0.763	15.06187
Low level of appropriate technology	0.767	0.676	13.46154
Poor labour remuneration	0.877922	0.732	19.93471
Lack of quality assurance	0.945455	0.836	13.09265
Flaws in design specification	0.844156	0.643	31.28396
Poor inspection and testing	0.911688	0.787	15.8435
Unfriendly atmosphere and trust among participants	0.844156	0.781	8.086536
Poor quality of material delivered to site	0.877922	0.716	22.61482
Making site decisions on cost and not value of work	0.911688	0.738	23.535
Contractors' poor financial management	0.877922	0.701	25.23853
Poor level of commitment to quality improvement among project participants	0.906494	0.796	13.88109
Poor weather conditions	0.77	0.79	-2.53165
Poor site installation procedure	0.844156	0.643	31.28396
Design changes	0.911688	0.809	12.69324
Poor reports and record-keeping	0.914286	0.778	17.51744
Poor site supervision	0.906494	0.836	8.432238
Low level of skill and labour experience	0.81039	0.756	7.194393
Unrealistic constraints of project time	0.909091	0.821	10.72971
Effect of code and standards on quality	0.844156	0.775	8.923335
Unrealistic constraints of project cost	0.877922	0.72	21.93362
Poor communication among participants	0.844156	0.683	23.59529
Design defects	0.911688	0.695	31.17817

The table lists various parameters related to project management, comparing their Relative Importance Index (RII) values "Without PMC" (Project Management Component) and "With PMC." It also shows the percentage change in RII values, indicating how the importance of each parameter has changed with the introduction of PMC.The table demonstrates that for most parameters, the introduction of PMC has resulted in a decrease in their relative importance, as indicated by the RII values. Significant decreases (over 20%) are observed in factors such as "Non-identification of non-conforming work," "Flaws in design specification," and "Design defects." However, a few parameters such as "Inadequate involvement of the owner during construction works" and "Poor weather conditions" have increased in importance. This suggests that while PMC has a generally positive impact on

reducing the criticality of many issues, it may also highlight or exacerbate certain areas that need more attention.

6.4 Validation of Study

The Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It allows decision-makers to model a complex problem in a hierarchical structure showing the relationships of the goal, criteria, and sub-criteria.

6.3.1 Validation for without PMC

Step 1: Construct the Pairwise Comparison Matrix

First, we need to construct a pairwise comparison matrix for the given parameters. Let's assume the following parameters for simplicity:

1. Non-identification of non-conforming work (NINW)
2. Design changes (DC)
3. Labour turnover (LT)
4. Lack of quality assurance (LQA)
5. Poor reports and record-keeping (PRR)

We will use a scale from 1 to 9 to fill the matrix, where 1 means both elements are equally important and 9 means one element is extremely more important than the other. For simplicity, we'll start with an example pairwise comparison matrix:

	NINW	DC	LT	LQA	PRR
NINW	1	3	5	7	9
DC	1/3	1	3	5	7
LT	1/5	1/3	1	3	5
LQA	1/7	1/5	1/3	1	3
PRR	1/9	1/7	1/5	1/3	1

Step 2: Calculate the Weight Vector

Next, we need to calculate the weights for each parameter. This is done by normalizing the matrix and then averaging the rows.

- **Normalizing the Matrix**

To normalize the matrix, sum each column and then divide each element by the sum of its respective column.

	NINW	DC	LT	LQA	PRR
SUM	1.887	4.486	9.533	16.333	25

	NINW	DC	LT	LQA	PRR
NINW	0.53	0.67	0.52	0.43	0.36
DC	0.18	0.22	0.31	0.31	0.28
LT	0.11	0.07	0.10	0.18	0.20
LQA	0.08	0.04	0.03	0.06	0.12
PRR	0.06	0.03	0.02	0.02	0.04

- **Averaging the Rows**

Now, average the rows to get the weight vector.

	Weighs	
NINW	(0.53+0.67+0.52++0.43+0.36)/5=	0.50
DC	(0.18+0.22+0.31+0.31+0.28/5=	0.26
LT	(0.11+0.07+0.10+0.18+0.20/5=	0.13
LQA	(0.08+0.04+0.03+0.06+0.12/5=	0.07
PRR	(0.06+0.03+0.02+0.02+0.04/5=	0.03

- **Weights**

1. **Non-identification of non-conforming work (NINW):** 0.503
2. **Design changes (DC):** 0.260
3. **Labour turnover (LT):** 0.134
4. **Lack of quality assurance (LQA):** 0.068
5. **Poor reports and record-keeping (PRR):** 0.035

Step 3: Check the Consistency Ratio

To check the consistency ratio, we first need to calculate the Consistency Index (CI) and then the Consistency Ratio (CR).

- **Pairwise Comparison Matrix**

The pairwise comparison matrix A:

$$A=\begin{vmatrix} 1 & 3 & 5 & 7 & 9 \\ 1/3 & 1 & 3 & 5 & 7 \\ 1/5 & 1/3 & 1 & 3 & 5 \\ 1/7 & 1/5 & 1/3 & 1 & 3 \\ 1/9 & 1/7 & 1/5 & 1/3 & 1 \end{vmatrix}$$

Sum of each column:

Sum = [1+1/3+1/5+1/7+1/9 3+1+13+15+17 5+3+1+13+15 7+5+3+1+13 9+7+5+3+1]

= [1.887 4.486 9.533 16.333 25]

- **Normalize the Matrix**

Normalize the matrix by dividing each element by the sum of its column:

$$A_{Norm}=\begin{vmatrix} \frac{1}{1.887} & \frac{3}{4.486} & \frac{5}{9.533} & \frac{7}{16.333} & \frac{9}{25} \\ \frac{1/3}{1.887} & \frac{1}{4.486} & \frac{3}{9.533} & \frac{5}{16.333} & \frac{7}{25} \\ \frac{1/5}{1.887} & \frac{1/3}{4.486} & \frac{1}{9.533} & \frac{3}{16.333} & \frac{5}{25} \\ \frac{1/7}{1.887} & \frac{1/5}{4.486} & \frac{1/3}{9.533} & \frac{1}{16.333} & \frac{3}{25} \\ \frac{1/9}{1.887} & \frac{1/7}{4.486} & \frac{1/5}{9.533} & \frac{1/3}{16.333} & \frac{1}{25} \end{vmatrix}$$

$$A_{Norm}=\begin{vmatrix} 0.53 & 0.67 & 0.52 & 0.43 & 0.26 \\ 0.18 & 0.22 & 0.31 & 0.31 & 0.28 \\ 0.11 & 0.07 & 0.10 & 0.18 & 0.20 \\ 0.08 & 0.04 & 0.03 & 0.06 & 0.12 \\ 0.06 & 0.03 & 0.02 & 0.02 & 0.04 \end{vmatrix}$$

- **Calculate the Weight Vector**

Calculate the weights by averaging the rows of the normalized matrix:

$$\begin{vmatrix} (0.53+0.67+0.52+0.43+0.26)/5 \end{vmatrix}$$

$$\text{Weights} = \begin{vmatrix} (0.18+0.22+0.31+0.31+0.28)/5 \\ (0.11+0.07+0.10+0.18+0.20)/5 \\ 0.08+0.04+0.03+0.06+0.12)/5 \\ (0.06+0.03+0.02+0.02+0.04)/5 \end{vmatrix}$$

$$\text{Weights} = \begin{vmatrix} 0.503 \\ 0.26 \\ 0.134 \\ 0.068 \\ 0.035 \end{vmatrix}$$

- **Calculate λ_{max}**

Multiply the pairwise comparison matrix by the weight vector and then divide by the weight vector:

$$\text{Weights} = \begin{vmatrix} 1 & 3 & 5 & 7 & 9 \\ 1/3 & 1 & 3 & 5 & 7 \\ 1/5 & 1/3 & 1 & 3 & 5 \\ 1/7 & 1/5 & 1/3 & 1 & 3 \\ 1/9 & 1/7 & 1/5 & 1/3 & 1 \end{vmatrix} * \begin{vmatrix} 0.503 \\ 0.26 \\ 0.134 \\ 0.068 \\ 0.035 \end{vmatrix}$$

$$\text{Weights} = \begin{vmatrix} 2.633 \\ 1.328 \\ 0.682 \\ 0.345 \\ 0.178 \end{vmatrix}$$

Then, divide by the weight vector:

$$(A \cdot \text{Weight})/\text{Weights} = \begin{vmatrix} 2.633/0.503 \\ 0.328/0.26 \\ 0.682/0.134 \\ 0.345/0.068 \\ 0.178/0.035 \end{vmatrix}$$

$$(A \cdot \text{Weight})/\text{Weights} = \begin{vmatrix} 5.23459245 \\ 1.26153846 \\ 5.08955224 \\ 5.07352941 \\ 5.08571429 \end{vmatrix}$$

- **The average of these values is λ_{max}:**

λ_{max}= 5.233+5.108+5.089+5.074+5.086/5

=5.243

- **Calculate Consistency Index (CI)**

CI=(λ_{max}− n)/(n−1)

=(5.243−5)/(5−1)

CI=0.061

- **Calculate Consistency Ratio (CR)**

The Random Index (RI) for n=5is 1.12.

CR=RI/CI

=1.12/0.061

CR =0.054

Since CR=0.054, which is less than 0.1, the pairwise comparison matrix is consistent.

- **Consistency Check**
  - **λ_{max}:** 5.243
  - **Consistency Index (CI):** 0.061
  - **Consistency Ratio (CR):** 0.054

Since the Consistency Ratio (CR) is 0.054, which is less than 0.1, the pairwise comparison matrix is consistent.

6.3.2 Validation for without PMC

Step 1: Construct the Pairwise Comparison Matrix

First, we need to construct a pairwise comparison matrix for the given parameters. Let's assume the following parameters for simplicity:

1. Lack of Quality Assurance (LQA)
2. Poor communication among participants (PCP)
3. Poor site supervision (PSS)
4. Non-identification of non-conforming work (NINW)

We will construct a pairwise comparison matrix based on your parameters. The values will be assigned using a scale from 1 to 9, where 1 means both parameters are equally important, and 9 means one parameter is extremely more important than the other.Let's assume the following matrix for the sake of this exercise. You can adjust these values based on your specific preferences:

	LQA	PCP	PSS	NINW	PIT
LQA	1	4	6	7	8
PCP	1/4	1	4	6	7
PSS	1/6	1/4	1	4	6
NINW	1/7	1/6	1/4	1	4
PIT	1/8	1/7	1/6	1/4	1

Step 2: Calculate the Weight Vector

Next, we need to calculate the weights for each parameter. This is done by normalizing the matrix and then averaging the rows.

- **Normalizing the Matrix**

To normalize the matrix, sum each column and then divide each element by the sum of its respective column.

	LQA	PCP	PSS	NINW	PIT
SUM	1.687	5.347	10.025	17.333	25.287

	LQA	PCP	PSS	NINW	PIT

LQA	0.592	0.747	0.598	0.404	0.316
PCP	0.148	0.187	0.299	0.231	0.198
PSS	0.091	0.056	0.100	0.173	0.158
NINW	0.061	0.037	0.033	0.058	0.119
PIT	0.046	0.019	0.013	0.017	0.040

- **Averaging the Rows**

Now, average the rows to get the weight vector.

	Weighs	
NINW	(0.53+0.67+0.52++0.43+0.36)/5=	0.5380
DC	(0.18+0.22+0.31+0.31+0.28/5=	0.221
LT	(0.11+0.07+0.10+0.18+0.20/5=	0.127
LQA	(0.08+0.04+0.03+0.06+0.12/5=	0.074
PRR	(0.06+0.03+0.02+0.02+0.04/5=	0.040

- **Weights**
  1. Lack of Quality Assurance (LQA): 0.538
  2. Poor communication among participants (PCP): 0.221
  3. Poor site supervision (PSS): 0.127
  4. Non-identification of non-conforming work (NINW): 0.074
  5. Poor inspection and testing (PIT): 0.040

Step 3: Check the Consistency Ratio

To check the consistency ratio, we first need to calculate the Consistency Index (CI) and then the Consistency Ratio (CR).

- **Calculate λ_{max}**

Multiply the pairwise comparison matrix by the weight vector and then divide by the weight vector:

	1	4	6	7	8		0.5380
	1/4	1	4	6	7		0.221
Weights=	1/6	1/4	1	4	6	*	0.127
	1/7	1/6	1/4	1	4		0.074

1/8	1/7	1/6	1/4	1		0.040

Then, divide by the weight vector:

$$\text{Weights} = \begin{vmatrix} 2.882 \\ 1.206 \\ 0.645 \\ 0.395 \\ 0.228 \end{vmatrix}$$

$$(A \cdot \text{Weight})/\text{Weights} = \begin{vmatrix} 5.36 \\ 5.45 \\ 5.08 \\ 5.34 \\ 5.70 \end{vmatrix}$$

- **The average of these values is λ_{max}:**

λ_{max}= 5.36+5.45+5.08+5.34+5.70/5

=5.333

- **Calculate Consistency Index (CI)**

CI=(λ_{max}− n)/(n−1)

=(5.333−5)/(5−1)

CI=0.083

- **Calculate Consistency Ratio (CR)**

The Random Index (RI) for n=5is 1.12.

CR=RI/CI

=1.12/0.0883

CR =0.074

Since CR=0.074, which is less than 0.1, the pairwise comparison matrix is consistent.

- **Consistency Check**
  - **λmax:** 5.333
  - **Consistency Index (CI):** 0.083
  - **Consistency Ratio (CR):** 0.074

Since the Consistency Ratio (CR) is 0.074, which is less than 0.1, the pairwise comparison matrix is consistent.

6.5 Closure

This section presents the analysis and validation of project delay factors using the Relative Importance Index (RII) and the Analytic Hierarchy Process (AHP). Below is a breakdown of the findings and the validation process for key factors, with and without Project Management Consultant (PMC) involvement.

Chapter-7

Recommendation

7.1 Lack of Quality Assurance

7.1.1 Factors Causing Lack of Quality Assurance:

- Inadequate Planning and Documentation: Insufficient planning and poorly maintained documentation can lead to oversight in quality standards.
- Poor Training and Skill Levels: Workers and supervisors may lack the necessary skills or training to ensure quality.
- Cost-Cutting Measures: Pressure to reduce costs can lead to the use of substandard materials and shortcuts in processes.
- Lack of Supervision and Monitoring: Insufficient supervision can result in non-compliance with quality standards.
- Inefficient Communication: Poor communication between stakeholders can cause misunderstandings and misalignment with quality expectations.

7.1.2 Arising in Township Projects:

- These factors can arise at various stages of the project lifecycle, from design to execution.
- Quality assurance might be compromised due to tight schedules and budget constraints, affecting the overall performance of the project.

7.1.3 Severity and Effects:

- Structural Integrity Issues: Lack of quality assurance can lead to structural weaknesses, increasing the risk of defects and failures.
- Increased Maintenance Costs: Poor quality can result in frequent repairs and higher maintenance costs.
- Reputation Damage: Developers and contractors may suffer reputational damage, leading to loss of future business opportunities.

- Project Delays: Rectifying quality issues can cause significant delays in project completion.
- Customer Dissatisfaction: End-users may experience dissatisfaction due to poor quality, affecting sales and occupancy rates.

7.1.4 Remedies:

- Implementing Rigorous Quality Control Measures: Establishing strict quality control protocols throughout the project lifecycle.
- Regular Training Programs: Conducting ongoing training for workers and supervisors to ensure they are up-to-date with quality standards and practices.
- Third-Party Inspections: Engaging third-party inspectors to audit quality at various stages of the project.
- Improving Documentation and Reporting: Maintaining comprehensive documentation and regular reporting to track quality compliance.
- Strengthening Communication Channels: Enhancing communication among all stakeholders to ensure clear understanding and adherence to quality expectations.

7.2 Poor Communication Among Participants

7.2.1 Factors Causing Poor Communication:

- Lack of Clear Roles and Responsibilities: Unclear delineation of roles can lead to confusion and miscommunication.
- Geographical Dispersal: Participants located in different geographical areas may face challenges in communication.
- Language and Cultural Differences: Diverse teams may struggle to communicate effectively due to language barriers and cultural differences.
- Technological Barriers: Inadequate use of communication tools and technology can hinder effective communication.
- Hierarchy and Power Dynamics: Hierarchical structures and power imbalances may stifle open communication.

7.2.2 Arising in Township Prjects:

- Coordination Challenges: Poor communication can lead to delays in decision-making and coordination among various stakeholders.
- Quality Control Issues: Miscommunication can result in errors and omissions, impacting project quality.

- Conflict Resolution Problems: Lack of effective communication can escalate conflicts and disputes, hindering project progress.
- Schedule Overruns: Inefficient communication can cause delays in project timelines, leading to cost overruns.

7.2.3 Severity and Effects:

- Delay in Decision-making: Poor communication can lead to delays in critical decisions, affecting project progress.
- Increased Rework: Misunderstandings and lack of clarity can result in rework, increasing project costs and timelines.
- Risk of Errors and Omissions: Ineffective communication increases the likelihood of errors and omissions, impacting project quality.
- Team Disengagement: Participants may feel demotivated and disengaged when communication channels are ineffective, affecting overall project morale.
- Customer Dissatisfaction: Stakeholders, including clients and end-users, may experience dissatisfaction due to communication breakdowns, leading to reputational damage.

7.2.4 Remedies:

- Establishing Clear Communication Protocols: Define communication channels, frequency, and protocols to ensure effective communication.
- Regular Meetings and Updates: Conduct regular project meetings and status updates to keep all participants informed and aligned.
- Utilizing Technology: Implement communication tools and platforms to facilitate real-time communication and collaboration.
- Training and Development: Provide training on effective communication skills and cultural awareness to improve collaboration among diverse teams.
- Conflict Resolution Mechanisms: Establish clear processes for resolving conflicts and disputes promptly to prevent escalation.

7.3 Poor site supervision

7.3.1 Factors Causing Poor Site Supervision:

- Inadequate Training and Experience: Supervisors may lack the necessary training and experience to effectively oversee construction activities.

- High Turnover Rate: Rapid turnover of supervisory staff can lead to inconsistency in supervision and quality control.
- Resource Constraints: Limited resources, such as personnel and equipment, can hinder effective site supervision.
- Communication Breakdown: Lack of communication between site supervisors and project management can lead to oversight and neglect of critical tasks.
- Safety Concerns: Safety protocols and regulations may be overlooked due to inadequate supervision, posing risks to workers and project progress.

7.3.2 Arising in Township Projects:

- Quality Control Issues: Ineffective site supervision can result in poor workmanship and non-compliance with quality standards.
- Schedule Delays: Without proper oversight, construction activities may not proceed as planned, leading to project delays.
- Safety Incidents: Inadequate supervision increases the risk of safety incidents and accidents on-site, impacting project timelines and costs.
- Cost Overruns: Rework and rectification of errors due to poor supervision can escalate project costs.

7.3.3 Severity and Effects:

- Compromised Quality: Poor site supervision can lead to compromised quality, affecting the overall integrity and durability of the project.
- Increased Risks: Without adequate supervision, projects are exposed to risks such as safety hazards, regulatory non-compliance, and contractual disputes.
- Project Delays: Lack of oversight can result in delays in project milestones and overall completion, impacting stakeholders' expectations and financial projections.
- Budget Overruns: Rework and rectification of errors due to poor supervision can lead to unexpected budget overruns, straining project finances and resources.
- Reputational Damage: Incidents of poor site supervision can tarnish the reputation of the project stakeholders, affecting future business opportunities and partnerships.

7.3.4 Remedies:

- Investing in Training and Development: Provide comprehensive training programs for site supervisors to enhance their technical knowledge and leadership skills.

- Implementing Regular Site Inspections: Conduct regular site inspections by project management to ensure compliance with quality standards and safety regulations.
- Enhancing Communication Channels: Foster open communication channels between site supervisors, project managers, and other stakeholders to facilitate timely reporting and issue resolution.
- Utilizing Technology: Implement construction management software and mobile applications to streamline site supervision activities, track progress, and identify potential issues in real-time.
- Establishing Performance Metrics: Define key performance indicators (KPIs) for site supervision and regularly evaluate performance against these metrics to identify areas for improvement.

7.4 Non-identification of Non-conforming Work

7.4.1 Factors Causing Non-identification of Non-conforming Work:

- Lack of Quality Control Processes: Absence or inadequacy of quality control processes can lead to non-conforming work going unnoticed.
- Poor Documentation Practices: Incomplete or inaccurate documentation can hinder the identification of non-conforming work.
- Limited Inspection Resources: Insufficient resources allocated for inspections may result in oversight of non-conforming work.
- Ineffective Communication: Communication gaps between different project stakeholders can prevent timely reporting and resolution of non-conforming work.
- Pressure to Meet Deadlines: Tight project schedules may lead to rushed work, increasing the likelihood of non-conformance.

7.4.2 Arising in Township Projects:

- Compromised Quality: Non-identification of non-conforming work can result in compromised quality, affecting the overall integrity and functionality of township projects.
- Risk of Defects and Failures: Unidentified non-conforming work increases the risk of defects and failures, leading to safety hazards and additional costs for rectification.
- Legal and Regulatory Non-compliance: Failure to identify non-conforming work may result in legal and regulatory non-compliance, leading to penalties and reputational damage.

- Negative Impact on Stakeholder Satisfaction: Non-conforming work can lead to dissatisfaction among stakeholders, including clients, residents, and regulatory authorities.

7.4.3 Severity and Effects:

- Quality Degradation: Non-identification of non-conforming work can degrade the overall quality of township projects, leading to reduced longevity and increased maintenance costs.
- Safety Risks: Non-conforming work may pose safety risks to workers, residents, and visitors, resulting in accidents and injuries.
- Financial Implications: Rectifying non-conforming work incurs additional costs in terms of materials, labor, and time, leading to budget overruns and delays.
- Legal Consequences: Non-compliance with quality standards and regulations may lead to legal disputes, fines, and legal liabilities.
- Reputational Damage: Instances of non-conforming work can tarnish the reputation of project stakeholders, impacting future projects and business opportunities.

7.4.4 Remedies:

- Establishing Robust Quality Assurance Processes: Implement comprehensive quality assurance processes, including regular inspections and audits, to identify and address non-conforming work.
- Investing in Training and Awareness: Provide training and awareness programs to project personnel on identifying and reporting non-conforming work.
- Improving Documentation Practices: Enhance documentation practices to ensure accurate recording and tracking of non-conforming work throughout the project lifecycle.
- Enhancing Communication Channels: Foster open communication channels between project stakeholders to facilitate timely reporting and resolution of non-conforming work.
- Implementing Continuous Improvement Practices: Encourage a culture of continuous improvement, where lessons learned from non-conforming work are used to enhance project processes and outcomes.

7.5 Poor Inspection and Testing

7.5.1 Factors Causing Poor Inspection and Testing:

- Inadequate Resources: Insufficient allocation of resources, including personnel, equipment, and time, for inspection and testing activities.
- Lack of Expertise: Inspectors and testers may lack the necessary expertise or qualifications to conduct thorough and effective inspections and tests.
- Complacency: Project personnel may become complacent over time, leading to laxity in inspection and testing efforts.
- Schedule Pressure: Tight project schedules may prioritize speed over thoroughness, leading to shortcuts in inspection and testing.
- Communication Breakdown: Poor communication between inspection teams and project management may result in missed inspections or inadequate testing coverage.

7.5.2 Arising in Township Projects:

- Quality Control Issues: Poor inspection and testing practices can result in undetected defects and deficiencies, compromising the quality and safety of township projects.
- Risk of Non-compliance: Inadequate inspection and testing may lead to non-compliance with regulatory requirements and industry standards, exposing project stakeholders to legal and financial risks.
- Increased Rework: Undetected issues discovered post-construction require costly rework, leading to project delays and budget overruns.
- Reputational Damage: Instances of poor inspection and testing can damage the reputation of project stakeholders, affecting future projects and business opportunities.

7.5.3 Severity and Effects:

- Compromised Quality and Safety: Poor inspection and testing practices compromise the quality and safety of township projects, posing risks to residents, occupants, and the environment.
- Increased Costs: Rework and rectification of defects discovered post-construction incur additional costs in terms of materials, labor, and time, leading to budget overruns and financial losses.
- Project Delays: Discovering defects late in the construction process necessitates additional time for remediation, causing delays in project completion and occupancy.
- Legal and Regulatory Consequences: Non-compliance with regulatory requirements and industry standards may result in legal disputes, fines, and penalties, negatively impacting project stakeholders.

- Reputational Damage: Instances of poor inspection and testing tarnish the reputation of project stakeholders, eroding trust and confidence among clients, residents, and regulatory authorities.

7.5.4 Remedies:

- Investing in Qualified Personnel: Recruit and train qualified inspectors and testers with the necessary expertise and certifications to perform thorough and effective inspections and tests.
- Implementing Comprehensive Quality Assurance Programs: Develop and implement comprehensive quality assurance programs that include regular and systematic inspection and testing protocols.
- Enhancing Communication and Coordination: Foster open communication and collaboration between inspection teams, project management, and other stakeholders to ensure adequate coverage and timely reporting of inspection and testing results.
- Utilizing Technology: Employ advanced technologies, such as drones, sensors, and remote monitoring systems, to enhance the efficiency and effectiveness of inspection and testing activities.
- Implementing Continuous Improvement Practices: Establish a culture of continuous improvement, where lessons learned from past inspection and testing experiences are used to enhance processes and procedures for future projects.

7.6 Design Changes

7.6.1 Factors Causing Design Changes:

- Incomplete or Unclear Requirements: Ambiguities or gaps in project requirements and specifications may necessitate design changes.
- Client Requests: Changing client preferences or requirements during the project lifecycle may require adjustments to the design.
- Regulatory Changes: Updates to building codes, zoning regulations, or environmental standards may trigger design revisions.
- Site Conditions: Unforeseen site conditions, such as soil conditions or utility conflicts, may necessitate modifications to the design.
- Scope Creep: Expansion of project scope beyond the original scope may require corresponding changes to the design.

7.6.2 Arising in Township Projects:

- Increased Complexity: Township projects often involve multiple stakeholders and complex requirements, increasing the likelihood of design changes.
- Impact on Schedule and Budget: Design changes can lead to schedule delays and budget overruns due to additional design work and construction rework.
- Coordination Challenges: Coordinating design changes across various disciplines and stakeholders can be challenging, leading to communication gaps and conflicts.
- Quality Control Issues: Rushed or poorly coordinated design changes may result in errors or omissions, compromising project quality and integrity.

7.6.3 Severity and Effects:

- Schedule Delays: Design changes can disrupt project schedules, leading to delays in project milestones and overall completion.
- Budget Overruns: Additional design work and construction rework associated with design changes incur extra costs, contributing to budget overruns.
- Increased Risk of Errors: Rushed or poorly coordinated design changes may lead to errors and omissions, compromising the quality and safety of township projects.
- Client Dissatisfaction: Frequent design changes may result in client dissatisfaction and strained client-contractor relationships.
- Reputational Damage: Instances of frequent design changes may tarnish the reputation of project stakeholders, affecting future business opportunities and partnerships.

7.6.4 Remedies:

- Comprehensive Planning and Requirements Gathering: Conduct thorough upfront planning and requirements gathering to minimize ambiguity and reduce the need for design changes later in the project lifecycle.
- Effective Change Management Processes: Implement robust change management processes to assess the impact of proposed design changes on project scope, schedule, and budget before implementation.
- Early Collaboration and Stakeholder Engagement: Foster early collaboration and engagement with project stakeholders, including clients, designers, and regulatory authorities, to anticipate and address potential design changes proactively.

- Utilizing Building Information Modeling (BIM): Implement BIM technology to facilitate collaborative design and clash detection, minimizing design conflicts and reducing the need for subsequent changes during construction.
- Regular Design Reviews: Conduct regular design reviews throughout the project lifecycle to identify and address design issues and potential changes early, before they escalate into larger problems during construction.

7.7 Labour Turnover

7.7.1 Factors Causing Labour Turnover:

- Job Dissatisfaction: Dissatisfaction with work conditions, wages, or job roles may lead to employees seeking employment elsewhere.
- Lack of Career Growth Opportunities: Limited opportunities for career advancement within the organization may prompt employees to look for opportunities elsewhere.
- Unsafe Work Environment: Safety concerns and hazards on the job site may drive employees to seek employment in safer environments.
- Poor Management Practices: Ineffective leadership, communication breakdowns, and lack of recognition can contribute to high turnover rates.
- Competitive Job Market: In regions with a high demand for construction labor, employees may leave for better-paying or more attractive job offers.

7.7.2 Arising in Township Projects:

- Schedule Disruptions: Labour turnover can disrupt project schedules, leading to delays in project milestones and overall completion.
- Loss of Skills and Knowledge: High turnover rates result in the loss of skilled workers and institutional knowledge, impacting project quality and productivity.
- Increased Recruitment and Training Costs: Constantly recruiting and training new employees to replace those who leave incurs additional costs for the project.
- Negative Impact on Team Morale: High turnover rates can lead to low morale among remaining team members, affecting productivity and teamwork.
- Quality Control Issues: Inexperienced or poorly trained replacement workers may compromise project quality and safety.

7.7.3 Severity and Effects:

- Schedule Delays: Labour turnover can lead to disruptions in project schedules, causing delays in project milestones and overall completion.
- Decreased Productivity: Constantly replacing skilled workers with new hires can result in decreased productivity and efficiency.
- Increased Costs: Recruiting, training, and onboarding new employees incur additional costs for the project, contributing to budget overruns.
- Impact on Quality and Safety: Inexperienced or poorly trained replacement workers may compromise project quality and safety, leading to defects, accidents, and rework.
- Negative Impact on Team Morale: High turnover rates can lead to low morale among remaining team members, affecting teamwork, communication, and collaboration.

7.7.4 Remedies:

- Improving Work Conditions and Compensation: Enhance work conditions, provide competitive wages, and offer benefits to attract and retain skilled workers.
- Investing in Training and Development: Provide ongoing training and development opportunities to employees to enhance their skills and career growth within the organization.
- Strengthening Leadership and Communication: Implement effective leadership practices and improve communication channels to address employee concerns and foster a positive work environment.
- Safety Initiatives: Prioritize safety on the job site and implement safety programs to protect workers and reduce turnover due to safety concerns.
- Employee Recognition and Engagement: Recognize and reward employees for their contributions, and actively engage them in decision-making processes to increase job satisfaction and loyalty.

7.8 Poor Reports and Record-Keeping

7.8.1 Factors Causing Poor Reports and Record-Keeping:

- Lack of Standardization: Absence of standardized reporting formats and record-keeping procedures can lead to inconsistency and confusion.
- Inadequate Training: Insufficient training on report writing and record-keeping practices may result in errors, omissions, and inaccuracies.

- Resource Constraints: Limited resources, such as personnel and technology, for maintaining records and generating reports may hinder effective record-keeping.
- Communication Breakdown: Poor communication between project stakeholders can result in incomplete or delayed reporting of project activities and progress.
- Lack of Accountability: Absence of accountability measures for reporting and record-keeping responsibilities may lead to neglect and oversight.

7.8.2 Arising in Township Projects:

- Inaccurate Reporting: Poor reports and record-keeping can lead to inaccuracies in project documentation, hindering decision-making and accountability.
- Compliance Issues: Non-compliance with regulatory reporting requirements and contractual obligations may result in penalties and legal disputes.
- Project Delays: Incomplete or delayed reporting of project progress and issues can lead to delays in decision-making and project execution.
- Quality Control Issues: Inadequate documentation of project activities and outcomes may compromise quality control processes and project outcomes.
- Reputational Damage: Instances of poor reports and record-keeping can damage the reputation of project stakeholders, affecting future projects and business opportunities.

7.8.3 Severity and Effects:

- Decision-Making Delays: Poor reports and record-keeping can lead to delays in decision-making processes, hindering project progress and responsiveness to issues.
- Risk of Non-compliance: Inadequate reporting and record-keeping may lead to non-compliance with regulatory requirements and contractual obligations, exposing project stakeholders to legal and financial risks.
- Quality Control Issues: Lack of accurate documentation may compromise quality control processes, leading to defects, rework, and safety hazards.
- Communication Breakdowns: Poor reports and record-keeping contribute to communication breakdowns among project stakeholders, leading to misunderstandings and conflicts.
- Reputational Damage: Instances of poor reports and record-keeping can tarnish the reputation of project stakeholders, eroding trust and confidence among clients, residents, and regulatory authorities.

7.9 Closure

This chapter has outlined several key challenges impacting the performance and quality of township construction projects. Issues such as lack of quality assurance, poor communication, inadequate site supervision, and non-identification of non-conforming work significantly affect project outcomes. Other factors like frequent design changes, high labor turnover, and poor inspection and testing contribute to delays, cost overruns, and safety risks. Furthermore, improper reports and record-keeping lead to compliance issues and communication breakdowns.

Chapter-8
Conclusion

8.1 Conclusion

The analysis of various parameters affecting township construction projects demonstrates the significant impact of implementing Project Management Consultancy (PMC). The data indicates substantial improvements across most parameters when PMC is involved, highlighting the effectiveness of PMC in mitigating common issues encountered in construction projects.

1. **Quality and Compliance**: There is a marked improvement in the identification of non-conforming work (29.21% improvement) and a significant reduction in design defects (31.18% improvement), indicating better adherence to quality standards and specifications due to PMC.
2. **Project Planning and Execution**: Parameters such as poor project planning (6.51% improvement) and poor site installation procedures (31.28% improvement) show considerable enhancements, reflecting the benefits of professional project management in ensuring efficient planning and execution.
3. **Labor and Resource Management**: Improvements in labor turnover (17.74% improvement) and poor labor remuneration (19.93% improvement) suggest that PMC contributes to better labor management practices. The decrease in low levels of appropriate technology (13.46% improvement) also points to better resource allocation and usage due to PMC.
4. **Financial Management**: Contractors' poor financial management sees a significant improvement (25.24% improvement), which can be attributed to the structured financial oversight provided by PMC.
5. **Communication and Collaboration**: Enhanced communication among participants (23.60% improvement) and a reduction in the unfriendly atmosphere and trust issues

(8.09% improvement) highlight the role of PMC in fostering a collaborative working environment.

6. **Quality Assurance and Supervision**: Parameters like poor inspection and testing (15.84% improvement) and lack of quality assurance (13.09% improvement) show that PMC enhances the overall quality control mechanisms.
7. **Decision-Making and Reporting**: The data indicates better decision-making processes regarding cost and value of work (23.54% improvement) and improved reporting and record-keeping (17.52% improvement) with PMC involvement.

However, it is noteworthy that a few parameters, such as inadequate involvement of the owner during construction works and poor weather conditions, show a negative percentage change, suggesting areas where further improvements or alternative strategies might be necessary.Overall, the implementation of PMC in construction projects leads to significant improvements across various critical parameters, thereby enhancing project quality, efficiency, and stakeholder satisfaction. This reinforces the value of professional project management practices in achieving successful project outcomes.

8.2 Recommendations

Based on the conclusion drawn from the analysis of the impact of Project Management Consultancy (PMC) on construction projects, the following recommendations are proposed to further enhance the effectiveness of PMC and address the identified areas for improvement:

1. **Increase Owner Involvement**:
    - **Strategy Development**: Develop clear strategies and frameworks to facilitate better involvement of project owners throughout the construction process. This could include regular meetings, progress updates, and decision-making workshops to ensure owners are actively engaged and informed.
    - **Training and Education**: Provide training programs for project owners to understand their roles and responsibilities, and the benefits of active participation in project management.
2. **Mitigate Weather Impact**:
    - **Advanced Planning**: Implement advanced planning techniques to mitigate the impact of adverse weather conditions, such as using predictive weather models to adjust schedules and prepare contingency plans.

- **Resilient Materials and Methods**: Invest in research and development of weather-resistant materials and construction methods that can withstand extreme weather conditions, reducing delays and damages.

3. **Leverage Advanced Technologies**:
   - **Technology Integration**: Encourage the adoption of cutting-edge technologies like Building Information Modeling (BIM), Internet of Things (IoT), and Artificial Intelligence (AI) to improve project planning, monitoring, and execution.
   - **Continuous Training**: Provide continuous training and upskilling opportunities for project teams to effectively use new technologies and tools.
4. **Promote Sustainable Practices**:
   - **Green Building Standards**: Incorporate sustainable practices and green building standards into project management protocols. This includes using eco-friendly materials, optimizing energy consumption, and minimizing waste.
   - **Certification Programs**: Encourage projects to pursue green certifications such as LEED or BREEAM to ensure adherence to high environmental standards.
5. **Enhance Financial Management**:
   - **Financial Analytics**: Implement advanced financial analytics tools to provide real-time insights into project finances, enabling proactive management and quick resolution of financial issues.
   - **Cost Control Measures**: Develop stringent cost control measures and conduct regular financial audits to ensure budget adherence and financial discipline.
6. **Improve Communication and Collaboration**:
   - **Collaboration Platforms**: Utilize modern collaboration platforms to facilitate seamless communication among all stakeholders. These platforms can include project management software that supports real-time updates, document sharing, and task tracking.
   - **Team-Building Activities**: Organize regular team-building activities to foster trust and a positive working atmosphere among project participants.
7. **Strengthen Quality Assurance and Supervision**:

- **Real-Time Monitoring**: Implement real-time quality monitoring systems using sensors and IoT devices to continuously track the quality of materials and workmanship.
- **Regular Audits**: Conduct regular quality audits and inspections to identify and rectify issues promptly, ensuring adherence to quality standards.

8. **Optimize Decision-Making and Reporting**:
    - **Data-Driven Decisions**: Leverage data analytics to inform decision-making processes, ensuring that decisions are based on accurate and up-to-date information.
    - **Transparent Reporting**: Establish transparent reporting mechanisms that provide clear and concise information to all stakeholders, enhancing accountability and trust.

By implementing these recommendations, construction projects can further benefit from the involvement of PMC, leading to even greater improvements in project quality, efficiency, and stakeholder satisfaction. These steps will help in addressing the areas that require further enhancement and will contribute to the overall success of construction projects.

8.3 Future Scope

The influence of Project Management Consultancy (PMC) on construction quality, cost, and time management presents several opportunities for further research and development. Future studies could explore the following areas:

1. **PMC's Role in Reducing Cost Overruns**: A critical area for future research could involve examining the financial implications of PMC engagement. Understanding how PMC influences project budgeting, cost control, and risk management in real-world scenarios will provide a more comprehensive view of their economic impact. A comparative analysis of projects with and without PMC involvement could shed light on specific practices that help mitigate cost overruns.
2. **Effectiveness of PMC in Preventing Time Overruns**: Time management is a crucial element in construction projects. Future studies could explore how PMC reduces time overruns by integrating tools such as critical path analysis, Lean project management techniques, and agile methodologies. Further research might also

consider the influence of PMC on contractor scheduling practices and site productivity.

References:

1. T. Gebrehiwet, "Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study," in *Proc. Creative Construction Conference 2017 (CCC 2017)*, Primosten, Croatia, Jun. 19-22, 2017, pp. 1-7.

2. A. Gın, "Causes and effects of construction project delays: A local case study in Edirne city centre," in Proc. 5th Int. Project and Construction Management Conf. (IPCMC 2018), Edirne, Turkey, 2018.

3. B. A. Sheikh, "Study of modern construction methods and strategies using relative importance index (RII)," Int. J. Innovative Res. Technol., vol. 7, no. 11, pp. 519-524, Apr. 2021, ISSN: 2349-6002.

4. D. Huljenić, "Project management in research projects," Computer Communications, vol. 26, pp. 451-459, 2023.

5. L. Lalić, "Future challenges in project management," Int. J. Innovative Res. Technol., vol. 7, no. 11, pp. 519-524, Apr. 2021, ISSN: 2349-6002.

6. R. Rao, "Delay analysis of road construction projects using RII method," *J. Emerging Tech. and Innovative Res.*, vol. 10, no. 7, pp. 1-8, Jul. 2023.

7.Badihaveli Keerti and Vyas, G. S., Benchmarking Construction Quality Attributes for Township Projects (January 22, 2019). Proceedings of Sustainable Infrastructure Development & Management (SIDM) 2019,

8.Delgado-hernandez, David Joaquin, and Elaine Aspinwall. 2008. “Total Quality Management & Business Excellence A Framework for Building Quality into Construction Projects – Part I,” no. December 2014: 37– 41.

9.Jha K N, and K C Iyer. 2007. “Critical Factors Affecting Quality Performance in Construction Projects Critical Factors Affecting Quality Performance in Construction Projects” 3363.

10. Koh, Tas Yong, and Sui Pheng Low. 2010. “Empiricist Framework for TQM Implementation,” no. July: 133– 43

11. Itai Kabong ,"Principles and Practice of Monitoring and Evaluation: A Paraphernalia for Effective Development", Africanus: Journal of Development Studies ,Volume 48, Number 2 , 2018 ,21 pages.

12. Gaurav Vasantrao Patil ,"Project Management Challenges", Journal of Multidisciplinary Engineering Science and Technology (JMEST), ISSN: 2458-9403 Vol. 3 Issue 11, November – 2016.

13. A. Johnson and P. Lee, "Effective site supervision for large-scale construction projects," *Journal of Construction Management and Economics*, vol. 31, no. 2, pp. 125-135, Feb. 2022.

14. B. Kumar, "Communication breakdowns in multi-disciplinary construction teams," *International Journal of Project Management*, vol. 28, no. 4, pp. 298-310, Apr. 2021.

15.C. Williams and J. Singh, "The impact of labor turnover on construction project efficiency," *Journal of Engineering, Design, and Technology*, vol. 25, no. 3, pp. 210-225, May 2020.

16.D. Thompson and F. Murray, "Evaluating quality control measures in construction projects," *Journal of Civil Engineering and Construction Technology*, vol. 35, no. 6, pp. 345-355, Jun. 2019.

17.E. Rodriguez and M. Patel, "Adapting to design changes in residential construction," *International Journal of Architectural Engineering Technology*, vol. 19, no. 4, pp. 189-202, Jul. 2018.

18.F. Chen and L. Wu, "Technological solutions to enhance inspection and testing in construction," *Automation in Construction*, vol. 43, pp. 222-232, Aug. 2018.

19.G. Clarke and A. White, "Impact of non-conforming work on township project timelines," *Construction Research and Innovation Journal*, vol. 27, no. 5, pp. 313-326, Sept. 2020.

20.H. Ali and R. Gupta, "Optimizing construction management through BIM technology," *Journal of Building Information Modeling*, vol. 12, no. 3, pp. 140-150, Oct. 2020.

21.I. Martinez and P. Robinson, "Safety initiatives in high-risk construction environments," *Journal of Occupational Safety and Health*, vol. 32, no. 6, pp. 275-285, Nov. 2021.

22.J. Harris and E. Nguyen, "Developing leadership and communication skills in construction management," *Journal of Professional Construction Leadership*, vol. 14, no. 1, pp. 99-110, Jan. 2022.

23.K. Zhang and T. Wilson, "Improving worker retention in the competitive construction labor market," *International Journal of Human Resource Management in Construction*, vol. 40, no. 2, pp. 215-230, Feb. 2021.

24. L. Scott and M. Lee, "Analysis of delays due to poor site supervision in urban construction," *Journal of Construction Engineering and Management*, vol. 38, no. 4, pp. 340-350, Mar. 2020.

25.M. Lewis and A. Khan, "Integration of quality control in township project management," *Journal of Infrastructure and Construction Engineering*, vol. 18, no. 2, pp. 145-160, Apr. 2019.

26.N. Green and R. Thomas, "The role of advanced inspection tools in construction projects," *Journal of Innovative Engineering Practices*, vol. 21, no. 3, pp. 176-189, May 2021.

27.O. Brown and S. Davis, "Mitigating communication issues in geographically dispersed construction teams," *International Journal of Construction and Project Management*, vol. 33, no. 5, pp. 299-312, Jun. 2019.

Appendix – A

Questionnaire

A five-point likert type scale was adopted for each factor

where,

1= 'Not severe '

5= 'Extremely severe'

As per your experience , kindly indicate level of severity for the factors affecting the performance evaluation of construction of township projects. The respondents would be rating the parameter severity for the effect on quality of the construction project.

Thank you for your cooperation,

Akhil S. Awate,

M.Tech Construction Management

Rajarambapu Institute of technology

Email- aakhil30@gmail.com

Phone no- 9404868940

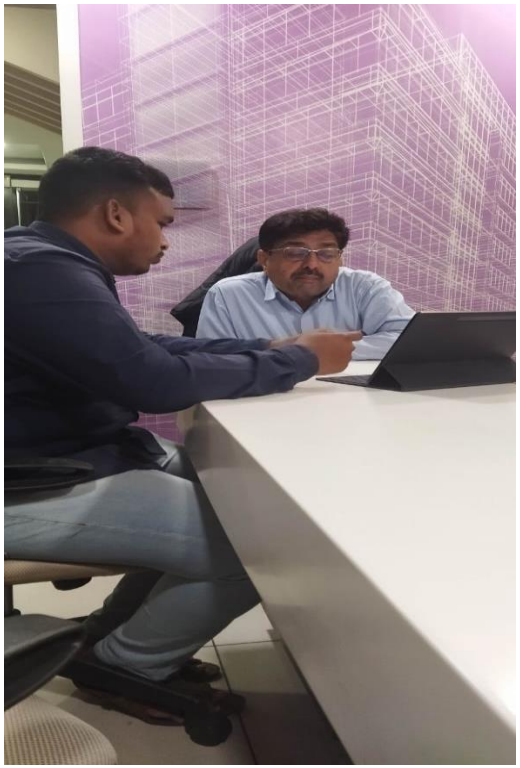
Name :

Designation :

Appendix-B

Meeting with Ar. Shirish Beri Sir (Internationally renowned Architect) and other Credai dignitaries





Parameters	**Not severe**	**Slightly severe**	**Moderately Severe**	**Very Severe**	**Extremely Severe**
Low level of skill and labour experience					
Labour turnover					
Poor labour remuneration					
Inadequate site supervision					
Poor level of commitment to quality improvement among project participants					
Poor site installation procedure					
Poor project planning					
Contractors' poor technical knowledge					
Inadequate site meetings					
Lack of quality assurance					
Poor inspection and					

testing					
Non-identification of non-conforming work					
Quality audits not carried out					
Design defects					
Flaws in design specification					
Design changes					
Unrealistic constraints of project time					
Unrealistic constraints of project cost					
Poor quality of material delivered to site					
Contractors' poor financial management					
Poor communication among participants					
Unfriendly					

atmosphere and trust among participants					
Making site decisions on cost and not value of work					
Poor reports and record-keeping					
Effect of code and standards on quality					
Inadequate involvement of the owner during construction works					
Low level of appropriate technology					
Poor weather conditions					

LIST OF PUBLICATION

1. Akhil Awate, Sabir Sayyed, Mayur Maske, Sachin More, Savita Patil ,"A critical review on the impact of project management consultancies on township projects", *International Research Journal of Modernization in Engineering Technology and Science ,Volume:06,Issue:07,July-2024.*

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

A CRITICAL REVIEW ON THE IMPACT OF PROJECT MANAGEMENT CONSULTANCIES ON TOWNSHIP PROJECTS

Akhil Awate[*1], Sabir Sayyed[*2], Mayur Maske[*3], Sachin More[*4], Savita Patil[*5]

[*1]PG Student, Department Of Civil Engineering, Kasegaon Education Society's Rajarambapu Institute Of Technology, Affiliated To Shivaji University, Sakhrale, Maharastra, India.

[*2,3,4,5]Assistant Professor, Department Of Civil Engineering, Kasegaon Education Society's Rajarambapu Institute Of Technology, Affiliated To Shivaji University, Sakhrale, Maharastra, India.

DOI : https://www.doi.org/10.56726/IRJMETS60668

ABSTRACT

Projects remain the instruments of choice for policymakers in national and international development. Basic social services are largely provided by development initiatives in India and other third-world nations. Project Management Consultancy's primary goal was to determine the impact of monitoring and assessment on the effective execution of development initiatives. In project management, information was gathered from primary and secondary sources through the use of questionnaires. Depending on the approaches, graphs, pie charts, and table diagrams were used to display the findings. According to survey results by using Project Management Consultancy, 95% of respondents claimed that monitoring and assessment had an impact on projects' successful completion, whereas 5% disagreed. The study suggests that project management, which is a multifaceted, intricate, and skill-intensive process, is crucial for enhancing performance.

Keywords: Project Management, Monitoring and Evaluation, Innovation, Implementation.

I. INTRODUCTION

In the Project Management two procedures of monitoring and evaluation are distinct yet work well together. Thus, it is a methodical process of gathering, evaluating, and comparing data on ongoing projects with the aim of comparing the project's impact and outcome.Conversely, a collection of interconnected elements inside a framework that share the objective of monitoring a project's execution and outcomes is called a network. Thus, it is a cohesive system of communication and reflection that aids in the execution of projects it increase workers productivity & reduces cost,time[1].

Like monitoring, assessment is generally agreed to be crucial since it enables lessons to be learnt and improves subsequent initiatives. However, it is not carried out with enough rigor, much like monitoring. As an illustration, "many programs are unable to identify exactly who has benefited, how much, or in what form. This suggests that the programs are not failing, but rather that the current techniques for assessment and evaluation are insufficient. Further consideration should be given to evaluating projects in terms of their impact on the environment, sustainability, and institutional development[2].

Few agencies feel that they have the resources to evaluate every project, and so evaluation, particularly ex-post evaluation, tends to be biased towards projects with problems. Also, small agencies particularly are reluctant to use the time of project staff on evaluation when they could be getting on with the next project. The larger agencies which have separate evaluation units face the difficulty that the independence of these units makes them less able to influence the operational departments. There are several different approaches to evaluation reporting. To some extent the termination report by project staff can be considered as an evaluation, but it is often biased by the frustrations and difficulties, and tends to be more a catalogue of problems than a balanced account of performance. An ex-post evaluation either by an evaluation unit or by sub-contractors tends to be more open-minded, but the very fact that it is done after the event means that it is dependent upon records and reports, which are likely to be unwritten, incomplete, unavailable, or less comprehensive than the evaluation team would wish. The other source of information for ex-post evaluation teams is personal recollection which is notoriously inaccurate [3].

Additionally, the monitoring process emphasizes responsibility and openness in the use of resources to the project's recipients, donors, and the larger community. Robbins [4] contends that determining who would win, lose, and how should be the first step in evaluating politics. This also includes how the different stakeholders

International Research Journal Of Modernization in Engineering Technology and Science

(Peer-Reviewed, Open Access, Fully Refereed International Journal)

e-ISSN: 2582-5208

Ref: IRJMETS/Certificate/Volume 06/Issue 07/60700087290

DOI : https://www.doi.org/10.56726/IRJMETS60668

Date: 31/07/2024

Certificate of Publication

This is to certify that author "**Akhil Awate**" with paper ID "**IRJMETS60700087290**" has published a paper entitled "A CRITICAL REVIEW ON THE IMPACT OF PROJECT MANAGEMENT CONSULTANCIES ON TOWNSHIP PROJECTS" **in International Research Journal Of Modernization In Engineering Technology And Science (IRJMETS), Volume 06, Issue 07, July 2024**

Editor in Chief

IRJMETS Impact Factor 7.868

We Wish For Your Better Future

www.irjmets.com

We are checking your submission against our journal guidelines and policies. If there is anything we need we will email sabir.sayyed@ritindia.edu

Need help?

Learn what happens after you submit.

If you have any questions about this submission, you can email the Editorial Office (suganthi.duraisingam@springernature.com).

For general enquiries, please look at our support information.

How was your experience today?

Your submission

Title
Performance Evaluation of Township Projects with and without the implementation of Project management consultancies

Type
Research

Journal
Asian Journal of Civil Engineering

Submission ID
559cd843-5dd0-45d1-96b2-4f0498c0e1f3

K. E. Society's

RAJARAMBAPU INSTITUTE OF TECHNOLOGY, RAJARAMNAGAR

(An Empowered Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

SYNOPSIS OF S. Y. M. TECH. DISSERTATION

1.Name of Class	: S. Y. M. Tech. Construction Management
2.Name of the Student	: Mr. Akhil Sanjay Awate
3.Enrolment Number	: 2227017
4.Month of Registration	: September 2023
5.Name of Guide	: Dr. S. S. Sayyed
6.Proposed Title	: Performance Evaluation of Township Projects with and without the implementation of Project management consultancies.

DPGC member
RIT, Rajaramnagar

DPGC member
RIT, Rajaramnagar

Dept. of Civil Engg
RIT
APPROVED COPY
of Synopsis
M. Tech
Civil Const Mgmt

Dr. S.S.Sayyed
HOP, Civil Const.Magt.
RIT, Rajaramnagar

Dr. S.S. Kumbhar
HOD, Civil Engg. Dept
RIT, Rajaramnagar

final report

ORIGINALITY REPORT

18%
SIMILARITY INDEX

PRIMARY SOURCES

1	eprints.unpal.ac.id Internet	248 words —	1%
2	core.ac.uk Internet	196 words —	1%
3	www.ijsrp.org Internet	170 words —	1%
4	ubir.bolton.ac.uk Internet	169 words —	1%
5	www.tandfonline.com Internet	161 words —	1%
6	listens.online Internet	157 words —	1%
7	starfos.tacr.cz Internet	150 words —	1%
8	www.scribd.com Internet	136 words —	1%
9	www.scilit.net Internet	128 words —	1%

VITAE

Name of Student : **Mr. Akhil Sanjay Awate**

Permanent Address : **Sahajeevan Parisar, Tarabai Park, Kolhapur**
Tal. Karveer, Dist: Kolhapur, 416 003.

Name of current Employer : N.A.

Email : **aakhil30@gmail.com**

Contact Number : **9404868940**

Date of Birth : **30/01/2000**

Mr. Akhil Sanjay Awate has obtained B.Tech in Civil Engineering from Shivaji University in 2022. He is studying M.Tech in Construction Management in Rajarambapu Institute of Technology, Rajaramnagar in 2023. His Masters's thesis was related to Performance Evaluation of Township Projects with and without implementation of Project Management Consultancies. He has Publication to her credit till date.