

Final Project 2

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Alaa Alsmhod
MIDOCEAN UNIVERSITY

Midocean University

Faculty of Management

Project Management



The Impact of Team Communication on Project Success in Chemical Plant Construction in Industrial Jubail City

Alaa Ali Alsmhod

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Faculty of Management - Midocean University

Supervisor

Dr. Mona Moustafa Elashry

Faculty member- Faculty of management- Midocean University

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Dedication

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Abstract

Purpose:

This study investigates the impact of team communication on project success, specifically in the context of chemical plant construction in Industrial Jubail City, Saudi Arabia. The research explores how effective communication within project teams influences critical success factors, including adherence to timelines, budget optimization, and safety performance.

Methodology:

A mixed-methods approach was adopted, combining quantitative data from structured surveys with qualitative insights from semi-structured interviews and focus groups. The study sample comprised professionals from various roles within chemical plant construction projects, including project managers, engineers, and safety inspectors. Statistical analysis was conducted using SPSS to test hypotheses and examine the relationships between communication practices and project success metrics.

Findings:

The findings reveal a significant positive relationship between effective communication and project success. Specifically, enhanced communication practices are associated with better adherence to project timelines, improved safety performance, and optimized budget outcomes. The study also highlights the importance of integrating communication theories with construction management principles to achieve these results.

Originality & Implications:

This research contributes to the theoretical understanding of communication dynamics within high-risk, industrial construction environments. Practically, the findings provide actionable recommendations for improving communication strategies in the construction industry, particularly in complex projects like those in Industrial Jubail City. The study underscores the necessity of continuous communication improvement to ensure project success in challenging environments.

Keywords:

Team communication, project success, chemical plant construction, Industrial Jubail City, project management, safety performance, budget adherence.

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Chapter 1: Introduction

1.1.Research Background

Since 1980, Saudi government has decided to diversify its industry by processing the oil into downstream products to score higher profit margin. To accomplish this vision, the government established Jubail industrial city. Jubail industrial city is in the eastern region of Saudi Arabia. It is located near one of the biggest oil reserves in the world. The industrial area was made ready for Chemical plants. Since 1980, chemical plants were constructed in the industrial area like Sabic chemical compounds and Sadara. The industrial area of Jubail is still expanding every year with new chemical plants projects. Construction of new chemical plants requires effective team communication for successful project delivery and adherence to timelines. Effective team communication plays a crucial role in ensuring that all stakeholders are aligned with the project goals and timelines. Clear and open communication enables the project team to address challenges promptly, share critical information, and make informed decisions. In the context of chemical plant construction, the coordination between engineers, construction workers, safety inspectors, and project managers is essential for the successful execution of tasks and the adherence to project timelines. Furthermore, clear communication can help in the early identification of potential issues, which can prevent delays and cost overruns. Therefore, fostering a culture of effective communication among team members is imperative in ensuring the smooth progress and timely completion of chemical plant construction projects. Effective team communication is not only essential for preventing delays and cost overruns but also for ensuring the safety of the construction workers and the surrounding environment. In the context of chemical plant construction, where strict adherence to safety protocols and regulations is paramount, clear and continuous communication can significantly

mitigate the risk of accidents and facilitate the swift resolution of any safety concerns that may arise.

There is a statistically significant relationship between team communication and project success. Effective team communication is not only essential for preventing delays and cost overruns but also for ensuring the safety of the construction workers and the surrounding environment. In the context of chemical plant construction, where strict adherence to safety protocols and regulations is paramount, clear and continuous communication can significantly mitigate the risk of accidents and facilitate the swift resolution of any safety concerns that may arise. Furthermore, a culture of open communication fosters a sense of accountability among team members, encouraging them to proactively report and address safety hazards, ultimately creating a safer work environment.

Research has shown that a lack of effective communication can lead to misunderstandings, errors, and even accidents at construction sites. By contrast, projects where team communication is prioritized tend to experience reduced safety incidents and improved overall project performance. It's also worth noting that effective communication not only encompasses verbal exchanges but also written documentation, visual aids, and regular meetings to ensure that all team members are on the same page regarding project goals, plans, and safety requirements. (Galli, 2021) Additionally, effective communication enables better coordination and collaboration among team members (Tong, 2022). This promotes efficient resource allocation, reduces rework, and minimizes delays in the construction process. The impact of team communication on project Success in chemical plant construction in Industrial Jubail City is significant.

In fact, fostering a culture of effective communication can also lead to improved employee satisfaction, as team members feel heard, valued, and supported in their roles. This, in turn, can contribute to higher productivity levels and better teamwork, positively impacting the project's timeline and outcomes. Therefore,

investing in communication training and continuously reinforcing the importance of effective communication within the construction team are critical steps in ensuring the success of chemical plant construction projects in Industrial Jubail City.

Moreover, team communication goes beyond just exchanging information; it also encompasses building trust and fostering a collaborative environment. When team members feel comfortable communicating openly and honestly with one another, they are more likely to share their expertise, raise potential issues, and collaboratively problem-solve, ultimately leading to more effective and efficient project execution. In addition, effective communication can also positively impact the quality of work and the overall project outcomes. When all stakeholders are on the same page and have a clear understanding of their roles and responsibilities, the likelihood of errors and rework is reduced, leading to improved project quality and client satisfaction.

As Industrial Jubail City continues to witness growth and development in the chemical plant construction sector, the role of team communication becomes even more critical. With increasingly complex projects and diverse teams, the ability to communicate effectively across various departments, disciplines, and hierarchical levels becomes a key determinant of project success.

1.2. Research Problem

In the context of ongoing expansion and development in Industrial Jubail City's chemical plant construction sector, what are the specific communication challenges faced by project teams, and how do these challenges impact project budget, safety performance, and overall project success?

1.2.1. Theoretical Gaps

1. **Understanding Communication Dynamics in Construction Projects:**

There is a gap in theoretical understanding regarding the specific communication dynamics within construction projects, especially in the context of chemical plant construction in industrial settings. Existing literature may not sufficiently address the unique challenges and requirements of communication in such complex and safety-critical environments.

2. **Impact of Communication on Project Success Metrics:** Theoretical research often lacks comprehensive insights into how communication practices directly influence project budget, safety performance, and overall project success in the specific context of chemical plant construction.

3. **Integration of Communication Theory with Construction Management:**

The intersection of communication theory and construction management practices, particularly in high-risk industrial environments, requires further exploration. Theoretical frameworks that effectively integrate communication theories with project management principles specific to chemical plant construction are limited and often random.

1.2.2. Practical Gaps

1. **Identification of specific communication challenges:** There is a gap in identifying and categorizing the specific communication challenges faced by project teams in chemical plant construction. Understanding these challenges is crucial for developing targeted communication strategies.

2. **Evaluation of communication strategies:** Practical insights into which communication strategies are most effective in mitigating challenges and improving project outcomes are lacking.

3. **Implementation of Communication Best Practices:** Despite theoretical knowledge, there is often a gap between recommended communication best practices and their practical implementation in construction projects.

1.3. Research Significance

1.3.1. At the theoretical level

- **Advancement of Knowledge:** The research contributes to advancing theoretical understanding of communication dynamics in complex industrial settings, particularly within the context of chemical plant construction in Jubail City which is witnessing continuous new projects.
- **Interdisciplinary Integration:** It promotes the integration of communication theories with disciplines such as engineering, safety staff and management.
- **Development of Frameworks:** The research may lead to the development of new theoretical frameworks or the refinement of existing ones that specifically address communication challenges in industrial construction projects. These frameworks can guide future researchers and highlight the importance.

1.3.2. At the practical level

- **Industry Impact:** Direct benefits to the chemical plant construction industry in Jubail City. Implementing research findings can improve project management practices, enhance safety protocols, and optimize resource allocation. This leads to cost savings, improved project Success, and enhanced competitiveness in the global market.

- **Policy and Standards Development:** Practical outcomes influence the development of industry standards, policies, and guidelines related to communication practices in chemical plant construction. This includes recommendations for integrating communication technologies, establishing training programs, and promoting collaborative communication across stakeholders.
- **Implementation Strategies:** Research findings will produce actionable methods for enhancing communication effectiveness within project teams. These methods may involve the adoption of communication technologies, organizational policies, training initiatives, and procedural improvements aimed at optimizing project outcomes and stakeholder satisfaction.

1.4. Research Questions

1. What are the specific communication challenges faced by project teams in Industrial Jubail City's chemical plant construction sector?
2. How does effective team communication impact project timelines, safety outcomes, and overall project success in chemical plant construction?
3. What industry-specific policies, standards, or guidelines should be developed based on research insights to improve communication practices in chemical plant construction?
4. What are the most effective strategies for integrating communication technologies and establishing training programs that promote collaborative communication across stakeholders in chemical plant construction projects?

1.5. Research Objectives

- To identify and categorize specific communication challenges encountered by project teams in the chemical plant construction sector in Industrial Jubail City.
- To investigate the impact of effective team communication on project timelines, safety outcomes, and overall project success in chemical plant construction.
- To develop theoretical frameworks that comprehensively explain communication dynamics within chemical plant construction projects in Industrial Jubail City.
- To evaluate and recommend specific communication strategies that effectively mitigate challenges and improve project outcomes in chemical plant construction projects.

Research Questions	Research Objectives
1. What are the specific communication challenges faced by project teams in Industrial Jubail City's chemical plant construction sector?	• To identify and categorize specific communication challenges encountered by project teams in the chemical plant construction sector in Industrial Jubail City.
2. How does effective team communication impact project timelines, safety outcomes, and overall project success in chemical plant construction?	• To investigate the impact of effective team communication on project timelines, safety outcomes, and overall project success in chemical plant construction.

3. What industry-specific policies, standards, or guidelines should be developed based on research insights to improve communication practices in chemical plant construction.	To develop theoretical frameworks that comprehensively explain communication dynamics within chemical plant construction projects in Industrial Jubail City.
4. What are the most effective strategies for integrating communication technologies and establishing training programs that promote collaborative communication across stakeholders in chemical plant construction projects?	To evaluate and recommend specific communication strategies that effectively mitigate challenges and improve project outcomes in chemical plant construction projects.

Table 1: Matching research questions and objectives

1.6. Research Hypotheses

H1. There is a significant relationship between communication and project success in the chemical plant construction projects in Industrial Jubail City.

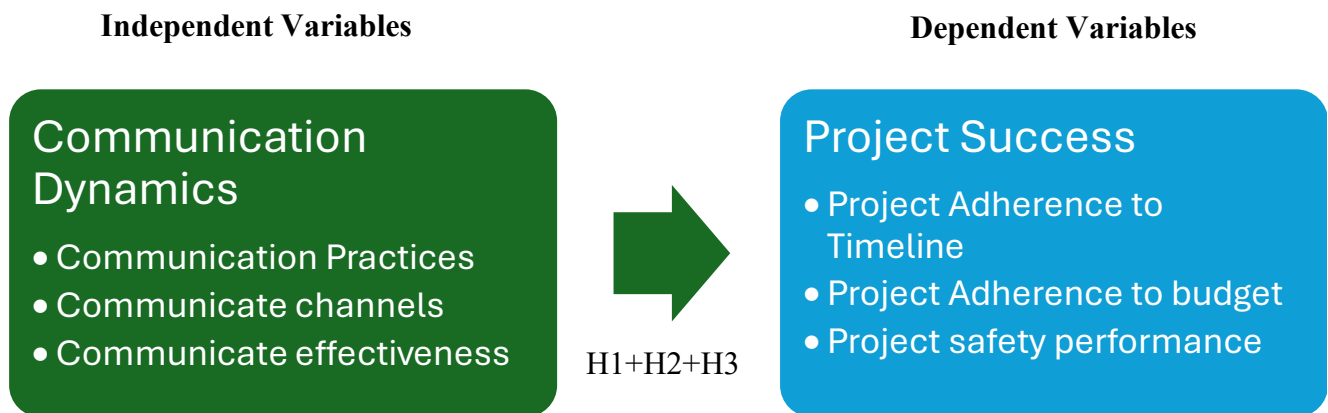
H2. There is a significant positive relationship between integrating theoretical frameworks that integrate communication theories with construction management principles and project timeline in the chemical plant construction projects in Industrial Jubail City.

H3. There is a significant positive relationship between addressing identified communication challenges through targeted strategies and project budget optimization in the chemical plant construction projects in Industrial Jubail City.

1.7. Research Model

- Independent Variables:

- Communication Dynamics: This variable encompasses the various aspects of communication within chemical plant construction projects, including communication channels, methods, frequency, clarity, and effectiveness.
- Dependent Variables:
 - Project Success: Includes measures such as project completion within scheduled timelines, adherence to budget.



1.8. Scope of The Study

The study focuses on understanding communication dynamics and strategies in the context of chemical plant construction projects within Industrial Jubail City, Saudi Arabia. Surveys will be conducted, and data will be analyzed to measure the impact of communication strategies on project timelines, safety outcomes, and overall success metrics.

1.9. The Project Structure

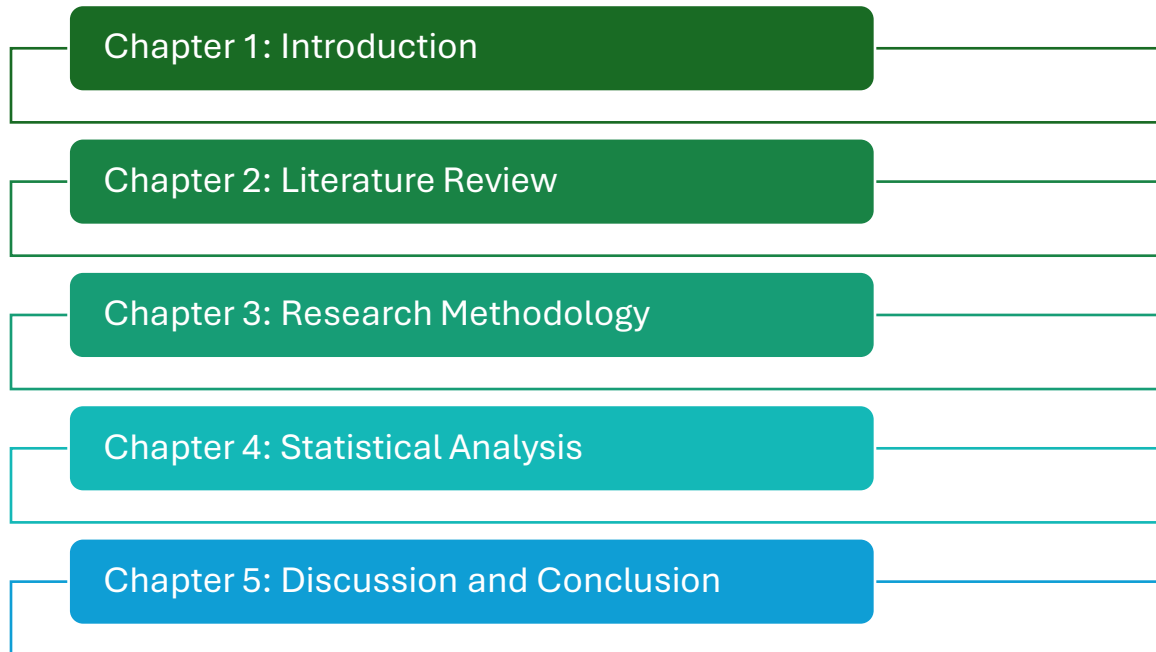


Figure 3: suggested project structure

Chapter 2: Literature Review

2.1 Introduction

The literature review provides a comprehensive examination of existing research related to communication dynamics in construction projects, with a particular focus on the chemical plant construction sector in Industrial Jubail City. This section synthesizes findings from previous studies, highlighting key theories, models, and empirical evidence relevant to the independent and dependent variables in this research.

2.2 The Independent Variable

Communication Dynamics in construction projects encompass various aspects, including communication channels, methods, frequency, clarity, and effectiveness. Research indicates that effective communication is critical for project success, as it influences team coordination, decision-making, and problem-solving. For instance, Jha and Iyer (2006) emphasize that clear communication channels and regular updates are crucial for preventing misunderstandings and ensuring project alignment. Particularly under the variable "conflict among project participants." This factor is highlighted as a critical failure factor that significantly impacts the performance of construction projects. It falls under the broader category of "critical failure factors," which suggests that poor communication or conflicts within the project team can lead to significant delays and negatively affect the project's overall success. Recent advancements in communication technology have significantly influenced the construction industry's ability to manage complex projects. According to Green

(2023), the integration of digital communication tools such as Building Information Modeling (BIM) and project management software has improved the efficiency and accuracy of information exchange among project stakeholders. These technologies facilitate real-time communication, enabling teams to swiftly address issues as they arise and reducing the likelihood of miscommunication. In the context of chemical plant construction, where precision and safety are paramount, the use of technology not only enhances coordination but also supports compliance with stringent safety regulations (Brown & Smith, 2023).

2.3 The Dependent Variable

Project Success in the context of chemical plant construction is evaluated based on several metrics, including project timelines and budget adherence. Successful projects are typically those that are completed within the scheduled time, adhere to budget constraints, and meet or exceed client expectations. Research by Pinto and Slevin (1988) highlights that effective communication significantly impacts these success metrics by facilitating better coordination and reducing the likelihood of delays and cost overruns. Furthermore, studies such as those by Jeong and Khoo (2008) reveal that project success is closely linked to the ability of project teams to communicate effectively, particularly in high-stakes environments like chemical plant construction. Another critical factor influencing communication in construction projects is the diversity of the workforce. Jubail City's chemical plant construction sector, like many large-scale industrial projects, often involves teams from various cultural and linguistic backgrounds. This diversity can lead to communication barriers that may hinder project success. Research by Zhao et al. (2022) indicates that cultural differences can result in varying interpretations of information and

expectations, leading to potential conflicts or misunderstandings. Addressing these challenges requires the implementation of culturally sensitive communication strategies and training programs that promote inclusivity and mutual understanding within diverse teams.

2.4 The Relationship Between the Independent and Dependent Variables

The relationship between **communication dynamics** and **project success** has been well-documented in the literature. Effective communication is shown to enhance team collaboration, streamline decision-making processes, and mitigate risks, all of which contribute to improved project outcomes. For example, research by El-Sabaa (2001) demonstrates that effective communication can lead to better project performance by ensuring that all stakeholders are aligned with project goals and expectations. Similarly, Chen and Kumaraswamy (2007) found that clear communication helps in managing project risks and uncertainties, ultimately leading to more successful project delivery. This body of research underscores the importance of addressing communication challenges to achieve optimal project success.

2.5 Conclusion

The literature review highlights the significant impact of communication dynamics on project success metrics in construction projects. Effective communication practices are essential for achieving timely project completion, budget adherence, and overall client satisfaction. Existing studies provide a solid foundation for understanding the relationship between communication and project outcomes, yet there remain gaps in addressing specific communication challenges within the chemical plant construction sector. This review establishes the context for further research into optimizing communication strategies to enhance project success in this high-stakes environment.

Chapter 3: Research Methodology

3.1 Introduction

The methodology section outlines the approach to investigating the communication challenges in chemical plant construction projects in Jubail Industrial City. It details the philosophical underpinnings, research approach, design, and techniques used to collect and analyze data. This section provides a framework for understanding how the research will be conducted to ensure robust and actionable findings.

3.2 Operational Definitions for Research Variables

- **Independent Variable:**
Communication Dynamics: The various aspects of communication within construction projects, including channels, technology, methods, frequency, clarity, and effectiveness.
- **Dependent Variable:**
Project Success: Metrics including project completion within scheduled timelines, adherence to budget, and safety performance.

3.3 Research Design

1. **Research Philosophy:** The study adopts a pragmatic research philosophy to address complex, real-world problems through the integration of both quantitative and qualitative methods.
2. **Research Approach:** A mixed-methods approach is employed, combining quantitative and qualitative methods:
 - **Quantitative:** Structured surveys to quantify communication practices and their impact on project metrics.

- Qualitative: Semi-structured interviews and focus groups to explore in-depth communication challenges and strategies.
3. **Research Strategy:**
 - Descriptive: Using surveys and document reviews to describe communication practices and their impacts.
 - Exploratory: Conducting interviews and focus groups to uncover new insights and understand underlying factors.
 4. **Time Horizon:** A cross-sectional time horizon is used to capture a snapshot of current practices and their immediate effects on project outcomes.
 5. **Data Collection and Analysis:** Details are provided in subsequent sections on the methods for collecting and analyzing data.
 6. **Research Onion**

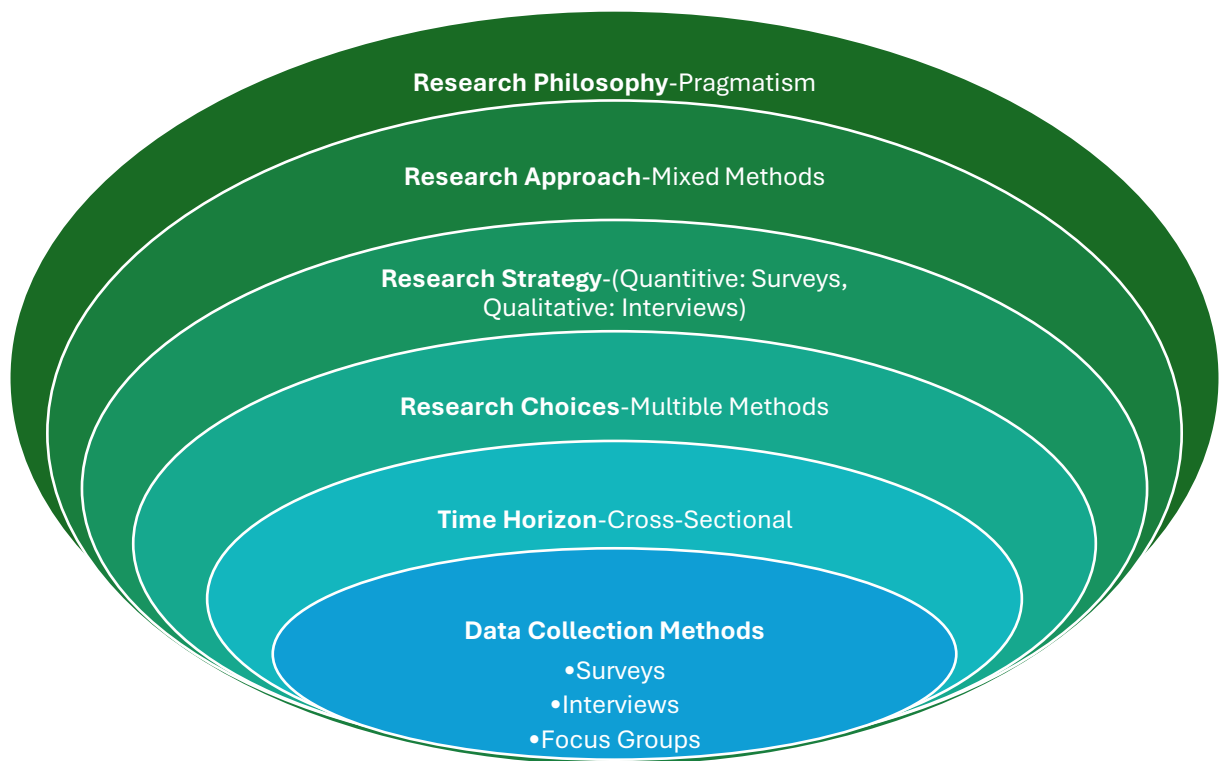


Figure 2: Research Onion

3.4 Research Population & Sampling Methods and Techniques

1. Research Population: The target population includes project managers, engineers, construction workers, safety inspectors, and other stakeholders involved in chemical plant construction projects in Jubail Industrial City.

2. Sampling Methods and Techniques:

- **Surveys:** Stratified random sampling to ensure diverse representation across various roles in chemical plants construction sites in Industrial Jubail City.
- **Interviews and Focus Groups:** Purposive sampling to select key informants and construction team members based on their relevance and expertise. Targeted group includes project department and safety department for multiple chemical plant construction sites in Jubail Industrial City.

3.5 Data Collection Method

1. **Surveys:** Structured questionnaires administered to gather quantitative data on communication practices, challenges, and their impact. Survey sample can be found in the appendix.
2. **Interviews:** Semi-structured interviews with project managers, senior engineers, and safety officers to gain qualitative insights.
3. **Focus Groups:** Moderated discussions with construction team members to explore communication challenges and effectiveness.

4. **Document Review:** Analysis of project reports, communication logs, safety incident reports, and project evaluations for historical data on communication practices. The documents will be reviewed during the interview visits as access to the designated sites and project document are limited.

3.6 Types of Data

1. **Quantitative Data:** Numerical data collected through surveys to measure communication practices, project timelines, safety outcomes, and overall success metrics.

2. **Qualitative Data:** Non-numerical data obtained from interviews, focus groups, and document reviews to explore in-depth insights and contextual understanding of communication dynamics.

3.7 Statistical Analysis Procedures

1. **Descriptive Statistics:** To summarize and describe the basic features of the survey data, including measures of central tendency and dispersion.

2. **Inferential Statistics:** Techniques such as correlation analysis, regression analysis, and hypothesis testing to examine relationships between communication practices and project success metrics.

3.8 Conclusion

The methodology provides a structured approach to investigating the communication challenges in chemical plant construction projects. By integrating a pragmatic philosophy with a mixed-methods approach, descriptive and exploratory strategies, and a cross-sectional time horizon, the research aims to deliver comprehensive and actionable insights. The detailed procedures for data collection

and analysis will ensure robust and reliable findings that can inform improvements in communication practices and project outcomes.

Chapter 4: Statistical Analysis & Findings discussion

4.1. Introduction

This section presents the statistical analysis and findings of the survey conducted to assess the impact of team communication on project timelines in the chemical plant construction sector in Industrial Jubail City. The analysis includes a detailed examination of the data gathered from project teams, focusing on communication practices, safety performance, and adherence to project timelines and budgets.

4.2. Sample profile

The survey data was collected from a random and diverse group of respondents involved in chemical plant construction projects. These groups were selected from either the project department or the safety department of each site. The conditions for the selected groups were as the following:

- Spent more than one year with the company.
- From safety or project department.

Descriptive statistics were calculated to summarize the basic features of the survey data, including the frequency of communication, effectiveness of communication channels, safety adherence, adherence to project budget, adherence to project timeline, and project management effectiveness.

Sample was categorized based on Age, Experience and Position. Frequency and percentage were calculated for the study sample. The demographics information is:

- Age (below 30 years old, between 30 and 40 years old, above 40 years old)
- Experience (Less than 5 years, between 5 and 10 years, above 10 years)
- Position (Management, Staff, Technicians)

The table below shows the categorization of the study sample:

Variable	Category	Number	% of total sample
Age	Less than 30 years old	24	62%
	Between 30 and 40 years old	6	17%
	Above 40 years old	10	22%
	Total	40	100%
Experience	Less than 5 years	20	49%
	Between 5 and 10 years	4	11%
	Above 10 years	16	40%
	Total	40	100%
Position	Manager	4	10%
	Staff	7	18%
	Technician	29	71%
	Total	40	100%

Table 2: Study Sample profile

For the table we can conclude the following:

1. Age Distribution:

- The majority of participants (24 individuals, 62%) are under 30 years old.
- 6 participants (17%) are between 30 and 40 years old.
- 10 participants (22%) are above 40 years old.

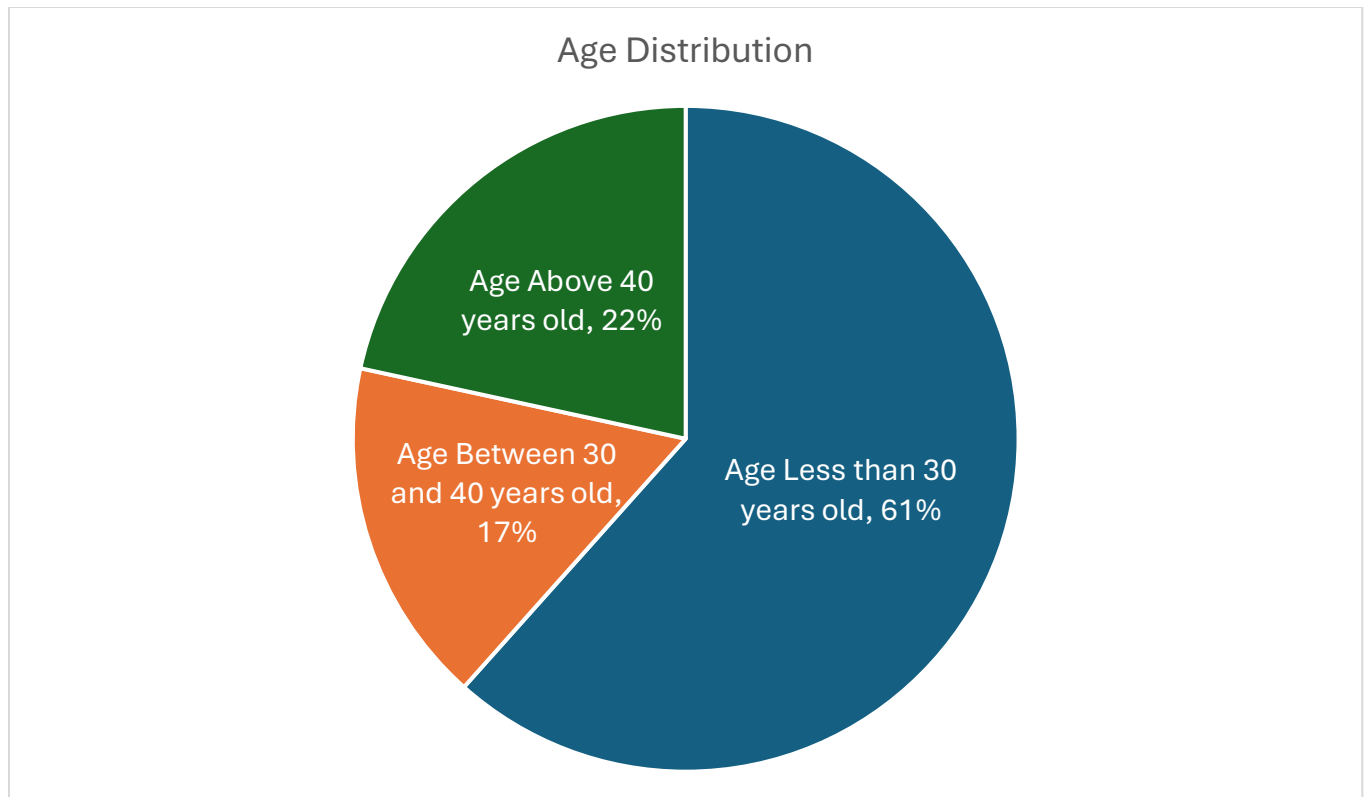


Figure 2: Age Distribution of the Study Sample

2. Experience Distribution:

- 20 participants (49%) have less than 5 years of experience.
- 6 participants (11%) have between 5 and 10 years of experience.
- 16 participants (40%) have more than 10 years of experience.

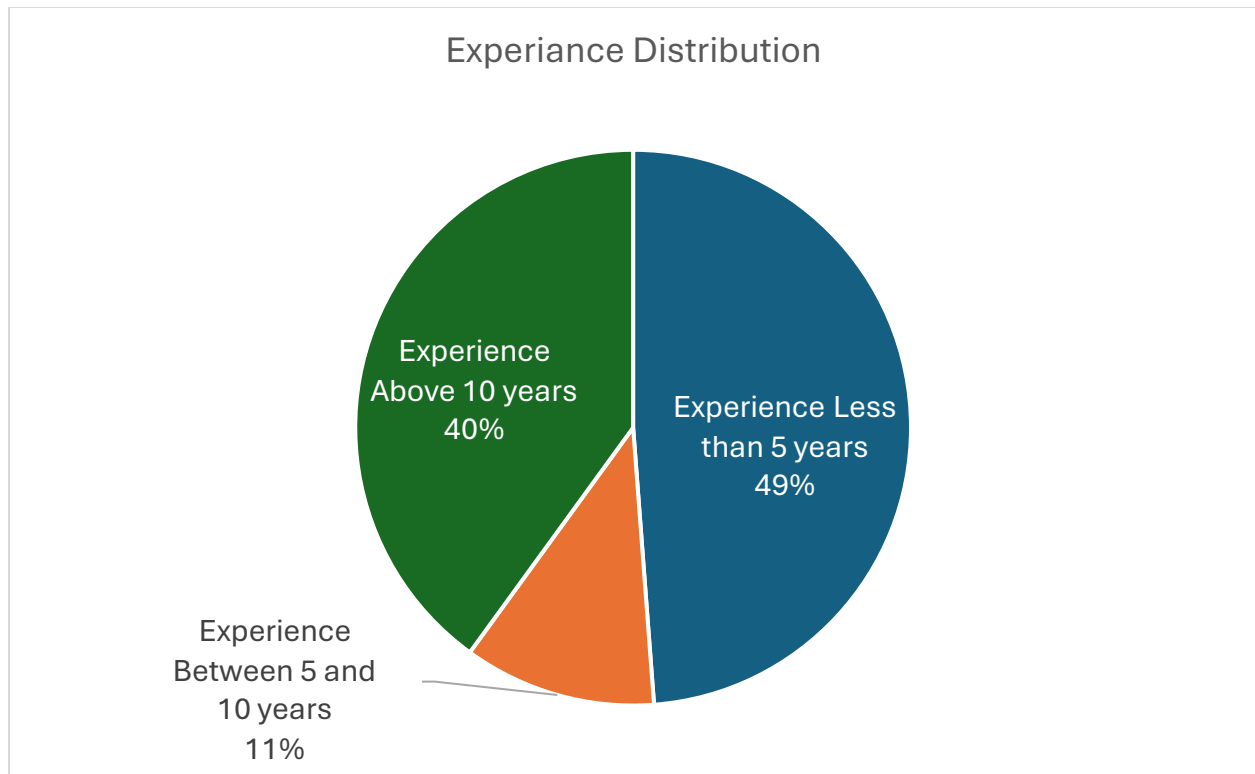


Figure 3: Experience Distribution of the sample

3. Position Distribution:

- 4 participants (10%) are in managerial positions.
- 7 participants (18%) are staff members.
- The majority, 29 participants (71%), are technicians.

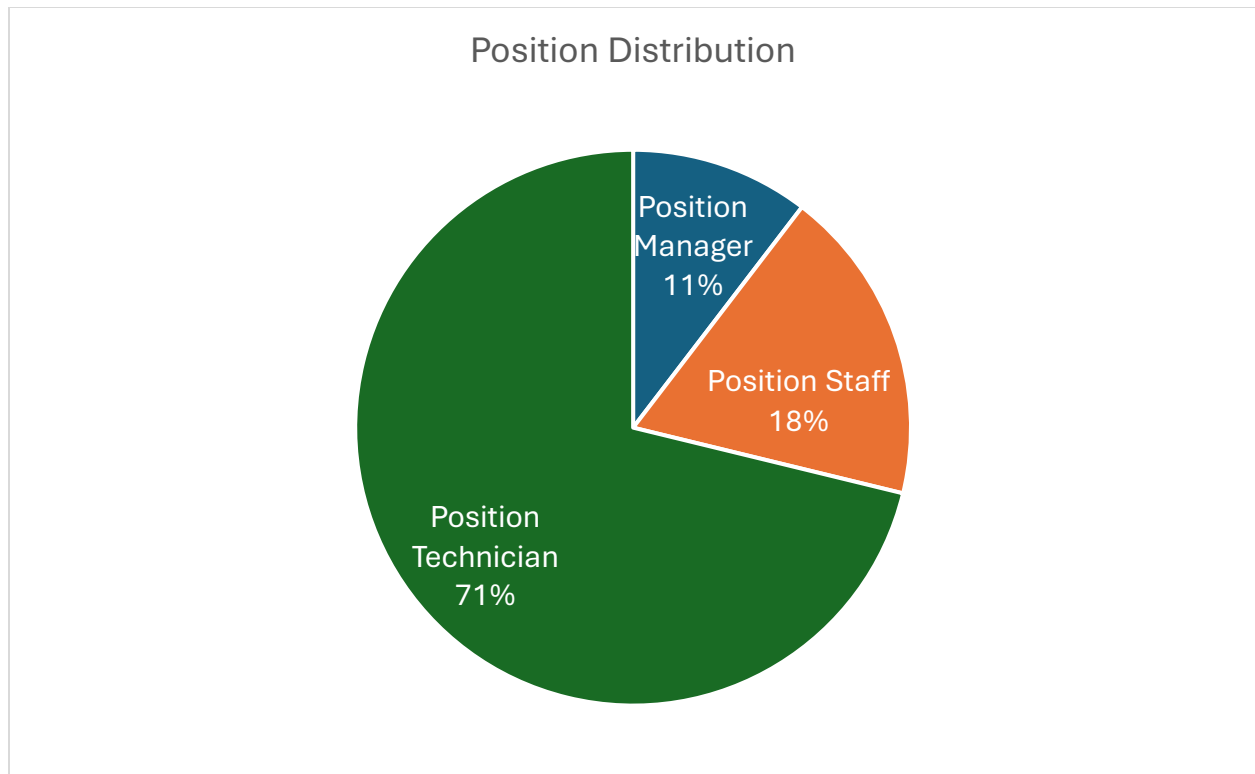


Figure 4: Position Distribution of the sample

Below is the table showing the factor and corresponding code for the questions in the survey:

Variable		Code	Question
Communication Dynamics	Communication	C1	How frequently do you communicate with project team members?
		C2	How effective do you find the current communication channels in addressing project-related issues?
		C3	How would you rate the overall communication effectiveness within the project?
Project Success	Safety Performance	P1.1	How often are safety protocols and procedures discussed in project meetings?

		P1.2	How would you rate the adherence to safety protocols on-site?
		P1.3	Have there been any safety incidents during the project?
	Project Timeline and Budget	P2	Is the project currently on schedule according to the original timeline?
		P3	Is the project adhering to the allocated budget?
	Project Managment	P4.1	How often are project timelines and budgets reviewed and adjusted as necessary?
		P4.2	How would you rate the project management's ability to keep the project on track?

Table 3: Survey Questions and the corresponding code

The frequency distribution for the survey conducted can be seen in the table below:

How frequently do you communicate with project team members?		
Class	Frequency	Percent
As needed	6	15
Monthly	3	7.5
Bi-weekly	9	22.5
Weekly	14	35
Daily	8	20
Total	40	100
How effective do you find the current communication channels in addressing project-related issues?		
Class	Frequency	Percent
Very ineffective	5	12.5

Ineffective	5	12.5
Neutral	6	15
Effective	15	37.5
Very effective	9	22.5
Total	40	100

How would you rate the overall communication effectiveness within the project?

Class	Frequency	Percent
Poor	6	15
Fair	4	10
Good	6	15
Very Good	13	32.5
Excellent	11	27.5
Total	40	100

How often are safety protocols and procedures discussed in project meetings?

Class	Frequency	Percent
Never	3	7.5
Rarely	10	25
Occasionally	10	25
Frequently	8	20
Always	9	22.5
Total	40	100

How would you rate the adherence to safety protocols on-site?

Class	Frequency	Percent
Very Poor	3	7.5

Poor	10	25
Fair	10	25
Good	8	20
Excellent	9	22.5
Total	40	100

Have there been any safety incidents during the project?

Class	Frequency	Percent
Yes	9	22.5
No	13	77.5
Total	40	100

Is the project currently on schedule according to the original timeline?

Class	Frequency	Percent
we are behind schedule	6	15
we are on schedule	9	42.5
we are ahead of schedule	17	42.5
Total	40	100

Is the project adhering to the allocated budget?

Class	Frequency	Percent
we are over budget	6	35

we are under budget	7	17.5
we are within budget	19	47.5
Total	40	100
How often are project timelines and budgets reviewed and adjusted as necessary?		
Class	Frequency	Percent
Rarely/Never	5	12.5
Quarterly	5	12.5
Monthly	12	30
Bi-weekly	3	7.5
Weekly	15	37.5
Total	40	100
How would you rate the project management's ability to keep the project on track?		
Class	Frequency	Percent
Very Poor	4	10
Poor	7	17.5
Fair	8	20
Good	7	17.5
Excellent	14	35
Total	40	100

Table 4: Frequency Distribution of survey

4.3. Validity & reliability tests for the questionnaires

Exploratory Factor Analysis (EFA):

Variable		Code	KMO		Loading Factor	(STD EV)	P values	AVE	
Communication Dynamics	Communication	C1	0.736		0.934	1.314	0	0.913	
		C2			0.916	1.319	0		
		C3			0.889	1.396	0		
Project Success	Safety Performance	P1.1	0.733	0.753	0.9	1.276	0	0.886	0.911
		P1.2			0.889	1.276	0		
		P1.3			0.87	1.544	0		
	Project Timeline and Budget	P2	0.5		0.963	1.436	0	0.963	
		P3			0.963	1.454	0		
	Project Managment	P4.1	0.5		0.895	1.431	0	0.895	
		P4.2			0.895	1.396	0		

Table 5:EVA Table

The table provided seems to summarize key statistics for different variables under two main constructs: “Communication Dynamics” and “Project Success.” Here’s a summary of the key findings:

1. Communication Dynamics:

- KMO: 0.736

- Loading Factors: The loadings for the three items (C1, C2, C3) range from 0.889 to 0.934, indicating strong associations with the underlying factor.

- Standard Deviation (STDEV): The values are between 1.314 and 1.396, showing moderate variability around the mean.

- P-Values: All p-values are 0, indicating that the loadings are statistically significant.

- Average Variance Extracted (AVE): The AVE for this construct is 0.913, which is very high, indicating that a large proportion of variance is explained by the construct.

2. Project Success:

○ Safety Performance:

- KMO: 0.733

- Loading Factors: The loadings for the three items (P1.1, P1.2, P1.3) range from 0.753 to 0.9, indicating strong to very strong associations with the factor.

- STDEV: The standard deviations range from 1.276 to 1.544, showing variability around the mean.

- P-Values: All p-values are 0, indicating statistical significance.

- AVE: The AVE for this construct is 0.887, which is high, indicating that the construct explains a substantial portion of variance.

○ Project Timeline and Budget:

- KMO: 0.5

- Loading Factors: The loadings for the items (P2, P3) are 0.963 for both, indicating very strong associations with the factor.

- STDEV: The standard deviations are 1.436 and 1.454, showing moderate variability.

- P-Values: Both are 0, indicating statistical significance.

- AVE: The AVE is 0.963, which is exceptionally high, indicating very strong variance explanation by the factor.

○ Project Management:

- KMO: 0.5

- Loading Factors: The loadings for the items (P4.1, P4.2) are 0.895 for both, indicating strong associations with the factor.

- STDEV: The standard deviations are 1.431 and 1.396, showing moderate variability.

- P-Values: Both are 0, indicating statistical significance.

- AVE: The AVE is 0.895, which is high, suggesting a strong proportion of variance explained by the construct.

Overall Summary:

- The KMO values range from 0.5 to 0.736, indicating adequate sampling adequacy.

- The loading factors are all high (above 0.75), indicating strong relationships between the items and their respective factors.

- The p-values being 0 suggest that all results are statistically significant.

- The AVE values, all above 0.85, indicate that a significant portion of the variance is explained by each construct, with some constructs explaining up to 96.3% of the variance. This suggests strong validity and reliability in the measured constructs.

Composite reliability:

To assess the reliability of the survey instrument, Cronbach's Alpha was calculated for the items related to communication dynamics and project success.

Variable		Number of statments		Cronbach's Alpha	
Communication Dynamics	Communication	3		0.900	
Project Success	Safety Performance	3	7	0.858	0.877
	Project Timeline and Budget	2		0.922	
	Project Managment	2		0.752	

Table 6: Reliability Statistic

The reliability analysis results show that the constructs related to “Communication Dynamics” and “Project Success” have high internal consistency, with Cronbach's Alpha values mostly above 0.8. These values suggest that the items used within each construct are consistent and reliable in measuring their intended concepts.

4.4. Descriptive statistics for research variables

In this study, research variables are assessed using a Likert scale, where responses are categorized into five levels ranging from “Strongly Disagree” to “Strongly Agree.”

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5	4	3	2	1

The Importance degree has been calculated according to the following equation:

Percentage was calculated for each scale by multiplying the mean calculated value into $(100/5)=20\%$.

The table below offers a detailed breakdown of the interpretation of mean calculated values, their corresponding results, percentage ranges, and the degree of importance attributed to each range. Specifically, mean values between 1 and 1.8 are interpreted as “Strongly Disagree” with a very low level of importance, covering a percentage range of 20% to less than 36%. Mean values from 2.6 to 3.4 indicate a “Neutral” stance, reflecting a medium level of importance and encompassing 52% to less than 68% of the percentage range. Finally, mean values from 4.2 to 5 suggest “Strongly Agree,” signifying a very high level of importance with a percentage range from 84% to 100%.

Mean Calculated value	Result	Percentage	Importance Degree
From 1 to <1.8	Strongly Disagree	From 20% to <36%	Very Low
From 1.8 to <2.6	Disagree	From 36% to <52%	Low
From 2.6 to <3.4	Neutral	From 52% to <68%	Medium
From 3.4 to <4.2	Agree	From 68% to <84%	High
From 4.2 to <5	Strongly Agree	From 84% to <100%	Very High

This categorization serves as a critical tool for interpreting the responses in the context of their significance to the research objectives. By establishing these thresholds, the study can effectively gauge the level of agreement or disagreement among respondents, as well as the relative importance of each variable within the broader research framework.

Variable		Mean calculated value		Variance		Result		Importance Level	
Communication Dynamics	Communication	3.43		1.505		Agree		High	
Project Success	Safety Performance	3.24	2.93	1.46	0.624	Neutral	Neutral	Medium	Medium
	Project Timeline and Budget	3.75		1.93		Agree		High	
	Project Managment	3.47		1.60		Agree		High	

From the table above mean calculated vales and variance we can conclude the following:

1. Communication Dynamics:

The mean value 3.43 indicates that respondents generally “Agree” on communication dynamics and “High” in importance.

2. Project Success:

The mean value 2.93 falls within the “Neutral” category, suggesting mixed responses and the importance level is rated as “Medium.”.

4.5. Testing Hypotheses & Findings Discussion

Component Correlations

		Communication	Project Success	Safety Performance	Project Timeline and Budget	Project Managment
Communication	Pearson Correlation	1	.308	.695**	.726**	.549**
	Sig. (2-tailed)		.053	<.001	<.001	<.001
	N	40	40	40	40	40
Project Success	Pearson Correlation	.308	1	.258	.408**	.299
	Sig. (2-tailed)	.053		.108	.009	.061
	N	40	40	40	40	40
Safety Performance	Pearson Correlation	.695**	.258	1	.539**	.543**
	Sig. (2-tailed)	<.001	.108		<.001	<.001
	N	40	40	40	40	40
Project Timeline and Budget	Pearson Correlation	.726**	.408**	.539**	1	.528**
	Sig. (2-tailed)	<.001	.009	<.001		<.001
	N	40	40	40	40	40
Project Managment	Pearson Correlation	.549**	.299	.543**	.528**	1

	Sig. (2-tailed)	<.001	.061	<.001	<.001	
	N	40	40	40	40	40
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 7: Correlation between components

Key Observations from the correlation matrix:

•**Strongest Correlations:** The strongest correlation observed is between “Communication” and “Project Timeline and Budget” ($r = 0.726$), indicating that good communication is strongly associated with keeping projects on timeline and within budget. Similarly, “Communication” is strongly correlated with “Safety Performance” ($r = 0.695$).

•**Significant Correlations:** Most of the correlations in the matrix are statistically significant, particularly those involving “Communication,” which shows significant positive correlations with all other variables except “Project Success.”

•**Project Success Correlations:** While “Project Success” has positive correlations with all variables, the only significant correlation is with “Project Timeline and Budget” ($r = 0.408$).

The correlation matrix indicates that communication plays a central role in influencing various aspects of project success, safety performance, and management. The significant positive correlations suggest that effective communication is critical to maintaining safety standards, adhering to timelines and budgets, and managing projects effectively. However, the direct correlation between communication and overall project success, while positive, is not statistically significant in this data set, suggesting that other factors might also play important roles in determining project success.

Hypotheses Testing:

H1. There is a significant relationship between communication and project success in the chemical plant construction projects in Industrial Jubail City.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.796 ^a	.633	.623	.65396

a. Predictors: (Constant), Communication Dynamics

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.030	1	28.030	65.541	<.001 ^b
	Residual	16.251	38	.428		
	Total	44.281	39			

a. Dependent Variable: Project Success

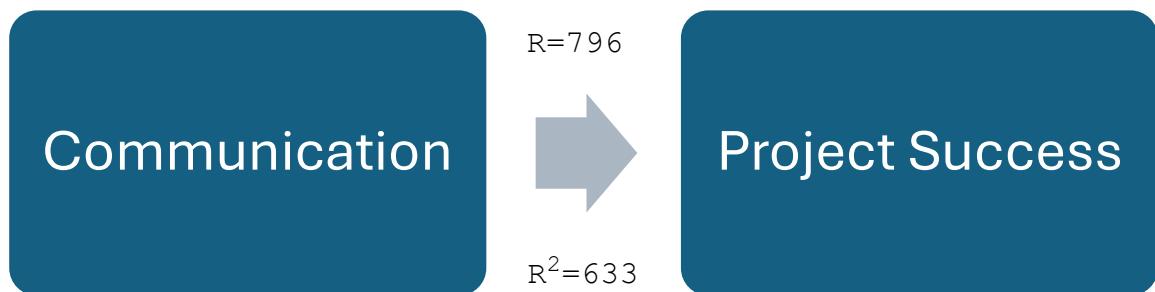
b. Predictors: (Constant), Communication Dynamics

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta	t		Lower Bound	Upper Bound
1	(Constant)	1.081	.311		3.480	.001	.452	1.710
	Communication Dynamics	.691	.085	.796	8.096	<.001	.518	.864

a. Dependent Variable: Project Success

- The R Square value of 0.633 indicates that 63.3% of the variance in project success can be explained by communication dynamics. The model shows a strong positive correlation between communication and project success, with an R value of 0.796.
- **ANOVA (Analysis of Variance):**
The ANOVA results indicate that the model is statistically significant ($p < 0.001$). This means there is a significant relationship between communication dynamics and project success.
- **Coefficients:**
The coefficient for communication dynamics ($B = 0.691$) is positive and highly significant ($p < 0.001$). This indicates that for every unit increase in communication dynamics, project success increases by 0.691 units, holding all else constant.



The hypothesis test strongly supports the claim that there is a significant relationship between communication dynamics and project success in chemical plant construction projects in Industrial Jubail City. The model explains a substantial portion of the variance in project success, and the statistical tests confirm the significance of communication dynamics as a

predictor. This suggests that enhancing communication within these projects could lead to better project outcomes.

H2. There is a significant positive relationship between integrating theoretical frameworks that integrate communication theories with construction management principles and project timeline in the chemical plant construction projects in Industrial Jubail City.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.726 ^a	.527	.515	.96940

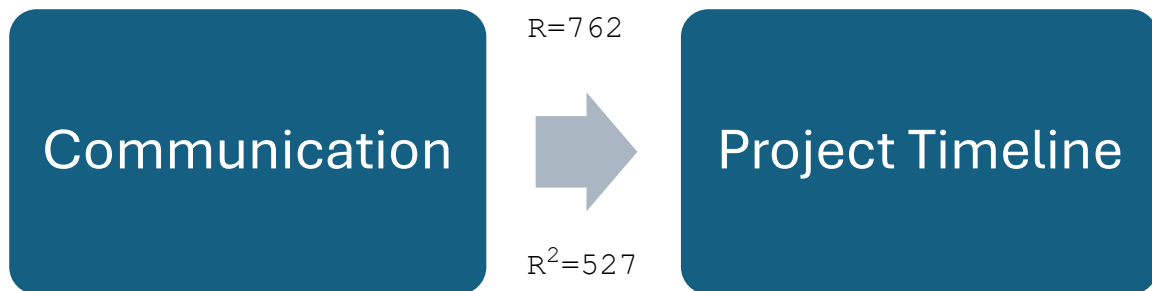
ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	39.790	1	39.790	42.341	<.001 ^b
1 Residual	35.710	38	.940		
1 Total	75.500	39			

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.924	.461		2.005	.052	-.009	1.856
	Communication Dynamics	.823	.127	.726	6.507	<.001	.567	1.079

a. Dependent Variable: PP2



- The R Square value of 0.527 indicates that 52.7% of the variance in project timelines can be explained by the integration of communication theories with construction management principles. The model shows a strong positive correlation ($R = 0.726$) between the integrated theoretical frameworks and project timelines.
- **ANOVA (Analysis of Variance):**
The ANOVA results indicate that the model is statistically significant ($p < 0.001$). This signifies that there is a significant relationship between the integration of communication theories with construction management principles and the project timeline.

- **Coefficients:**

The coefficient for communication dynamics ($B = 0.823$) is positive and highly significant ($p < 0.001$). This indicates that for every unit increase in communication dynamics, project timeline increases by 0.823 units, holding all else constant.

The hypothesis test supports the assertion that there is a significant positive relationship between integrating communication theories with construction management principles and project timelines in chemical plant construction projects in Industrial Jubail City. The model explains over half of the variance in project timelines, and the statistical tests confirm the importance of this integration. This suggests that applying these theoretical frameworks can lead to more effective project timelines and improved project outcomes.

H3. There is a significant positive relationship between addressing identified communication challenges through targeted strategies and project budget optimization in the chemical plant construction projects in Industrial Jubail City.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.549 ^a	.302	.283	1.07147

a. Predictors: (Constant), Communication Dynamics

ANOVA^a

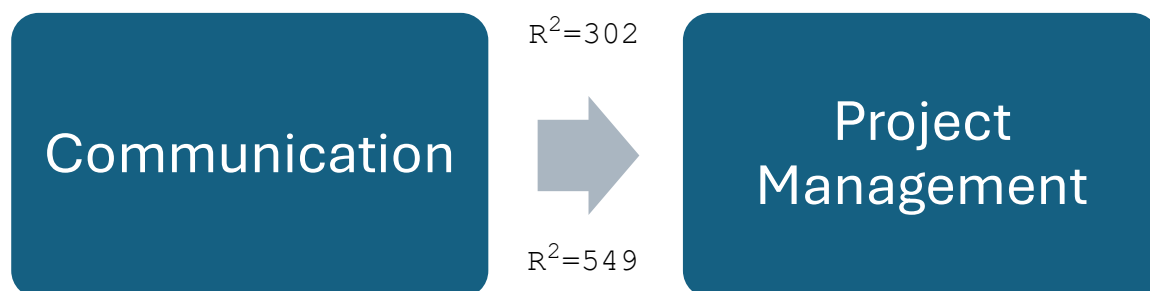
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.849	1	18.849	16.419	<.001 ^b
	Residual	43.626	38	1.148		
	Total	62.475	39			

a. Dependent Variable: PP3

b. Predictors: (Constant), Communication Dynamics

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B
		B	Std. Error	Beta			Lower Bound
1	(Constant)	1.530	.509		3.004	.005	.499
	Communication Dynamics	.567	.140	.549	4.052	<.001	.284



- The R Square value of 0.302 indicates that 30.2% of the variance in project budget optimization can be explained by addressing communication challenges through targeted strategies. The model shows a moderate positive

correlation ($R = 0.549$) between communication dynamics and project budget optimization.

- **ANOVA (Analysis of Variance):**

- The ANOVA results indicate that the model is statistically significant ($p < 0.001$). This suggests that addressing communication challenges through targeted strategies has a significant impact on project budget optimization.

- **Coefficients:**

The coefficient for communication dynamics ($B = 0.567$) is positive and highly significant ($p < 0.001$). This indicates that for every unit increase in addressing communication challenges through targeted strategies, project budget optimization increases by 0.567 units, holding all else constant. The confidence interval further confirms the reliability of this coefficient.

The hypothesis test supports the assertion that there is a significant positive relationship between integrating communication theories with construction management principles and project timelines in chemical plant construction projects in Industrial Jubail City. The model explains over half of the variance in project timelines, and the statistical tests confirm the importance of this integration. This suggests that applying these theoretical frameworks can lead to more effective project timelines and improved project outcomes.

4.6. Conclusion

The statistical analysis has been done using SPSS V-29 and MS Excel to highlight several critical issues related to communication practices in chemical plant construction projects. The mixed effectiveness of communication channels, coupled with inconsistent safety adherence and widespread delays, underscores the

need for more robust communication strategies. These strategies should be designed to foster better coordination, enhance safety protocols, and ensure that projects are delivered on time and within budget. Future research should focus on developing tailored communication frameworks that address the unique challenges of this industry, with a particular emphasis on integrating these frameworks into everyday project management practices.

Chapter five: Research limitations, Recommendations & Conclusion

5.1. Research Limitations & Future Research

This study has provided valuable insights into the relationship between communication dynamics and project success within chemical plant construction projects in Industrial Jubail City. However, like any research, it is subject to certain limitations that should be acknowledged.

Sample Size and Generalizability: The study was conducted with a sample size that, while sufficient for statistical analysis, may not fully represent the broader population of chemical plant construction projects. Future research could expand the sample size to include a more diverse range of projects and geographical locations, thereby enhancing the generalizability of the findings.

Data Collection Methodology: The reliance on self-reported data through surveys may introduce biases such as social desirability or recall bias. While efforts were made to mitigate these biases, future studies could complement survey data with observational data or interviews to triangulate findings and provide a more nuanced understanding of communication dynamics.

Scope of Variables: The study focused primarily on communication dynamics as the independent variable affecting project success. However, project success is influenced by a multitude of factors, including financial management, technological adoption, and team dynamics. Future research could explore these additional variables to provide a more holistic view of what drives project success in this context.

Context-Specific Findings: The findings of this study are specific to chemical plant construction projects in Industrial Jubail City. The unique environmental, cultural, and economic factors in this region may limit the applicability of these

results to other settings. Comparative studies in different industrial contexts or regions would be valuable in assessing the consistency of these findings.

5.2. Research Recommendations

Based on the findings of this study, several recommendations can be made to improve communication practices and, consequently, project success in chemical plant construction projects.

1. Enhancing Communication Channels: The study highlights the critical role of effective communication in project success. It is recommended that project managers invest in advanced communication tools and platforms that facilitate real-time information sharing and collaboration. Tools such as Building Information Modeling (BIM) and integrated project management software should be considered for widespread adoption.

2. Communication Training Programs: To address communication challenges, it is recommended that companies implement regular training programs focused on communication skills. These programs should cover not only basic communication strategies but also conflict resolution, cultural sensitivity, and the use of communication technology.

3. Regular Communication Audits: Project managers should conduct regular audits of communication practices to identify and rectify issues promptly. This could involve surveys, focus groups, or feedback sessions that engage all stakeholders, ensuring that communication channels remain effective and aligned with project needs.

4. Integrating Communication with Project Management: The integration of communication theories with project management principles, as highlighted in this

study, suggests that a more structured approach to communication could yield significant benefits. It is recommended that project management frameworks explicitly incorporate communication strategies and that these strategies be monitored and evaluated continuously throughout the project lifecycle.

5. Addressing Identified Challenges through Targeted Strategies: The study's findings emphasize the importance of addressing communication challenges through targeted strategies. Project teams should prioritize the identification of specific communication barriers and develop tailored strategies to overcome them. This might include improving language translation services, adjusting communication protocols to accommodate time zone differences, or enhancing the clarity and accessibility of project documentation.

5.3. Conclusion

The research conducted in this study has reinforced the critical importance of communication dynamics in the success of chemical plant construction projects in Industrial Jubail City. The findings demonstrate that effective communication is not only a facilitator of project success but also a crucial factor in ensuring safety, adherence to timelines, and budget optimization.

The study has provided evidence that integrating communication theories with project management principles can significantly enhance project outcomes. Moreover, addressing communication challenges through targeted strategies has been shown to positively impact budget adherence, further emphasizing the role of communication in project success.

In conclusion, fostering effective communication within project teams is essential for the successful delivery of complex construction projects. The recommendations provided in this chapter offer practical steps that project managers and organizations can take to enhance communication practices and, in turn, improve project performance. Future research should continue to explore the multifaceted relationship between communication and project success, with an emphasis on expanding the scope of inquiry and applying these insights across different industrial contexts.

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Appendix

Questionnaires

Survey on The Impact of Team Communication on Project Timeline in Chemical Plants Construction in Industrial Jubail City

Dear Mr/Ms.....,

We are conducting a survey to gather valuable insights on the communication practices, safety performance, and overall project management of the chemical plant construction project in Jubail, Saudi Arabia. Your participation is crucial in helping us understand the effectiveness of current practices and identifying areas for improvement.

This survey is designed to assess how communication channels are being utilized, how safety protocols are being adhered to, and how well the project is sticking to its timeline and budget. Your honest feedback will play a significant role in enhancing the overall efficiency and success of the project.

Please be assured that all responses will be kept **confidential** and used solely for the purpose of improving project outcomes.

Thank you for your time and valuable input.

Sincerely,

The Researcher

Alaa Alsmhod

Student of Project Management , Midocean University

Section 1 (S) : Communication Practices, Channels, and Effectiveness

How frequently do you communicate with project team members?

- Daily
- Weekly
- Bi-weekly
- Monthly
- As needed

Which communication channels do you primarily use for project-related discussions? (Select all that apply)

- Email
- Phone calls
- Video conferencing
- In-person meetings
- Instant messaging (e.g., WhatsApp, Teams)
- Project management software (e.g., MS Project, Primavera)
- Other (Please specify)

How effective do you find the current communication channels in addressing project-related issues?

- Very effective
- Effective
- Neutral
- Ineffective
- Very ineffective

What challenges have you faced in communication during the project? (Select all that apply)

- Language barriers
- Time zone differences
- Lack of timely responses
- Technical issues with communication tools
- Misunderstandings or miscommunications
- Other (Please specify)

How would you rate the overall communication effectiveness within the project?

- Poor
- Fair
- Good
- Very Good
- Excellent

Section 2: Safety Performance and Adherence

How often are safety protocols and procedures discussed in project meetings?

- Always

- Frequently
- Occasionally
- Rarely
- Never

How would you rate the adherence to safety protocols on-site?

- Excellent
- Good
- Fair
- Poor
- Very Poor

Have there been any safety incidents during the project?

- Yes
- No

If Yes, please briefly describe the nature of the incident and how it was handled.

.....

Section 3: Project Adherence to Timeline and Budget

Is the project currently on schedule according to the original timeline?

- Yes, we are on schedule
- No, we are ahead of schedule
- No, we are behind schedule

If behind schedule, what are the main reasons for the delay?

Is the project adhering to the allocated budget?

- Yes, we are within budget
- No, we are under budget
- No, we are over budget

If over budget, what are the main factors contributing to the overspend?

.....

How often are project timelines and budgets reviewed and adjusted as necessary?

- Weekly
- Bi-weekly
- Monthly
- Quarterly

- Rarely/Never

How would you rate the project management's ability to keep the project on track?

- Excellent
- Good
- Fair
- Poor
- Very Poor

What strategies or tools have been most effective in keeping the project on schedule and within budget?

.....

Section 4: Additional Feedback

What do you believe are the greatest strengths of the current project management and communication practices?

.....

.....

.....

What areas do you believe need improvement to enhance the project's overall success?

.....

Any additional comments or suggestions?

.....

Correlation Matrix^a

		Project Safety Performanc e 1	Project Safety Performanc e 2	Project Safety Performanc e 3	Project Timelin e	Projec t Budge t	Project Timelin e and Budget	Project Manageme nt	Communicatio n 1	Communicatio n 2	Communicatio n 3
Correlatio n	Project Safety Performance 1	1.000	.717	.674	.308	.456	.541	.274	.569	.571	.551
	Project Safety Performance 2	.717	1.000	.647	.420	.567	.541	.317	.493	.571	.565
	Project Safety Performance 3	.674	.647	1.000	.436	.558	.487	.410	.539	.528	.663
	Project Timeline	.308	.420	.436	1.000	.855	.417	.422	.577	.533	.585
	Project Budget	.456	.567	.558	.855	1.000	.574	.404	.752	.650	.731
	Project Timeline and Budget	.541	.541	.487	.417	.574	1.000	.603	.535	.474	.519
	Project Management	.274	.317	.410	.422	.404	.603	1.000	.342	.459	.362
	Communicatio n 1	.569	.493	.539	.577	.752	.535	.342	1.000	.699	.809
	Communicatio n 2	.571	.571	.528	.533	.650	.474	.459	.699	1.000	.744
	Communicatio n 3	.551	.565	.663	.585	.731	.519	.362	.809	.744	1.000
Sig. (1- tailed)	Project Safety Performance 1		<.001	<.001	.027	.002	<.001	.044	<.001	<.001	<.001
	Project Safety Performance 2	.000		.000	.003	.000	.000	.023	.001	.000	.000
	Project Safety Performance 3	.000	.000		.002	.000	.001	.004	.000	.000	.000
	Project Timeline	.027	.003	.002		.000	.004	.003	.000	.000	.000
	Project Budget	.002	.000	.000	.000		.000	.005	.000	.000	.000
	Project Timeline and Budget	.000	.000	.001	.004	.000		.000	.000	.001	.000
	Project Management	.044	.023	.004	.003	.005	.000		.015	.001	.011
	Communicatio n 1	.000	.001	.000	.000	.000	.000	.015		.000	.000
	Communicatio n 2	.000	.000	.000	.000	.000	.001	.001	.000		.000
	Communicatio n 3	.000	.000	.000	.000	.000	.000	.011	.000	.000	

a. Determinant = .000

Rotated Component Matrix^a

	Component	
	1	2
Project Timeline	.890	
Project Budget	.873	.320
Communication 1	.706	.465
Communication 3	.683	.532
Communication 2	.633	.518
Project Management	.558	
Project Safety Performance 1		.903
Project Safety Performance 2		.816
Project Safety Performance 3	.354	.758
Project Timeline and Budget	.499	.535

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser

Normalization.

a. Rotation converged in 3 iterations.

Item Statistics

	Mean	Std. Deviation	N
Project Timeline and Budget	3.45	1.431	40
Project Management	3.50	1.396	40
Communication 1	3.38	1.314	40
Communication 2	3.45	1.319	40
Communication 3	3.48	1.396	40
Project Safety Performance 1	3.25	1.276	40
Project Safety Performance 2	3.25	1.276	40
Project Safety Performance 3	3.23	1.544	40
Project Timeline	3.70	1.436	40
Project Budget	3.80	1.454	40

Statistics

		Communication 1	Communication 2	Communication 3	Project Safety Performance 1	Project Safety Performance 2	Project Safety Performance 3	Project Timeliness	Project Budget	Project Timeline and Budget Management	Communication Dynamics
N	Valid	40	40	40	40	40	40	40	40	40	40
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		3.38	3.45	3.48	3.25	3.25	3.23	3.70	3.80	3.45	3.4333
Median		4.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	3.00	4.0000
Std. Deviation		1.314	1.319	1.396	1.276	1.276	1.544	1.436	1.454	1.431	1.22695
Variance		1.728	1.741	1.948	1.628	1.628	2.384	2.062	2.113	2.049	1.505
Skewness		-.605	-.626	-.631	-.029	-.029	-.222	-.808	-.951	-.308	-.930
Std. Error of Skewness		.374	.374	.374	.374	.374	.374	.374	.374	.374	.374
Percentiles	25	3.00	2.25	2.25	2.00	2.00	2.00	3.00	3.00	2.25	2.3333
	50	4.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	3.00	4.0000
	75	4.00	4.00	5.00	4.00	4.00	5.00	5.00	5.00	5.00	4.3333