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# KEY INTERNAL FACTORS CAUSING SCHEDULE DELAYS IN YEMEN-MOBILE TELECOM TRANSCEIVER SITES PROJECTS

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## Abstract

In Yemen, telecom projects frequently experience schedule delays, which in turn impede the successful execution of strategic initiatives and the effective deployment of new public services. This study aims to investigate the internal factors causing schedule delays in Yemen-Mobile's transceiver sites projects. A re-structured questionnaire was distributed to employees involved in the implementation of transceiver sits projects in Yemen Mobile. Of the 191 questionnaires distributed, 154 valid responses were collected and used for analysis. The study identified ten major factors that have a significant detrimental influence on project schedules and caused delay. Procurement phase - related issues emerged as the most influential. These factors included a lack of technical equipment, supplier-related delays, lengthy purchasing procedures and unqualified technical equipment suppliers. Furthermore, Delays in the implementation phase also include delays in fiber optic network connection, security-related material and equipment delays to the project site and implementation start barriers. In addition to, the lack of comprehensive procurement planning, ineffective the strategy of addressing challenges of sites acquisition and lack of monitoring and control plans were identified as a critical planning issue. The study provided practical recommendations for improving procurement management, boosting the efficiency of the implementation phase, and addressing planning issues.

## Article Info

**Keywords:**
Projects , Transceiver Sites, Schedule, Yemen-Mobile, Telecom Projects, Delay

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## 1. INTRODUCTION

The telecommunications sector is one of the most dynamic global industries, characterized by an exceptionally rapid pace of innovation and a constant evolution of products and services. As telecommunications companies expand their operations and market reach, the strategic importance of optimizing internal processes and refining technological infrastructure has become paramount. Ultimately, a company's sustained success within this swiftly developing external environment hinges critically on its inherent capacity to proactively and effectively adapt to the constantly shifting demands and emerging needs of the market [1]. The information and communication technology (ICT) sector is a cornerstone of Yemen's national infrastructure, serving as the second-largest source of public revenue after the petroleum sector and generating significant direct and indirect employment opportunities [2]. Beyond its economic contributions, ICT plays a pivotal role in diverse social processes encompassing the government, personal, familial, and business fields. ICT serves as a critical driver for economic organizations by facilitating the timely flow of information to decision makers, particularly within the highly globalized and interconnected market landscape. Owing to the rapid and continuous nature of technological advance-

ments and evolving customer needs, the ICT industry and mobile network operators (MNOs) specifically focus on developing advanced and adaptable infrastructure. This may allow for the expansion of services with appropriate quality and cost, ensuring alignment with the accelerating pace of change within the telecommunications industry [3]. Telecommunication companies are increasingly adopting advanced project management methodologies inspired by best practices in information technology (IT) projects. This may enhance internal processes and overall effectiveness, and optimize resource allocation. By embracing these modern approaches, telecommunication companies can navigate the complexities of their projects more effectively, ultimately achieving their strategic goals [2]. Project management, as defined [4], is the application of specialized knowledge, tools, and techniques to guide teams toward achieving all project objectives within the established cost, quality, and schedule constraints. [5][6] A comprehensive schedule is a critical element of successful project management and involves meticulous task definition, clear prioritization, and realistic time allocation for each activity [4]. [7] A project must have a definite start and end point and meet specific objectives, adhering to three fundamental criteria: on-time completion, within-budget accomplishment, and meeting the prescribed quality requirements. A well-defined schedule fosters organized efforts, ensures smooth progress, and ultimately facilitates on-time project delivery. However, project delays can constitute significant challenges, often leading to negative repercussions. These include budget overruns, compromised final work quality, and failure to achieve project goals on schedule. Similar to construction projects, schedule slippages are a common occurrence in ICT projects, as noted in [8]and [9]. The telecommunications industry is undergoing a significant global shift, characterized by the widespread decommissioning of 3G networks in favor of more advanced technologies, such as 4G and 5G. This transition is primarily driven by the need to repurpose finite-spectrum resources and existing infrastructure to support the increasing demand for faster, more capable networks. As older, less efficient technologies such as 3G become obsolete and lose global support, some mobile carriers worldwide are actively shutting them down [10]. The telecommunications sector is one of the most encouraging sectors in Yemen for business investments. A recent study demonstrates that Yemen's telecom companies are growing faster than other telecom companies in Arab countries [11]. The number of mobile phone subscriptions increased five-fold, from 3 million in 2006 to 16 million in 2016, leading to an almost 56.9% penetration for a population of approximately 28 million. However, the mobile penetration rate is one of the lowest in the Middle East and North Africa (MENA) region [12]. According to World Bank data, the number of mobile phone subscriptions was 20,047,500 in 2023, which is 49.4% of the total population of Yemen (see Figure 1) [12]. The mobile telecommunications sector in Yemen comprises one public CDMA Sector supplier (Yemen Mobile) and three privately owned GSM businesses (Sabafon, MTN (YOU), and Y) [11].

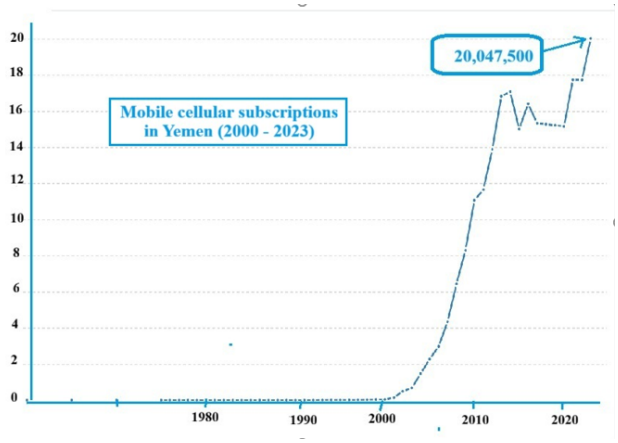


**Figure 1.** Mobile cellular subscriptions - Rep. Yemen

Yemen Mobile Company's 2022 annual report [13] outlines strategic objectives that align with this global trend, aiming to establish a leadership position in 4G Internet services and drive operational and digital transformation within Yemen. Key initiatives include the completion and operation of a central data center for 4G LTE services, and the ongoing deployment of 4G/LTE network sites across most governorates. A crucial final step in this transformation is the eventual shutdown of the CDMA (3G) network. However, [12], in his study evaluating the effectiveness of project management at Yemen Mobile, noted an average level of project completion within the project timelines but did not address the specific factors causing delays, particularly concerning transceiver site projects, which are essential for service delivery. This highlights a critical challenge that impacts Yemen Mobile's strategic objectives. This research problem revolves around delays in implementing new transceiver sites for Yemen Mobile's 4G/ LTE network. These delays directly impede a company's ability to achieve two vital strategic goals.

1. Transitioning to a fully functional 4G/LTE network by expanding 4G infrastructure is paramount given the increasing obsolescence and global lack of support for older CDMA technology.

2. Improving network coverage and accessibility through the implementation of new transceiver sites is essential to providing broader 4G access across all governorates, thereby meeting user needs and market demands for modern communication and Internet services.

Therefore, this study aims to identify the internal factors causing schedule delays in the implementation of Yemen Mobile's transceiver site projects and to provide a set of concrete recommendations to improve the effi-

ciency of Yemen Mobile's projects. The great importance of this study lies in its valuable contributions, both academically and practically. On one hand, it seeks to fill critical knowledge gaps by providing deep insights into the factors causing delays in telecom projects in Yemen, which also enriches the understanding of project management in this vital sector. On a practical level, the study offers concrete solutions and recommendations aimed at improving telecom project management, specifically at Yemen Mobile (the largest mobile company in Yemen), helping to address chronic problems in project implementation and enhance their effectiveness.

## 2. LITERATURE REVIEW

### 2.1. Project

A project is a unique and temporary endeavor undertaken to create a specific product, service, or result. Unlike ongoing operations, projects have a defined beginning and end, with clear objectives and scope. They are typically characterized by the need for careful planning, organization, and control to achieve the desired outcomes within specific constraints. According to [14], a project can be viewed as a temporary organizational structure designed to produce a unique output. This output is subject to limitations in terms of the time, cost, and quality. The temporary nature of a project implies a well-defined start and end point, distinguishing it from the ongoing operational activities. Furthermore, [4] the project's role as a temporary undertaking is aimed at producing a novel product, service, or result. This definition underscores a project's distinct nature and separation from routine organizational functions.

### 2.2. Project Management

Project management has become an indispensable function across a wide spectrum of industries including construction, information technology, architecture, hospitality, engineering, and new product development [15]. It encompasses systematic planning, organization, direction, and control of organizational resources to achieve specific time-bound objectives [16].

Project management involves the strategic application of knowledge, skills, tools, and techniques to ensure that project deliverables meet the established requirements [4]. By effectively integrating these elements, organizations can optimize project performance and achieve strategic goals. Successful project management is characterized by the consistent attainment of project objectives within predefined constraints of time, cost, and quality while effectively utilizing allocated resources and securing stakeholder acceptance [16].

### 2.3. Project Management in Telecommunication Sector

The global telecommunications sector is characterized by continuous evolution, necessitating robust project management practices for the successful execution, deployment, and upkeep of intricate telecom projects. The dynamic nature of the telecom market, driven by rapid technological advancements and expansion, demands constant initiation of new technology projects. However, research indicates challenges within the Yemeni telecommunication landscape. Studies by [3] and [17] highlight issues, such as project delays and cost overruns. While [17] there was a high level of effective project management practices within Yemen Mobile Company and an average level of project success, the study also demonstrated a statistically significant positive correlation between effective project management dimensions, particularly the organizational structure supporting project management and project success. The research recommended the adoption of project management software, such as the MS Project or Primavera. Further investigations [18] suggest that the Six Sigma DMADV methodology can enhance project management performance in telecom site rollout projects by establishing improved project management models. Similarly, [19] identified shortcomings in the generic project model used by Yemen, impacting the company's objectives and local market reputation. This study advocates the DMADV method to mitigate errors and strengthen the processes and performance of site rollout project management. Moreover, [3] his research further emphasized the significant impact of project management methodologies (PMM) on project success in Yemeni telecommunication companies when comprehensively applied and supplemented. The study recommends a transition from traditional to modern project management approaches to align with the industry's rapid technological changes and escalating demand for telecom services. More recently, [20] a study evaluating project management strategies in the Yemeni telecommunications sector revealed that the waterfall methodology was the most prevalent (41.6%), followed by agile (22.8%). Other methodologies, Six Sigma, Scrum, and Lean, have lower adoption rates. The study also indicated the nascent adoption of sustainable practices such as energy efficiency within some projects.

### 2.4. Project Scheduling

Project scheduling is defined as the output of a schedule model that includes a detailed plan that specifies the project activities, their sequence, duration, resource allocation, and overall schedule [15]. Project scheduling aims to identify dependencies between tasks, estimate resource requirements, and determine the precise start

and finish dates for each activity [14]. Various scheduling methodologies can be used, including but not limited to master charts, Gantt charts, and network diagrams. These tools provide visual representations of project timelines and dependencies, enabling project managers to effectively communicate and monitor progress.

## 2.5. Schedule Overrun

A schedule overrun, often synonymous with a schedule delay or slippage, occurs when a project's completion date extends beyond the initially projected timeline. This discrepancy between planned and actual project durations represents a significant challenge for project managers and organizations. (Al-Khelli,2021) defines a schedule overrun as an increase in the project implementation period beyond the contractual completion date. This definition underscores the contractual implications of these delays. [9] provides a broader perspective, characterizing project delays as any factor that obstructs timely completion of project activities. This encompasses a wider range of potential causes of schedule overruns. The prevalence of schedule overruns is particularly pronounced in complex and dynamic project environments such as those common in developing countries. The inherent uncertainties and risks associated with these projects often contribute to scheduling extensions. For instance, [21] found that 47% of projects in Yemen experienced schedule overruns, highlighting the severity of this issue in this context. Like other infrastructure-intensive industries, the ICT sector is not immune to scheduling overruns. [8] and [9] emphasize the frequent occurrence of schedule slippages in ICT projects. This suggests that, despite advancements in project management methodologies and technologies, challenges related to timely project delivery persist in this domain. Schedule overruns can have far-reaching consequences including increased costs, reputational damage, and client dissatisfaction. To address this issue effectively, a comprehensive understanding of the root causes of schedule overruns is essential.

## 2.6. Yemen Mobile Transceiver Sites Projects

The case study is based on information from different mobile telecom transceiver site projects conducted by Yemen Mobile Company, which is the leading provider of mobile services in Yemen. The design and components of mobile transceiver site vary from one site to another according to many factors, the most important of which is the terrain of the region or area where the site will be built and installed.

**1. Greenfield Sites:** The Greenfield sites are installed sites installed in rural or non-urban areas in open terrain such as fields, deserts, and mountains. This type of site is usually erected with a tower and is normally intended to provide coverage in a wide-open area of several kilometers.

**2. Rooftop Sites:** The Rooftop sites are installed sites installed on buildings in urban areas and are usually intended to provide coverage in dense areas in towns and cities. In most cases, transceiver sites consist of the following equipment.

- Tower or pole (in rooftop sites) with antenna and microwave equipment.
- Equipment shelters and encloser builds for BTS and telecommunication equipment . . . etc.
- The power infrastructure and encloser buildings include utility sources, power generators, solar power systems, rectifiers, air conditioners, and backup batteries.
- Boundary wall and guard room. The implementation phases for Yemen Mobile's transceiver sites projects goes through several stages.

**1. Planning Phase:** The planning phase is the first step in translating the company's strategic objectives into actionable action plans. During this phase, all plans necessary for project implementation are prepared, including procurement and implementation plans.

**2. Execution Phase:** The implementation of new mobile telecom sites is usually done through different successive processes, each of which comprises numerous sub-processes that are performed by different teams from the Yemen Mobile departments in addition to subcontractors who are usually assigned to carry out the site construction work.

**3. Operation and Maintenance Phase:** Once work is fulfilled and accepted, the site is assigned and formally handed over to the network operation and maintenance management to be put into service.

## 2.7. Internal Factors causing delay in Telecom projects

Identifying and classifying the factors causing delays in telecom projects have been the subject of diverse research in various global contexts. Recognizing that the frequency and importance of these delay factors vary by country and project type, researchers have employed diverse classification schemes; however, a global consensus on these schemes remains elusive. To establish a comprehensive and appropriate set of factors for the current research, a systematic review and analysis was conducted using the findings of previous studies, focusing exclusively on internal delay factors. Studies conducted by [18], which aimed to enhance project management performance in the MTN Syria mobile site rollout project, and by [22] and [19],which aimed to understand

current practices and identify areas for performance improvement in MTN Yemen site rollout projects, identified twenty and thirty-eight delay factors, respectively. Both studies used a similar framework to analyze the delay factors in mobile site rollout projects. This framework organizes factors into six categories: logistics, site acquisition, project management, site planning and design, site creation, and site integration.

Crucially, from these lists, each study extracted ten internal delay factors.

While [23] studying telecom tower construction in Ghana aimed to evaluate factors influencing time and cost overruns, it classified its twenty-six delay factors into three categories: client-related, contractor-related, and consultant-related factors. This study identified a large number of internal factors, specifically twenty-two. By contrast, [24], who categorized thirty-eight delay factors causing delays in the 4G-LTE rollout in Indonesia's Jadebotabek area, used a similar but expanded classification. They included a fourth category, "Other external causes," resulting in a count of twenty-nine internal delay factors.

[8] whose research aimed to identify and analyze the causes of schedule overruns in telecom projects in Zambia adopted a highly detailed organizational scheme. The thirty-four delay factors were divided into four main groups and 14 subgroups; however, only a small number of the four main delay factors were internal. In contrast, [9] who studied 40 delay factors in the construction of telecommunications towers in Ghana, placed all factors into a single broad category, 12 of which were internal. [25]) Using a very specific approach, the nine factors were divided into four groups: external environment, material factors, project specifications, and team capability; eight of these factors were internal. Finally, [26], who focused on improving construction time using the Lean Six Sigma DMAIC methodology in Libya, identified the most comprehensive list of all studies (fifty-two delay factors), which were organized into 12 activity groups representing the project execution path, with 11 factors classified as internal.

According to the previous studies listed in Table 1, a list of thirty-four internal factors causing delays in telecommunications projects was compiled. This list was reduced to eliminate duplicate and overlapping factors by combining and rewording them. The wording of other factors was also refined for greater precision and clarity to ensure accurate responses from the survey participants. These factors are categorized into three groups: planning, procurement, and implementation. This structure was specifically used to illustrate the process and sequence of procedures for transceiver-site projects at Yemen Mobile, thus ensuring the achievement of the objectives of the study.

Following an initial literature review, the identified delay factors underwent a thorough validation process involving specialists and experts from the relevant departments and divisions within Yemen Mobile. This crucial step assessed the relevance of these factors to the actual phases and processes of implementing Yemen Mobile's transceiver-site projects.

As a result, this internal review allowed the elimination of irrelevant factors and the inclusion of delay factors directly related to work phases. This comprehensive process resulted in twenty-three directly relevant internal factors, as listed in Table 2. The questionnaire then underwent a final review by academic project management experts and was distributed subsequently.

## 3. METHODOLOGY

### 3.1. Research Design

The research design represents the integrated practical and methodological framework through which the applied aspect is studied, and the research objectives are achieved. These procedures include defining the study population and sample according to scientific criteria to ensure the generalizability of the results and clarify the methodology followed in the preparation, design, construction, and analysis of the items of the data collection instrument in a clear, accurate, and appropriate manner for the research objectives and sample characteristics.

### 3.2. Research Approach

This study utilized a mixed-methods approach that integrates both quantitative and qualitative data collection and analysis. Quantitative research aims to determine the numerical distribution of the phenomena and variables under study, thereby providing a measurable statistical perspective. By contrast, qualitative research focuses on producing in-depth narrative or textual descriptions of the studied phenomena, allowing for a deeper understanding of contexts and individual experiences [27]. The qualitative approach also contributes to exploring attitudes, behaviors, and experiences through tools, such as in-depth interviews, focus groups, and other appropriate methods [28].

This integrated approach aims to provide a comprehensive and in-depth description of the sequence of operations during the implementation of transceiver site projects at the Yemen Mobile Company, in addition to a comprehensive understanding of the factors causing schedule overruns in the implementation of these sites.

### 3.3. Data Collection

To achieve the research objectives, the primary data were represented by a questionnaire that was considered the main data collection instrument, directed to all employees working in various departments and sectors of Yemen Mobile Company working in transceiver site projects. Secondary data included a comprehensive

**Table 1.** Summary Of Internal Factors Causing Delay in Telecom Projects

| No. | Planning Factors | Reference |
|---|---|---|
| 1 | Inappropriate planning | (Alaghbari, et al. 2021) (Mohammed, 2016) (Bakhtiar, et al., 2019) |
| 2 | Poor subcontractor selection processes | (Danso & Antwi, 2012) |
| 3 | Slowdown in design preparation | (Bakhtiar, et al., 2019) |
| 4 | Lack of quality assurance/control | (Duru & Alhasweh, 2012) (Alaghbari, et al. 2021) (Mohammed, 2016) (Danso & Antwi, 2012) (Bakhtiar, et al., 2019) |
| 5 | Risk issues | (Mohammed, 2016) |
| 6 | Lack of control | (Duru & Alhasweh, 2012) (Alaghbari, et al. 2021) (Mohammed, 2016) (Danso & Antwi, 2012) (Bakhtiar, et al., 2019) |
| 7 | Centralization of decision-making process of client | (Danso & Antwi, 2012) |
| **No.** | **Procurement Factors** | **Reference** |
| 8 | Equipment delays | (Alaghbari, et al. 2021) (Mohammed, 2016) (Anaba, 2021) (Arista & Hariadi, 2023) (Khaled, et al., 2024) |
| 9 | Late delivery of project materials by suppliers | (Danso & Antwi, 2012) (Mwanaumo, et al., 2020) (Anaba, 2021) (Arista & Hariadi, 2023) (Bakhtiar, et al., 2019) |
| 10 | Procurement approval process | (Mohammed, 2016) (Alaghbari, et al. 2021) (Mwanaumo, et al., 2020) |
| 11 | Lack of tower materials in the local market | (Danso & Antwi, 2012) (Anaba, 2021) (Arista & Hariadi, 2023) (Khaled, et al., 2024) |
| 12 | Uncertain price | (Bakhtiar, et al., 2019) |
| 13 | Delay at customs | (Mohammed, 2016) (Alaghbari, et al. 2021) (Mwanaumo, et al., 2020) |
| 14 | Rigid processes and procedures | (Mwanaumo, et al., 2020) |
| 15 | Team members must be competent | (Arista & Hariadi, 2023) |
| **No.** | **Implementation Factors** | **Reference** |
| 16 | Major disputes/ negotiations on site | (Danso & Antwi, 2012) (Khaled, et al., 2024) |
| 17 | Unrealistic clients' requirements | (Danso & Antwi, 2012) (Anaba, 2021) (Bakhtiar, et al., 2019) |
| 18 | Delay in transportation to the site location | (Duru & Alhasweh, 2012) (Mohammed, 2016) (Alaghbari, et al. 2021) (Khaled, et al., 2024) |
| 19 | Inexperience tower construction engineers/technician | (Mohammed, 2016) (Alaghbari, et al. 2021) (Danso & Antwi, 2012) (Arista & Hariadi, 2023) (Bakhtiar, et al., 2019) |
| 20 | Delay in payment | (Danso & Antwi, 2012) (Anaba, 2021) (Bakhtiar, et al., 2019) |
| 21 | Late in revising and approving design documents | (Anaba, 2021) (Bakhtiar, et al., 2019) (Khaled, et al., 2024) |
| 22 | Documentation issues | (Mohammed, 2016) (Alaghbari, et al. 2021) (Anaba, 2021) (Arista & Hariadi, 2023) (Bakhtiar, et al., 2019) (Khaled, et al., 2024) |
| 23 | Improper installations | (Mohammed, 2016) (Alaghbari, et al. 2021) (Danso & Antwi, 2012) (Anaba, 2021) (Bakhtiar, et al., 2019) (Khaled, et al., 2024) |
| 24 | Poor site Management | (Anaba, 2021) (Arista & Hariadi, 2023) (Bakhtiar, et al., 2019) |
| 25 | Absence of efficient project progress tracking | (Danso & Antwi, 2012) |
| 26 | Site uplink is not ready | (Khaled, et al., 2024) |
| 27 | Damage during transportation | (Duru & Alhasweh, 2012) (Mohammed, 2016) |
| 28 | Contract modifications | (Danso & Antwi, 2012) (Anaba, 2021) |
| 29 | Delays in sub-contractor's work | (Anaba, 2021) (Bakhtiar, et al., 2019) |
| 30 | Financial difficulties faced by contractors | (Mohammed, 2016) (Alaghbari, et al. 2021) (Bakhtiar, et al., 2019) |
| 31 | Delay from the executing company | (Khaled, et al., 2024) |
| 32 | Inappropriate construction method | (Danso & Antwi, 2012) (Bakhtiar, et al., 2019) |
| 33 | Low productivity of labor | (Danso & Antwi, 2012) (Bakhtiar, et al., 2019) |
| 34 | Under estimate project duration | (Bakhtiar, et al., 2019) |

library of internal documents and data obtained from Yemen Mobile Company. These data were used to draw a detailed map and precise understanding of the procedural sequence adopted by the company regarding the implementation of transceiver sites. In addition, an in-depth review of relevant academic literature, including

**Table 2.** Internal Factors causing delay in Yemen Mobile Transceiver sits projects

| | | | |
|---|---|---|---|
| **Planning factors** | | | |
| 1 | Lack of comprehensive procurement planning. | 4 | Absence of project quality control plans |
| 2 | Ineffective strategy to address the challenges of sites acquisition | 5 | Lack of risk assessment mechanisms during implementation |
| 3 | Ineffective contractor selection standards | 6 | lack of monitoring and control plans. |
| **Procurement Factors** | | | |
| 7 | Lack of technical equipment (BTS, Genset, Batteries…) | 10 | Construction material shortages near project sites |
| 8 | Supplier-related delays in technical equipment delivery. | 11 | Unqualified technical equipment suppliers |
| 9 | Lengthy purchasing procedures | 12 | Tendering and purchasing staff capabilities |
| **Implementation Factors** | | | |
| 13 | Implementation start barriers | 19 | Incomplete technical documentation |
| 14 | Inadequate pre-bid site assessments | 20 | Delays in fiber optic network connection |
| 15 | Security-related material and equipment delays | 21 | Inefficient project management by contractors |
| 16 | Lack of qualified technical personnel among contractors | 22 | Lack of implementation of health and safety measures |
| 17 | Lack of advanced project management software. | 23 | Technical & construction errors during implementation |
| 18 | Delays in contractor payment disbursements | | |

master's theses, peer-reviewed scientific articles, and specialized books, was conducted with the aim of extracting valuable insights and information about previous studies related to schedule overruns in telecommunications site construction projects, whether in the Yemeni context or in other international contexts.

## 3.4. Population and Sampling:

The secondary data showed that the study sample size was 191 employees, which is the total number of employees working in various departments and sections directly involved in the implementation of transceiver site projects until the end of December 2024. These are those who work on implementing transceiver site projects at Yemen Mobile Company, starting from the planning stage through procurement and implementation to other related departments. This number includes various job levels within the company's organizational structure (specialists, team leaders, department heads, directors, and above).

Estimate the appropriate sample size from the limited study population using Richard Jaeger's formula in equation 1. This formula considers the population size, confidence level, acceptable error level, and coefficient of variation.

$$n = \frac{\left(\frac{z}{d}\right)^2 \times (p)^2}{1 + \frac{1}{N}\left[\left(\frac{z}{d}\right)^2 \times (p)^2 - 1\right]} \quad (1)$$

Where:

n: the required sample size

N: the population size = 191

z: the standard score corresponding to a 95% confidence level = 1.96

d: the acceptable error level at a 95% confidence level = 0.05

p: the coefficient of variation among the population units = 0.5

By applying the formula shown in Equation 2, the required sample size was determined to be 128 (127.79) employees, representing 67% of the total population size.

$$n = \frac{(1.96/0.05)^2 \times (0.5)^2}{1 + \frac{1}{191}\left[(1.96/0.05)^2 \times (0.5)^2 - 1\right]} \quad (2)$$

To gather data and achieve the necessary sample size, a comprehensive survey approach was employed using Google Forms, distributing the survey link (closed-ended questionnaire) to all 191 targeted employees. Based on the official approval from the Ministry of Communications and Information Technology, Yemen Mobile was directed to fully cooperate with the researcher and

provide the data required to complete the study. Additionally, a covering letter included in the questionnaire confirmed the researcher's commitment to using all the data exclusively for scientific research purposes and maintaining strict confidentiality. The researcher also shared the results of this study with Yemen Mobile Company. A total of 162 questionnaires were returned. Following a review, eight responses were excluded because they were from individuals outside the defined study population. Consequently, a final sample of 154 valid questionnaires were available for analysis, representing a response rate of 80.60%. This response rate is considered robust and suitable for statistical analysis, aligned with the guidelines established by Jaeger's formula and generally accepted scientific research standards.

## 3.5. Research Instrument

The questionnaire included a cover letter explaining the study's significance and comprising 23 items, which covered section one demographic information, section two including internal factors causing schedule delays in the implementation of Yemen Mobile's transceiver site projects, which were divided into three groups (procurement, planning, and implementation factors). The three groups of independent variables were the Planning Factors group (with six factors), Procurement Factors group (with six factors), and Implementation Factors group (with 11 factors). To ensure clarity and accessibility for all respondents, the questionnaire was translated from English into Arabic by a professional translator with careful attention to maintaining the relevance and meaning of the statements. The final copy of the questionnaire (English and Arabic versions) was revised by five academics from the field before it was approved for distribution.

Five-Likert scales and agreement measures were employed to gauge respondents' perceptions, ensuring a nuanced assessment of diverse dimensions. The answers in the first section were obtained by the appropriate choice of answers. In the second section, respondents were required to rate the factors on a Likert scale ranging from 1 (very low important/non-important) to 5 (very highly important). The RII was used to rank the internal factors causing schedule delays in the implementation of Yemen Mobile's transceiver site projects as perceived by respondents; thus, comparative analysis is possible.

The Relative Importance Index (RII) is a non-standard technique used by researchers in many studies, including construction management research, to analyze data from structured surveys that include classifying opinions or expressing relative differences in viewpoints [29]. Several previous studies, including, [23], [6], [5], and [9], have demonstrated their usefulness in classifying and comparing the intensity of factors based on survey participants' opinions. For example, studies investigating the factors or causes of delays and schedule overruns make the RII a suitable and effective tool for the analysis required in this study. The RII technique was used according to the following equation:

$$RII(\%) = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5(n_5 + n_4 + n_3 + n_2 + n_1)} \times 100$$

where n1, n2, n3, n4, and n5 are the numbers of respondents who selected (1) very low important/non-important, (2) low importance, (3) medium importance, (4) highly important, and (5) very highly important, respectively. The weighting assigned to each factor by the respondents ranged from one to five.

The questionnaire underwent rigorous validation and reliability testing involving experts in the Yemen Mobile Company evaluation and feedback from project management professionals. Table 3 shows that the Cronbach's alpha values demonstrate satisfactory reliability, ranging from 78.1% to 87%, with an average of 92.1%, ensuring the robustness of the measurement scales.

**Table 3.** Cronbach's Alpha.

| Factors Group | Number of factors | Cronbach's Alpha Coefficient $\alpha$ |
|---|---|---|
| Planning Factors | 6 | 0.825 |
| Procurement Factors | 6 | 0.781 |
| Implementation Factors | 11 | 0.870 |
| **All Internal Factors** | **23** | **0.921** |

## 3.6. Data analysis

The study employed the Statistical Package for the Social Sciences (SPSS)to analyze survey data and address the research questions. A 5-point Likert scale was used to gather respondents' opinions. Data analysis involved a frequency analysis to describe the demographic characteristics and profiles of the respondents. Descriptive analysis was used to measure the level of importance by answering the questions on a five-point Likert scale. Then, the factors causing schedule overrun were ranked based on the answers using the Relative Importance Index (RII). Correlation analysis was used to assess the linear association between various factor groups, including internal, organizational, and external factors. In addition, regression analysis was used to investigate the relationship between the seven groups of independent variables (social, environmental/natural, governmental, organizational, planning, procurement, and implementation) on the dependent variable (schedule overrun). Differences testing was used to determine whether statistically significant differences existed in the means of the study

**Table 4.** Demographic information obtained from the questionnaires

| Information | | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Female | 7 | 4.50% |
| | Male | 147 | 95.50% |
| **Age** | More than 50 Year | 12 | 7.80% |
| | 41–50 Year | 70 | 45.50% |
| | 30–40 Year | 71 | 46.10% |
| | Less Than 30 Year | 1 | 0.60% |
| **Educational Level** | PhD | 1 | 0.60% |
| | Master's | 33 | 21.40% |
| | Bachelor's | 115 | 74.70% |
| | Post-secondary diploma | 5 | 3.20% |
| **Job Position** | Administration Director | 6 | 3.90% |
| | Head of Department | 20 | 13.00% |
| | Team Leader | 24 | 15.60% |
| | Specialist | 104 | 67.50% |
| **Experience** | Less Than 5 Year | 4 | 2.60% |
| | 5–10 Year | 22 | 14.30% |
| | 11–15 Year | 58 | 37.70% |
| | More Than 16 Year | 70 | 45.50% |
| **Administration / Department** | Strategic planning and performance evaluation | 2 | 1.30% |
| | Technical Committee | 2 | 1.30% |
| | Corporate Affairs | 3 | 1.90% |
| | Internal Audit and Risk Management | 5 | 3.20% |
| | Network Engineering | 5 | 3.20% |
| | Network Operations Center (NOC) | 7 | 4.50% |
| | Corporate Services | 12 | 7.80% |
| | Network Planning and Optimization | 23 | 14.90% |
| | Project Implementation | 23 | 14.90% |
| | Procurement | 25 | 16.20% |
| | Network Operation and Maintenance | 47 | 30.50% |

variables across the different subgroups of respondents.

## 4. RESULTS AND DISCUSSION

### 4.1. Frequency analysis

Table 4 describes the demographic information obtained from the questionnaires. The study participants were predominantly male (95.5%) and ranged in age from 30 to 50 years (91.6%). The sample was highly educated, with 96.8% holding a bachelor's, master's, or doctoral degree. Professionally, the participants were experts in their fields, with 67.5% categorized as specialists. A significant majority (83.2%) had more than 11 years of professional experience.

A notable finding was that the study sample included both sexes. The low percentage of females (4.5%) is attributed to the limited number of women working in the technical departments responsible for project implementation, including Yemen Mobile's transceiver site projects. This significant disparity is due to the physically demanding and field-based nature of the projects. They also require constant travel between different locations across Yemen's governorates and the potential to encounter harsh conditions in diverse geographical areas, including mountainous and desert regions. These conditions pose a particular challenge for women, especially given the ongoing security instability in the country as well as prevailing cultural factors in Yemeni society that may limit women's participation in this type of fieldwork at project sites. The diverse representation and participation of various operational departments involved in implementing major projects ensures a comprehensive and varied range of perspectives. The results also showed that approximately three-quarters of the study sample held a bachelor's degree, and most were engineers specializing in this type of project with more than 11 years of

**Table 5.** Descriptive Analysis of Internal Factors Groups Causing Schedule Delays

| Rank | Factors Group | Mean | SD | RII | Importance |
|---|---|---|---|---|---|
| 1 | Procurement Factors (6) | 4.28 | 0.56 | 86% | Very effective |
| 2 | Planning Factors (6) | 4.01 | 0.64 | 80% | Effective |
| 3 | Implementation Factors (11) | 4 | 0.59 | 80% | Effective |
| **All Internal Factors (23 factors)** | | **4.08** | **0.52** | **82%** | **Effective** |

experience. Overall, the high level of education and extensive professional experience of the research sample enhanced the reliability and credibility of the study's findings.

## 4.2. Descriptive Analysis

The internal factors were classified into three groups: planning factors (five factors), procurement factors (six factors), and implementation factors (11 factors), with a detailed descriptive analysis for each group to be presented in the following sections.

Table 5 provides an overview of the impact of the different internal factor groups on schedule overruns.

All Internal factor groups, which included (23 factors) had a Relative Importance Index (RII) of 82%). Among all categories, procurement factors were the most influential cause of schedule overruns in Yemen Mobile's transceiver site projects, which had the highest RII at 86%, while planning and implementation factors were both considered effective, with an identical RII of 80%.

### *4.2.1. Planning Factors Causing Schedule Delays:*

The planning factors are presented in Table 6. The most significant planning factor was the lack of comprehensive procurement planning, with an RII of 88%. Ineffective strategies to address the challenges of site acquisition" and the lack of monitoring and control plans," with RIIs of 82% and 80%, respectively. The factors "Lack of risk assessment mechanisms during implementation"," ineffective contractor selection standards, and "ineffective contractor selection standards" had a lower effect on the project schedule with the same RII of 77%. The planning factor group, as a whole, had an RII of 80%.

### *4.2.2. Procurement Factors Causing Schedule Delays*

Table 7 presents the ranking of procurement factors. "Lack of technical equipment" received an exceptionally high RII of 95%. Other highly important factors included "Supplier-related delays in technical equipment delivery" (RII of 94%) and "Lengthy purchasing procedures" (RII of 92%). Followed by "Unqualified technical equipment suppliers" and "Tendering and purchasing staff capabilities" with RII of 83% and 78% respectively. "Construction material shortages near project sites" received the lowest RII in this group, at 71%. The procurement factor group has a very high RII of 86%.

### *4.2.3. Implementation Factors Causing Schedule Delays*

Table 8 presents the implementation factors. "Delays in fiber optic network connection" and "Security-related material and equipment delays" were identified as having the highest importance, with RIIs of 91% and 90%, respectively. "Implementation start barriers," "Delays in contractor payment disbursements" and "Lack of advanced project management software" with RIIs of 81%,80%, and 80%, respectively. Followed by "Technical and construction errors during the implementation," "Lack of qualified technical personnel among contractors," "Inefficient project management by contractors" and "Inadequate pre-bid site assessments" with RIIs of 79%,79%, 78%, and 77%, respectively.

The factors with the lowest RIIs were "Incomplete technical documentation" and "Lack of implementation of health and safety measures" at 71%. The implementation factor group had an overall RII score of 80%.

### *4.2.4. Top Ten Internal Factors Causing Schedule Delays*

The top ten internal factors significantly influence the project and cause schedule delays in Yemen Mobile's telecom transceiver site projects, as outlined in Table 9, by their Relative Importance Index (RII).

The most significant procurement factor is the lack of technical equipment (BTS, Genset, Batteries, etc.) with a relative importance index (RII of 95%). This underscores a severe and persistent shortage of crucial resources, a finding corroborated by studies from Ghana [9], [23], [30], [19] [18], all of which cite equipment shortages as a primary cause of telecom project delays.

Supplier-related delays in technical equipment delivery (RII of 94%) and lengthy purchasing procedures (RII of 92%) have emerged as highly influential factors. These findings are consistent with research from Zambia [8] [30], which also highlighted the impact of lengthy procurement processes on project timelines. Supplier-related delays in equipment delivery have been

**Table 6.** Ranking of Planning Factors Causing Schedule Delays

| Rank | Factors | Mean | SD | RII | Importance |
|---|---|---|---|---|---|
| 1 | Lack of comprehensive procurement planning | 4.4 | 0.73 | 88% | Very high |
| 2 | Ineffective strategy to address the challenges of sites acquisition | 4.09 | 0.78 | 82% | High |
| 3 | lack of monitoring and control plans | 4.02 | 0.92 | 80% | High |
| 4 | Lack of risk assessment mechanisms during implementation | 3.85 | 0.91 | 77% | High |
| 5 | Ineffective contractor selection standards | 3.85 | 0.91 | 77% | High |
| 6 | Absence of project quality control plans | 3.83 | 0.97 | 77% | High |
| **All Planning Factors** | | **4.01** | **0.64** | **80%** | **High** |

**Table 7.** Ranking of Procurement Factors Causing Schedule Delays

| Rank | Factors | Mean | SD | RII | Importance |
|---|---|---|---|---|---|
| 1 | Lack of technical equipment (BTS, Genset, Batteries...) | 4.73 | 0.59 | 95% | Very high |
| 2 | Supplier-related delays in technical equipment delivery | 4.69 | 0.63 | 94% | Very high |
| 3 | Lengthy purchasing procedures | 4.61 | 0.64 | 92% | Very high |
| 4 | Unqualified technical equipment suppliers | 4.15 | 0.92 | 83% | High |
| 5 | Tendering and purchasing staff capabilities | 3.92 | 0.91 | 78% | High |
| 6 | Construction material shortages near project sites | 3.56 | 1.08 | 71% | High |
| **All Procurement Factors** | | **4.28** | **0.56** | **86%** | **Very high** |

a recurring issue, as evidenced by studies in Zambia [8][19][18]. Additionally, the presence of unqualified technical equipment suppliers (RII of 83%) stemming from inadequate quality selection standards further contributes to these procurement delays. Planning factors also significantly contribute to schedule overruns in Yemen Mobile's transceiver-site projects. Within the internal factors group, these groups had a relative importance index (RII of 80%), making their impact considerable. The most significant planning factor is the lack of comprehensive procurement planning (RII of 88%), indicating a critical weakness in the early stages of projects, leading to delayed material orders, supply chain issues, and delayed transceiver site project implementation. Previous studies, such as [30] those in Ghana, have confirmed that poor planning delays the implementation of telecommunication projects, while improved project planning and scheduling are not among the most significant factors delaying the construction of telecom towers [9] in Ghana.

The ineffective strategy to address the challenges of site acquisition (RII of 82%) and the lack of monitoring and control plans (RII of 80%) also significantly contributed to delays. This study agrees with a study by [9] Ghana, which concluded that weak monitoring and control is one of the most important factors that delay the construction of telecommunications towers. This was also demonstrated by a study by [24], which found that weak planning and control delays the implementation of telecommunication projects. implementation factors significantly contribute to schedule overruns in Yemen Mobile's transceiver-site projects. Within the internal factors group, these groups had a Relative Importance Index (RII of 80%), making their impact considerable. The most significant implementation factors were delays in the fiber-optic network connection (RII of 91%). This means that the process of connecting the fiber-optic network to the site after construction is extremely slow, and even if the physical site is ready, without fiber, the transceiver site cannot begin operating. This significantly contributes to delays in the launch of telecommunication services. This finding aligns with [31] that in Indonesia, which highlighted that securing the necessary permits and addressing community resistance during installation and excavation contribute to fiber optic network connection delays. It is noteworthy that previous studies of [18] and [19] did not include fiber optic network connections

**Table 8.** Ranking of Implementation Factors Causing Schedule Delays

| Rank | Factors | Mean | SD | RII | Importance |
|---|---|---|---|---|---|
| 1 | Delays in fiber optic network connection | 4.53 | 0.66 | 91% | Very high |
| 2 | security-related material and equipment delays to the project site | 4.49 | 0.66 | 90% | Very high |
| 3 | Implementation start barriers | 4.03 | 0.84 | 81% | High |
| 4 | Delays in contractor payment disbursements | 4.00 | 0.81 | 80% | High |
| 5 | Lack of advanced project management software | 3.98 | 0.87 | 80% | High |
| 6 | Technical and construction errors during the implementation | 3.97 | 0.91 | 79% | High |
| 7 | Lack of qualified technical personnel among contractors | 3.97 | 0.99 | 79% | High |
| 8 | Inefficient project management by contractors | 3.92 | 0.89 | 78% | High |
| 9 | Inadequate pre-bid site assessments | 3.84 | 1.02 | 77% | High |
| 10 | Incomplete technical documentation | 3.76 | 1.04 | 75% | High |
| 11 | Lack of implementation of health and safety measures | 3.56 | 1.04 | 71% | High |
| **All Implementation Factors** | | **4.00** | **0.59** | **80%** | **High** |

**Table 9.** The Top Ten Internal Factors Causing Schedule Delays

| Rank | Factors | Mean | SD | RII | Importance | Factors Group |
|---|---|---|---|---|---|---|
| 1 | Lack of technical equipment (BTS, Genset, Batteries. . . ). | 4.73 | 0.59 | 95% | V. High | Procurement |
| 2 | Supplier-related delays in technical equipment delivery. | 4.69 | 0.63 | 94% | V. High | Procurement |
| 3 | Lengthy purchasing procedures. | 4.61 | 0.64 | 92% | V. High | Procurement |
| 4 | Delays in fiber optic network connection. | 4.53 | 0.66 | 91% | V. High | Implementation |
| 5 | Security-related material and equipment delays to the project site | 4.49 | 0.66 | 90% | V. High | Implementation |
| 6 | Lack of comprehensive procurement planning. | 4.40 | 0.73 | 88% | V. High | Planning |
| 7 | Unqualified technical equipment suppliers. | 4.15 | 0.92 | 83% | High | Procurement |
| 8 | Ineffective strategy to address the challenges of sites acquisition. | 4.09 | 0.78 | 82% | High | Planning |
| 9 | Implementation start barriers. | 4.03 | 0.84 | 81% | High | Implementation |
| 10 | lack of monitoring and control plans. | 4.02 | 0.92 | 80% | High | Planning |

as a factor, likely because of the MTN's reliance on microwave links for transmission between transceiver sites.

Another highly influential factor is the security-related material and equipment delays (RII = 90%). This underscores the direct impact of the prevailing security situation on the logistics of delivering essential items to the project sites. Such delays invariably lead to work stoppages, prolonged construction phases, costly downtime for labor and machinery, and consistent findings in studies [18], [19], and [30] in Ghana.

To a lesser extent, implementation start barriers (RII of 81%) also contribute to delays, primarily due to initial societal biases and resistance to the installation of telecommunication equipment. This societal impact was similarly noted by and in studies conducted in Ghana [30][9].

The findings generally indicate that delays in transceiver site projects stem from structural and strategic planning deficiencies and not merely procedural errors. These issues underscore the urgent need for a strategic shift in project management to align itself with the complex Yemeni environment. Key challenges include the lack of comprehensive procurement planning, ineffective strategies for addressing site acquisition challenges, and weak monitoring and control plans, all of which underlie most project delays.

**Table 10.** Pearson's Correlation Coefficient

| Factors | Planning Factors | | Procurement Factors | | Implementation Factors | |
|---|---|---|---|---|---|---|
| | R | Sig. | R | Sig. | R | Sig. |
| Planning Factors | – | – | 0.600 | 0.000 | 0.668 | 0.000 |
| Procurement Factors | 0.600 | 0.000 | – | – | 0.659 | 0.000 |
| Implementation Factors | 0.668 | 0.000 | 0.659 | 0.000 | – | – |

Procurement problems, such as equipment shortages and supplier delays, have emerged as the most significant contributing factors, directly attributable to the absence of comprehensive and proactive planning. Treating equipment requests reactively, rather than proactively, places Yemen Mobile Company under constant time pressure. This deficiency is exacerbated by external constraints imposed against Yemen, such as supply restrictions on telecom equipment and compliance with tendering regulations, where even minor delays from suppliers or legal procedures can have a disastrous impact on the project schedule.

However, delays during the implementation phase are caused by diverse and complex challenges. First, the delay in delivering the fiber-optic network is a structural challenge beyond the company's control, stemming from its institutional dependence on the Public Telecommunications Corporation. This creates an operational bottleneck, which is difficult to mitigate. Second, delays in material delivery owing to security reasons and implementation obstacles indicate an ineffective internal strategy for addressing site acquisition challenges. This deficiency arises from the absence of a comprehensive risk management plan that extends beyond traditional security considerations to include societal and cultural risks, such as the community acceptance of projects, which reduces network coverage.

Finally, the problem is exacerbated by a lack of organizational learning. This absence is manifested in the lack of a systematic mechanism for documenting and evaluating recurring problems that occur during the contracting and acquisition processes. This failure to learn from past experiences prevents management from developing effective solutions and remedies for recurring problems, perpetuating the impact of past mistakes and hindering the company's timelines and expansion capabilities.

## 4.3. Correlation Analysis

Table 10 shows the Pearson's Correlation Coefficient, which indicates a positive correlation between planning and procurement factors ($r=0.600$, $p<0.05$), positive correlation between planning and implementation factors ($r=0.668$, $p<0.05$). and positive and a significant correlation between procurement and implementation factors ($r=0.659$, $p<0.05$).

This suggests that changes in one group were highly associated with similar changes in the other.

## 4.4. Regression Analysis

The regression analysis in Table 11 shows that the model has a high explanatory power, with an R-squared value of 0.850. This means that the variables in the model account for approximately 85% of the variance in the schedule overruns. The results highlight the robust relationship between predictor variables (planning, procurement, and implementation).

**Table 11.** Model Summary

| Model | R | $R^2$ | $R^2$ (Adjusted) | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.924 | 0.853 | 0.850 | 0.178 |

Further analysis Table 12 presents multiple linear regression to test the relationship between the three groups of independent variables–planning, procurement, and implementation–on the dependent variable project schedule, which causes delays in Yemen Mobile's transceiver site projects. The results indicate that all independent variables demonstrate a statistically significant relationship with project delay.

## 4.5. Differencing Test

Based on demographic characteristics, a two-way analysis of variance (t-test) was used for variables with two categories, while a one-way analysis of variance (ANOVA) was used for variables with three or more categories to assess significant differences in responses.

The analysis found that gender, age, education level, job position, and level of experience did not significantly influence the perceptions of internal factors (planning, procurement, and implementation factors).

Statistically significant differences in perceptions were found across various administrations/departments for all the three factor categories. One-way analysis of variance (ANOVA) revealed significant differences in planning factors ($F=2.136$, $P=0.025$) and implementation factors ($F=3.033$, $P=0.002$). These differences are likely due to the diverse tasks and responsibilities inherent in

**Table 12.** Model Coefficients

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | 0.750 | 0.117 | | 6.408 | 0.000 |
| Planning Factors | 0.112 | 0.032 | 0.154 | 3.513 | 0.001 |
| Procurement Factors | 0.162 | 0.035 | 0.198 | 4.559 | 0.000 |
| Implementation Factors | 0.520 | 0.037 | 0.665 | 14.245 | 0.000 |

[a] Dependent variable is (project schedule).

the departments involved in the project's implementation.

## 5. CONCLUSION AND RECOMMENDATION

This study presents a detailed investigation of the internal factors causing schedule delays in Yemen Mobile's transceiver site projects. Through a structured quantitative approach and statistical analysis, this study identified and ranked the most influential internal variables affecting project timelines, offering practical insights for project managers and policymakers operating in complex infrastructure environments.

The demographic profile of the respondents reflected a highly experienced and academically qualified workforce. The majority were between the ages of 30 and 50 (91.6%), with 96.8% holding university degrees, and 83.2% possessing over 11 years of professional experience. This demographic composition underscores the credibility and depth of the perspectives captured in the study as they stem from seasoned professionals with substantial field exposure.

Internal factors were categorized into three primary groups aligned with the project phases: procurement, planning, and implementation. Among these, procurement-related issues emerged as the most critical cause of schedule delays, consistently registering the highest Relative Importance Index (RII). Key procurement challenges include the unavailability of essential technical equipment (such as BTS units, generators, and batteries), supplier-related delays, lengthy purchasing procedures, and involvement of unqualified vendors. These issues significantly disrupt project timelines and resource flows.

Planning-related factors also had a high impact, particularly the lack of comprehensive procurement planning and ineffective strategies for site acquisition. These deficiencies hinder early stage coordination and contribute to cascading delays. Implementation factors, including delays in fiber optic network connections, security-related disruptions in material delivery, and barriers to initiating execution phases, further exacerbate schedule overruns.

The study also ranked the project implementation stages based on their impact on delays. The fiber optic network connection phase was identified as the most delay-prone, followed closely by procurement, site acquisition, construction and installation, and finally planning and handover. Each stage exhibited a high degree of vulnerability to both technical and administrative disruptions.

Statistical analysis confirmed significant positive correlations among all internal factors, which were strongly associated with scheduled overruns ($p = 0.000$). While demographic variables such as gender, age, education, and experience did not yield significant differences in perception, notable variations were observed across administrative departments, highlighting the influence of organizational context on stakeholder perspectives.

The study concludes by emphasizing the need for targeted interventions including improved procurement planning, streamlined supplier management, and enhanced interdepartmental coordination. Based on the findings, the following recommendations were proposed to contribute to reducing the causes of delays in transceiver site projects of Yemen Mobile and other telecommunications companies in Yemen:

**1.** Align detailed procurement plans with project schedules to prevent delays and support Yemen Mobile Co's strategic goals.

**2.** Conduct a comprehensive review of existing purchasing procedures and adopt a real-time tracking system for the purchasing process to help reduce processing times and improve oversight.

**3.** Reduce reliance on single suppliers by diversifying and pre-qualifying reliable suppliers to ensure timely equipment delivery.

**4.** Plan fiber optic connectivity early and use temporary microwave links when needed.

**5.** Engage local communities to reduce security risks and facilitate site access to resolve barriers to implementation.

**6.** Assess social/legal risks in sites selection and consider alternative nearby locations.

**7.** Implement an advanced project management software to monitor progress and control deviations from the plan

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