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# Mobile Technology for Improving Project Management in the Construction Industry - Philippine Setting

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## Abstract

The construction industry, a vital component of national development, has faced increasing complexity and demands, necessitating adept project management. Despite a historical resistance to digitization, the sector is undergoing a transformation, catalyzed by global events such as the COVID-19 pandemic. This shift toward progressive digitization aligns with the construction industry's need for innovative solutions to address challenges like workforce shortages and supply chain disruptions. This study introduces mobile technology in enhancing project management within the Philippine construction setting. Leveraging insights from industry experts, it investigates the impact of mobile communications and social networks on transforming communication and collaboration dynamics. As the industry embraces digitization, mobile platforms emerge as a crucial tool for efficient project delivery, especially in times of crisis. The mobile platform application is tailored to meet the unique demands of the construction industry, encompassing functionalities such as tracking construction teams, schedules, equipment, materials, and finances, and facilitating file-sharing. The implementation of this mobile system contributes to collaborative communication among engineers, contractors, project managers, and owners. The research findings, synthesized from this analysis, provide insights into the system's effectiveness as a comprehensive management platform in the construction industry. Finally, the paper outlines the development of a mobile solution specifically tailored to address challenges prevalent in Region 4A, Philippines, offering a potential resolution to some of the industry's critical issues and pressures.

## Keywords

Agile Software Development, mobile platform, construction industry, project management, and Quality-in-Use Validation

## 1. Introduction

Effective project management is paramount for the successful completion of construction projects, ensuring delivery to clients on time, within budget, and with profitable outcomes. Kendall Jones (2022) emphasizes the necessity for careful planning, meticulous progress monitoring, and robust communication and collaboration among stakeholders in the construction process.

In recent years, construction projects have assumed a pivotal role in national development, growing both in scale and technical complexity. Increased client demands, stringent government regulations, and a rising public aspiration for an enhanced quality of life necessitate robust project management strategies, particularly for large and intricate projects. Recognizing the significance of interrelations among involved parties and communication methods, Mohamad Syazli Fathi, Norshakila Rawai, and Mohammad Abedi (2012) highlight the transformative impact of mobile communications and social networks on communication within the construction industry.

Despite a cultural shift towards digitization, the construction industry has been slow to embrace technological advancements. The pandemic, however, has accelerated the need for online operations, creating both challenges and opportunities for the industry (van Schendel, 2020). In this context, the researcher focuses on digital transformation in construction management, aiming to address project delays caused by workforce and supply shortages during the pandemic. It is timely that project managers have been striving to deliver projects significantly affected by this pandemic in the construction industry. The consequences are project delays caused by a shortage of workforce and goods due to travel and movement restrictions. The researcher is looking to digital transformation in construction management to provide answers to manage on time and budget while meeting quality and safety standards. The mobile platform provides the project team with a vehicle to efficiently deliver projects.

The motivation behind this research stems from the crucial need to bridge the gap between traditional construction practices and the evolving landscape of digital technologies. The construction industry, often perceived as resistant to change, is confronted with challenges that can no longer be effectively addressed through conventional methods. The motivation is rooted in the understanding that embracing digital solutions, particularly in project management, can enhance efficiency, reduce delays, and elevate overall project outcomes.

The construction industry, despite recognizing the impending influence of digitization, lags in the adoption of advanced digital tools and practices. Before the COVID-19 crisis, a significant percentage of construction companies acknowledged the imminent impact of digitization, yet only a fraction fully utilized digital planning tools (van Schendel, 2020). This gap between awareness and implementation poses a critical problem, hindering the industry's ability to adapt to the evolving demands of modern construction projects.

The current global situation, exacerbated by the COVID-19 pandemic, has underscored the vulnerabilities of traditional construction practices. Workforce and supply shortages have led to project delays, prompting the exploration of innovative solutions to manage projects on time and within budget while maintaining high standards of quality and safety. The motivation, therefore, is to explore how digital transformation, specifically through mobile platforms, can catalyze overcoming these challenges and reshaping the construction industry's operational landscape.

Smartphones are getting into the construction industry with innovative solutions for all related professionals to provide solutions and mobility to the go-to construction workers and management. Mobile cloud solutions are growing increasingly important in the building trade. Studies show that communication occupies 90% of construction project managers' time. When problems arise – if different players don't have the same information or can't access the data, for instance – the entire process can quickly grind to a halt. Most building firms still use project management programs as things are installed on desktop PCs. Yet cloud-based and mobile solutions have the tremendous advantage of being available wherever you happen to be working. Again, it becomes apparent how much sense it makes to work on-site with mobile devices Roland Berger (2016).

In an article by LetsBuild (2019), across every aspect of a construction project, there are now mobile applications to help. Pre-construction or scheduling, project management, field reporting, and back-office jobs. These things can run more smoothly and efficiently, helped by mobile technology. Mobile apps have changed the project, asset, and time management game. The smartphones we carry are more potent than all the computers used in the moon missions of the 1970s. Impressive computational power aside, the real party trick of the smartphone is its ability to instantly

connect data with the internet. The same technology we use to share cat pictures with our friends also allows us to track resources in real time from anywhere EZofficeinventory (2017). For construction professionals, adopting mobile technology into their workflows makes perfect sense. You are always between the office, the job sites, meetings with stakeholders, and pre-bid conferences. Having the ability to access the tools and information to get the job done from wherever you are is critical (Kendall Jones, 2018).

In light of these challenges, the need for a comprehensive exploration of the role of mobile technology in construction project management becomes evident. The research seeks to address these problems by examining the potential of mobile platforms to revolutionize communication, enhance collaboration, and ultimately improve the efficiency and effectiveness of construction project management practices. Construction project management software is an application or platform that provides tools for project managers, project owners, and contractors to plan, manage, control, and analyze their construction projects. Standard features include job costing, bid management, project scheduling, tracking, accounting, document management, and collaboration. Construction project management software benefits include streamlining operations that allow you to scale your business, operate more efficiently, make more accurate estimates, easily manage shared files, and complete more jobs on time and within budget Sarah Tolle (2022).

### 1.1 Objectives

The study aims to create a construction project management system mobile application, serving a specific purpose in efficiently delivering projects, and laying the foundation for versatile tools applicable in both professional and personal contexts within the construction industry, specifically aiming to:

1. Identify the management practices of the construction industry in terms of Project initiation, Project planning, Project execution, and Project closure.
2. Evaluate the performance of the mobile technology in enhancing project management within the Philippine construction setting user's acceptability using ISO 25010.
3. Evaluate and assess the impact of mobile technology on project performance, cost, and schedule.

## 2. Literature Review

### 2.1 Overview of project management in the construction industry

This section addresses the findings from the Mobile Platform for Project Management System in the Construction Industry. The feature of the mobile platform is through the perception of the challenges and experiences of the construction industry stakeholders. It is necessary to help the organizations achieve efficiency and cost savings.

Project management is a professional service to assist the owner or the investor and their architect and engineering staff in managing the design and construction of the project Nowak, Pawel, and Andrew Price (2017). Throughout human history, project management has always been practiced informally. Still, it emerged as a distinct profession in the mid-20th century when a group of forward-thinking individuals from the aerospace, engineering, pharmaceutical, and telecommunications fields realized a changing world needed new tools. Motivated by the need to address the scheduling and resource issues associated with increasingly complex projects, they met to begin to set down and standardize the tools for a new profession PMI. In an article, Proofhub, Vartika Kashya states that project management is taking projects' success to a new level, and he projects management tools & software are the way to natural progression.

Project management tools are helpful software pieces that aid project managers and their teams plan, organizing, and managing their tasks efficiently. They help individuals meet their deadlines and produce fantastic work in the end. These tools come in a broad range of shapes and sizes, and their relevant software can be accessed by Allison Lynch (2022).

There is a project management tool available in the market. Lily Ugbaja (2022) finding the best project management tool for your business can be daunting. There are at least a dozen options to choose from. It doesn't help that many project management tools have similar features and purposes. Although many project management solutions have wide-reaching features, one tool might not fulfill all your needs or fix every issue.

Newbold (2018) highlighted that construction projects are characteristically complex, requiring careful planning and execution, effective communication, and coordination among stakeholders to deliver completed projects on schedule, within budget, and to the satisfaction of the owner. Project management techniques such as critical path method (CPM) and earned value management (EVM) have been commonly used to estimate costs, monitor progress, and manage risks in construction projects (Lopes and Moretti, 2017).

However, the traditional paper-based systems of project management in the construction industry have become outdated with the advent of new technologies. Mobile technology has increasingly been adopted in construction project management to enhance performance and productivity. Through smartphones and tablets, stakeholders can stay connected, share information, and access real-time data for informed decision-making and performance tracking (Eadie et al., 2013).

Recent studies have highlighted the potential benefits of mobile technology in construction project management, including reduction in project completion time and cost, increased accuracy in information sharing, improved collaboration among stakeholders, and enhanced safety management (Shaout et al., 2020; Zhou et al., 2020). Nevertheless, challenges such as the cost of technology adoption, inadequate digital literacy among stakeholders, and resistance to change have been identified as barriers to the successful implementation of mobile technology in construction project management (Sampaio et al., 2018)

## 2.2 Importance of mobile technology in project management

In an article on project management, Delos Santos et al. (2021) identify the essential features to consider when picking a system. He explained that effective construction project management relies on key features ensuring smooth operations and successful project completion. Real-time updates provide stakeholders with crucial information, aiding accurate project completion estimations and facilitating efficient monitoring for better decision-making. A robust reporting tool enhances communication among stakeholders, streamlining task management through a centralized platform.

Unlimited accessibility is vital, allowing participants to connect regardless of location, and enabling prompt issue reporting through mobile access. Data security, adhering to standard protocols, and employing bank-level measures, ensures the safety of stored and transmitted project-related information.

Effective file-sharing features are essential, providing a secure, centralized point and notifications for modified files. Responsive 24/7 support with skilled staff tailored to construction industry needs addresses software-related issues. Issue tracking and Gantt charts for visual project timelines aid in documentation, follow-ups, scheduling, and planning.

Consideration of deployment options, such as Software as a Service (SaaS) or on-premises solutions, is crucial, in offering systematic approaches to project management. Collectively, these features contribute to the efficiency, security, and overall success of construction project management.

In the construction industry, the use of mobile devices at various stages of a construction project is on the upswing. In the construction industry, having accurate information on the fly is essential to make critical decisions on time and eventually compete in the industry. Construction is witnessing efficient and effective use of mobile devices for personnel on construction site. It is increasingly clear that mobile devices are here to stay in the construction industry because of their ability to improve communication and productivity Anoop Sattineni et al. (2015).

## 2.3 Effectiveness of mobile technology in project management

In contrast to standard mobile phones, "smartphones" are powerful computing devices offering traditional wireless voice service as well as native software applications and, perhaps most importantly, the ability to connect to and run a myriad of Internet-based services, including email, geo-location, streaming video, and social networking, while providing a good user experience (Martin Kenney and Bryan Pon, 2011).

Communication through phones is essential for contractors. It should be equipped to snap pictures, record videos, make annotations, upload data, make calls and receive texts as part of the job. Smartphone has a vast potential in the construction industry built with innovative techniques to improve productivity and efficiency in project implementation. According to Gurjot Bhatia (2020), new technologies in construction are being developed; and what

seemed like future tech 10-20 years ago—connected equipment and tools, telematics, mobile apps, autonomous heavy equipment, drones, robots, augmented and virtual reality, and 3D printed buildings—are here, being deployed and used on job sites across the world. It is also expected that there will be more extensive use of technology in construction and construction management in the future as companies realize the long-term efficiency and cost savings of such techniques.

Another article Infragistics, Mobile Man (2015), states that mobility is the number one technology trend construction companies focus on in 2015 and beyond. Three key factors drive the demand for mobile technology in the workplace: executive demand, an increasingly mobile workforce, and the growing need for real-time information, as found in IDG Research Services. In another survey by Sage Software with over 600 construction professionals from small and midsized firms, 33% feel the need to improve communication and collaboration, 32% want to streamline processes, and over 80% think that mobile technology is a high or moderate priority.

## 3. Methods

The research methodology employed in this study aims to comprehensively describe past practices and challenges within the construction industry and develop a construction project management mobile system. A quantitative research design is chosen, providing a structured framework for collecting and analyzing numerical data to rigorously examine existing practices and challenges. The developmental research method, depicted in Figure 1 through fishbone analysis, identifies causes of problems and validates problems comprehensively, allowing for adaptability to changing requirements and continuous feedback. The study utilizes a descriptive research method with a survey questionnaire to gather data, evaluating the system's validity in the user's perspective. The research unfolds in Region IVA, Philippines (CALABARZON), a strategic hub for off-site construction projects, focusing on 232 San Juan, Calamba City, Laguna. The respondents, limited to contractors, sub-contractors, project managers, and field and office engineers in Calabarzon, evaluate the software based on their knowledge of mobile applications and essential features. The questionnaire covers management practices, ISO 25010 system features, assessments user's evaluations and end-users, ensuring a robust investigation into construction industry practices.

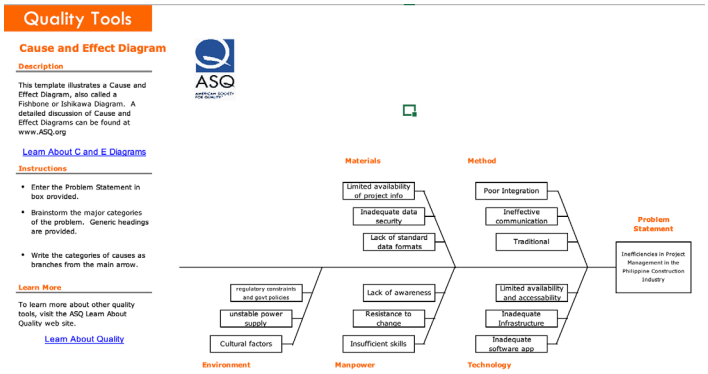


Figure 1. Fishbone Analysis for Problem Validation

In this study, a primary research instrument was a comprehensive questionnaire aimed at extracting insights from construction industry professionals. Divided into four parts, it covered management practices, system features under ISO 25010, assessment of IT professionals and evaluation of end-users, particularly engineers. Validity was ensured by pilot-testing the questionnaire with respondents not included in the study, focusing on the NCR area. Internal consistency of responses was gauged using Cronbach's Alpha as shown in Table 1, with a higher score indicating greater reliability. This methodological approach ensures a robust investigation into construction management practices, guided by standardized criteria and reliability measures.

Table 1. Internal Consistency of Cronbach's Alpha (Gliem and Gliem, 2003)

| Cronbach's Alpha, $\boldsymbol{\alpha}$ | Internal Consistency |
|---|---|
| $\alpha \geq 0.8$ | Excellent |
| $0.8 > \alpha \geq 0.7$ | Good |
| $0.7 > \alpha \geq 0.5$ | Satisfactory |
| $\alpha < 0.5$ | Poor |

## 4. Data Collection

The data collection procedures for this research were meticulously organized into three phases to address specific challenges related to project management software in the Philippine construction industry. The Exploratory Phase focused on gaining a comprehensive understanding of existing issues through two-stage data collection involving focus groups, online surveys, and phone interviews. The Design and Development Phase leveraged insights from the exploratory phase to create a mobile solution, involving IT experts in designing interfaces aligned with practitioners' needs. The Field Usability and Evaluation Phase aimed to reveal companies' experiences with mobile technology, using a survey rooted in the ISO/IEC 25010 standard. Data collected underwent statistical treatment using Frequency, Weighted Mean, and Average Weighted Mean. Ethical concerns were addressed by adhering to principles like obtaining informed consent, ensuring privacy, and acknowledging works of other authors.

In the context of sample size determination, Slovin's Formula serves as a valuable tool for striking a balance between surveying an entire population and working with a representative subset. This systematic approach incorporates factors such as total population size and an acceptable margin of error, ensuring a methodical and data-driven sampling process. Slovin's Formula stands as a crucial element for researchers aiming to achieve statistically sound and reliable research outcomes, reinforcing the reliability and applicability of research findings to the broader population of interest.

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

Where:
n is the sample size.
N is the total population size.
e is the margin of error.

Table 2: Responses and Descriptor for ISO/IEC 25010

| **Criterion** | **Response** | | | |
|---|---|---|---|---|
| | **4** | **3** | **2** | **1** |
| | **Descriptors** | | | |
| 1. Functional Suitability | Highly Functional (HF) | Functional (F) | Needs Improvement (NI) | Poor (P) |
| 2. Performance Efficiency | Highly Efficient (HE) | Efficient (E) | Needs Improvement (NI) | Poor (P) |
| 3. Compatibility | Highly Compatible (HC) | Compatible (C) | Needs Improvement (NI) | Poor (P) |
| 4. Usability | Highly Usable | Usable (U) | Needs Improvement (NI) | Poor (P) |
| 5. Reliability | Highly Reliable (HR) | Reliable (R) | Needs Improvement (NI) | Poor (P) |
| 6. Security | Highly Secured (HS) | Secured (S) | Needs Improvement (NI) | Poor (P) |
| 7. Maintainability | Highly Maintainable (HM) | Maintainable (M) | Needs Improvement (NI) | Poor (P) |
| 8. Portability | Highly Portable (HP) | Portable (M) | Needs Improvement (NI) | Poor (P) |
| **Interpretation** | 3.26 – 4.00 | 2.51 – 3.25 | 1.76– 2.50 | 1.00 – 1.75 |

Table 2 shows s a standard that defines a set of quality characteristics and criteria for evaluating the quality of software products. These characteristics are grouped into eight categories, and each category has associated criteria for assessing the software's performance. The assessment is done on a scale of 1 to 4, with each level corresponding to a specific descriptor. The descriptors for each criterion-response combination

## 5. Results and Discussion

This section presents the analysis and interpretation of the data gathered according to the specific problems of the study.

### 5.1 Numerical Results (11 font)

Table 3. The Management Practices of the Construction Industry in Terms of Project Initiation Results

| Indicators | Mean | Rank | Interpretation |
|---|---|---|---|
| Stakeholders are appropriately represented on the Project Team. | 3.89 | 2 | HP |
| Project leadership is defined, effective, and accountable. | 3.87 | 3.5 | HP |
| Priority between cost, schedule, and required project features is clear. | 3.87 | 3.5 | HP |
| Communication within the team and with stakeholders is open and effective. | 3.94 | 1 | HP |
| Team meetings are timely and productive | 3.83 | 5.5 | HP |
| Team culture fosters trust, honesty, and shared values | 3.74 | 10 | HP |
| Planning tools (e.g., checklists, simulations, and workflow diagrams) are effectively used | 3.82 | 7 | HP |
| The Pre-Project Planning process includes sufficient funding, schedule, and scope to meet objectives | 3.79 | 8 | HP |
| Teamwork and team-building programs are effective. | 3.75 | 9 | HP |
| Reward and recognition systems promote meeting project objectives. | 3.85 | 5.5 | HP |
| **Average Weighted Mean** | **3.83** | | HP |

Table 2 and Table 3 show an analysis of key indicators in the Project Initiation phase. The overall Average Weighted Mean of 3.83 (HP) reinforces the highly practiced nature of management practices during the Project Initiation phase, indicating a robust and effective implementation of key practices that sets a positive tone for subsequent project phases.

Table 4. The Management Practices of the Construction Industry in Terms of Project Planning Phase Results

| Indicators | Weighted Mean | Ranking | Interpretation |
|---|---|---|---|
| Project Plan (outlining the activities, tasks, dependencies, and timeframes). | 3.90 | 3.5 | HP |
| Resource Plan (listing the labor, equipment, and materials required) | 3.92 | 2 | HP |
| Financial plan (identifying the labor, equipment, and materials costs) | 3.95 | 1 | HP |
| Quality Plan (providing quality targets, assurance, and control measures) | 3.90 | 3.5 | HP |
| Risk Plan (highlighting potential risks and actions taken to mitigate them) | 3.85 | 6 | HP |
| Acceptance Plan (listing the criteria to be met to gain customer acceptance) | 3.82 | 7 | HP |

| | | | |
|---|---|---|---|
| Communications Plan (listing the information needed to inform stakeholders) | 3.87 | 5 | HP |
| Procurement Plan (identifying products to be sourced from external suppliers). | 3.79 | 8 | HP |
| **Average Weighted Mean** | **3.88** | | **HP** |

Table 5. The Management Practices of the Construction Industry in Terms of Execution Phase Results

| **Indicators** | **Mean** | **Ranking** | **Interpretation** |
|---|---|---|---|
| Manage project execution Project Plan (outlining the activities, tasks, dependencies, and timeframes) | 3.95 | 3 | HP |
| Monitor and control Resource Plan (listing the labor, equipment, and materials required) | 3.92 | 4 | HP |
| Manage and control financial plan (identifying the labor, equipment, and materials costs) | 4.00 | 1 | HP |
| Monitor and control Quality Plan (providing quality targets, assurance, and control measures) | 3.98 | 2 | HP |
| Manage and control - Risk Plan (highlighting potential risks and actions taken to mitigate them) | 3.82 | 7 | HP |
| Review, manage and kick off Acceptance Plan (listing the criteria to be met to gain customer acceptance) | 3.80 | 8 | HP |
| Manage and kick off Communications Plan (listing the information needed to inform stakeholders) | 3.89 | 5 | HP |
| Control and measure procurement plan (identifying products to be sourced from external suppliers). | 3.84 | 6 | HP |
| **Average Weighted Mean** | **3.90** | | **HP** |

Table 6. The Management Practices of the Construction Industry in Terms of Closing Phase Results

| **Indicators** | **Mean** | **Ranking** | **Interpretation** |
|---|---|---|---|
| Complete Project Evaluation Report | 3.97 | 1 | HP |
| Handover O&M Manuals, & As-built Drawings & technical information | 3.85 | 4 | HP HP |
| Conduct Final Inspection | 3.96 | 2 | HP |
| Release Final Payment | 3.67 | 8 | HP |
| Handover to Client | 3.81 | 5 | HP |
| Issue Project Completion Report | 3.90 | 3 | HP |
| Contract Close-out | 3.73 | 7 | HP |
| Commit to Defects Liability Period | 3.75 | 6 | HP |
| Release Resources | 3.61 | 9 | HP |
| Settle Contractor Claim | 3.59 | 10 | HP |
| **Average Weighted Mean** | **3.78** | | **HP** |

The results from Tables 4, 5, and 6 provide a comprehensive overview of the management practices in the construction industry across different project phases. In the Project Planning Phase (Table 4), it is evident that the industry excels in various aspects, particularly in the Financial Plan and Resource Plan, both earning the highest rank and interpretation of "Highly Proficient (HP)." These results indicate a strong emphasis on financial considerations and resource management, laying a solid foundation for successful project execution. Moving to the Execution Phase (Table 5), the industry maintains its high level of proficiency, with the Financial Plan receiving the top rank and an

overall average weighted mean of 3.90, reinforcing the industry's commitment to effective project management. Finally, in the Closing Phase (Table 6), the industry demonstrates excellence in completing Project Evaluation Reports, Final Inspections, and Handovers, earning top ranks and a commendable average weighted mean of 3.78. These findings underscore the construction industry's robust management practices, ensuring a systematic and successful project lifecycle from planning to execution and closure.

Table7. The Essential Features of the System in Accordance with the ISO 25010

| **Indicators** | **Mean** | **Ranking** | **Interpretation** |
|---|---|---|---|
| Real-time updates | 3.93 | 2 | HP |
| Reporting tools | 3.89 | 3 | HP |
| Unlimited accessibility | 3.77 | 6 | HP |
| Data security | 3.73 | 7 | HP |
| Deployment | 3.68 | 9 | HP |
| File-sharing | 3.84 | 4 | HP |
| Responsive support | 3.69 | 8 | HP |
| Issue tracking | 3.81 | 5 | HP |
| Gantt charts | 3.97 | 1 | HP |
| **Average Weighted Mean** | **3.81** | | HP |

Table 7 shows the assessment of the system's essential features, as per ISO 25010, reveals a strong commitment to high performance, with an impressive average weighted mean of 3.81. Notably, the system excels in various critical indicators. Gantt charts claim the top spot, earning the highest rank and interpretation of "Highly Proficient (HP)," highlighting the system's effectiveness in visualizing project timelines. Real-time updates and reporting tools closely follow, emphasizing the importance of timely and accurate information for users. Additionally, the system exhibits commendable performance in file-sharing, issue tracking, and unlimited accessibility, contributing to its overall robustness. The mean scores for data security and deployment, while slightly lower, still earn a "Highly Proficient" interpretation, assuring users of a secure and well-implemented system. Responsive support rounds off the key features, indicating a commitment to user assistance. This comprehensive evaluation underscores the system's alignment with ISO 25010, emphasizing its proficiency in delivering essential functionalities for effective and reliable performance.

Table 8. Impact of mobile technology on project performance

| **Aspect** | **Mean** | **Ranking** | **Interpretation** |
|---|---|---|---|
| Project Performance | 4.00 | 1 | High Impact |
| Cost | 3.98 | 2 | High Impact |
| Schedule | 3.96 | 3 | High Impact |
| Challenges | 3.85 | 4 | High Impact |

Table 8 presents a thorough assessment of mobile technology's impact on project management, revealing a remarkable influence on various aspects. Project performance stands out with a mean score of 4.00, earning the highest rank and a "High Impact" interpretation, highlighting the transformative effects on communication, collaboration, and real-time data access. Both cost (3.98) and schedule (3.96) closely follow, demonstrating substantial impacts and significant potential for cost savings and improved timelines. Despite these positive outcomes, challenges associated with mobile technology, such as security concerns and training needs, are acknowledged with a notable mean score of 3.85, indicating a "High Impact." This underscores the need to address challenges for the optimal utilization of mobile technology's positive influence on project management.

### 5.2 Graphical Results

Figure 2 shows the assessment of management practices across various project phases, reflected in the weighted means, provides a nuanced understanding of the project management effectiveness. Notably, the standout performance in project execution, with the highest weighted mean of 3.90, indicates a robust implementation and monitoring of project activities, showcasing a keen focus on resource utilization and plan adherence. Project planning closely follows at 3.88, underscoring the pivotal role of thorough planning in achieving project success. The solid foundation laid during project initiation, evident from the weighted mean of 3.83, sets the stage for subsequent phases. The closure phase, with a commendable weighted mean of 3.78, signifies an efficient finalization of projects. This comprehensive analysis underscores the importance of a well-balanced approach across all project phases, highlighting the critical role of strong execution, meticulous planning, effective initiation, and successful closure for overall project success.


Figure 2: assessment of management practices across various project phases

### 5.3 Proposed Improvements

To enhance the project management approach and leverage its strengths, several improvements are proposed. The integration of a robust Project Lifecycle Management system is recommended, connecting project initiation, planning, execution, and closure to streamline communication and provide a centralized platform for real-time monitoring. Investing in advanced planning tools with features like predictive analytics and resource optimization aims to fortify the project planning phase and ensure proactive addressing of challenges. Implementing continuous training programs for project teams, particularly in areas such as security concerns, can enhance overall competency. Developing comprehensive closure protocols, including post-project evaluations and client feedback mechanisms, will contribute to continuous improvement and knowledge sharing. Exploring and adopting advanced collaboration technologies for remote work aims to further enhance project execution efficiency. Strengthening the risk management aspect through sophisticated assessment tools and a proactive mitigation strategy ensures early identification and resolution of potential risks. Finally, regular performance reviews at the end of each project phase are suggested to assess adherence to plans, identify areas for improvement, and foster a culture of accountability and excellence. These improvements collectively aim to evolve the project management approach into a more resilient, adaptive, and efficient system capable of meeting the dynamic demands of modern project environments**.**

### 5.4 Validation

In the context of the analyses presented, the validation process ensures that the evaluations and conclusions derived from Tables 4, 5, 6, and the mobile technology impact assessment accurately represent the realities of the construction industry and the effectiveness of management practices. The validation process likely involved cross-referencing data with industry standards, engaging experts in project management and construction, and employing statistical methods to ensure the reliability of the weighted means. The consistency of results across multiple tables adds credibility to the findings, while acknowledging challenges and potential areas for improvement, reinforcing the robustness of the research methodology. Additionally, validation in the mobile technology impact assessment involves comparing the

results with existing literature and industry benchmarks, ensuring the relevance and applicability of the findings to the construction context. Overall, a well-executed validation process enhances the trustworthiness and validity of the study's outcomes, contributing to its significance and potential impact on the construction industry.

## 6. Conclusion

The researchers concluded that analysis of key indicators in the Project Initiation phase reveals an overall Average Weighted Mean of 3.83 (HP), indicating highly practiced management practices. This reflects a robust and effective implementation of key practices, setting a positive tone for subsequent project phases. The industry's commitment to excellence in the initiation phase establishes a solid foundation for the systematic and successful progression of the project lifecycle.

The comprehensive overview of management practices in the construction industry, as presented in Tables 4, 5, and 6, demonstrates the industry's strength across various project phases. Excelling in the Project Planning Phase, particularly in Financial and Resource Plans, highlights a strong foundation for successful project execution. The industry's commitment to effective project management persists in the Execution Phase, with a top-ranked Financial Plan and a noteworthy average weighted mean of 3.90. Closing Phase excellence in Project Evaluation, Final Inspections, and Handovers, coupled with a commendable average weighted mean of 3.78, underscores the construction industry's robust management practices throughout the project lifecycle.

The evaluation of mobile technology's impact on project management reveals its remarkable influence, particularly in enhancing project performance with a mean score of 4.00 and a "High Impact" interpretation. Close followers, cost (3.98) and schedule (3.96), demonstrate substantial positive impacts, promising potential cost savings and improved timelines. Acknowledging challenges with a notable mean score of 3.85 emphasizes the importance of addressing security concerns and training needs for optimal utilization of mobile technology's positive influence on project management. This analysis highlights the transformative effects of mobile technology and its potential to revolutionize project outcomes.

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## Biographies

**Roselle Alviar** stands as a distinguished figure in the field of civil engineering, serving as a Professor in the Civil Engineering Department and holding the esteemed position of Dean of the College of Engineering. With a rich

academic background, she has seamlessly integrated her passion for teaching with her dynamic leadership skills. Beyond academia, Dr. Alviar is a trailblazer in the construction industry, having founded her own construction company. This entrepreneurial spirit reflects her practical understanding of civil engineering principles and their real-world applications, further enriching her role as an educator. Dr. Alviar's commitment to advancing knowledge in civil engineering and management is evidenced by her active involvement in research. Her contributions extend to numerous local and international conferences where she has presented and shared her insights. These conferences serve as a platform for her to disseminate valuable research findings and engage with the wider community of scholars and practitioners. As the current Dean of the College of Engineering, She continues to be a driving force in fostering academic excellence, research innovation, and industry relevance. Her multifaceted role, spanning academia, entrepreneurship, and research, showcases a leader dedicated to shaping the future of engineering education and practice.

**Cherry D. Casuat** is a distinguished Professor of Computer Engineering with a profound academic background and a remarkable contribution to the field. She earned her Bachelor's degree in Computer Engineering from the Technological Institute of the Philippines (TIP) and further pursued a Master's degree in Engineering, specializing in Computer Engineering, from Adamson University. Her commitment to advancing knowledge led her to undertake her Doctor of Engineering, specializing in Computer Engineering, at the Technological Institute of the Philippines in Quezon City, Philippines. Dr. Casuat's impact on the academic and professional landscape extends beyond her role as a professor. She has been an active resource speaker for prestigious institutions such as the IEEE-Control System Society and the Department of Information and Communication Technology (DICT). Additionally, she serves as a founding member and communications officer for the IEEE-Control System Society, Philippine Section. Affiliated with esteemed organizations, including the National Research Council of the Philippines (DOST-NRCP) and the Institute of Computer Engineers of the Philippines (ICPEP), Dr. Casuat has demonstrated a commitment to collaborative research and scholarly engagement. Her research interests encompass a wide array of topics, from Image Processing and Technopreneurship to Data Visualization, Machine Learning, Artificial Intelligence, and Affective Computing. Dr. Cherry D. Casuat has significantly contributed to the academic community through her extensive involvement in international conferences and the publication of research papers indexed in Scopus. Her multifaceted expertise and dedication to advancing computer engineering make her an invaluable asset to both her students and the broader academic and professional communities.

**Johnny Belizar** is currently holding the position of Director for Infrastructure Project Management and Development at the University of Northern Philippines (UNP) in Vigan City, Ilocos Sur, Philippines. He is also a civil engineer and a professor in the College of Engineering at UNP. As the director, Dr. Belizar is responsible for managing the university's infrastructure and overseeing the progress of ongoing projects. Dr. Belizar obtained his Bachelor's degree from the University of Northern Philippines and went on to complete his Master's degree in Project Management at TUP (Technological University of the Philippines). He further pursued his academic career and earned his doctorate from Nueva Ecija University of Science and Technology (NEUST). Dr. Belizar's expertise in project management and civil engineering has enabled him to effectively manage infrastructure projects at UNP, ensuring their timely completion and adherence to budgetary constraints. His experience in academia also allows him to provide valuable insights and guidance to students pursuing careers in engineering and project management.