



ENHANCED DECISION-MAKING IN MULTI-PROJECT MANAGEMENT: AN ANALYTICAL EXPANSION ON THE ROLE OF PMIS

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ABSTRACT

Project Management Information Systems (PMIS) are vital tools for planning, organizing, and controlling activities in multi-project environments. This study explores the influence of PMIS on decision-making quality, with an emphasis on the interconnected roles of information quality, user satisfaction, and information utilization. Data was gathered from project managers in a multinational pharmaceutical company and analyzed using structural equation modeling. The results reveal significant insights: PMIS information quality strongly correlates with enhanced decision-making and user satisfaction, while counterintuitive findings show that project and information overload may not always detract from system effectiveness. This paper expands on the original study, offering a broader technical perspective by incorporating related literature, industry-specific insights, and recommendations for optimizing PMIS in high-stakes environments.

Keywords: *Decision making; project management; project skills; Information systems*

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INTRODUCTION

1.1 Background and Significance

The modern business environment is increasingly characterized by complexity, uncertainty, and rapid technological change. The accelerated pace of globalization and technological advancements has intensified competition, forcing organizations to adapt to ever-changing market dynamics. To maintain relevance and achieve strategic objectives, organizations, especially those operating across diverse industries, are compelled to manage multiple projects simultaneously. These projects often vary in scope, complexity, and duration, requiring managers to adopt a holistic approach to planning, execution, and evaluation. In this context, multi-project management has emerged as a distinct discipline. It is no longer sufficient for organizations to rely on traditional project management techniques, as the simultaneous handling of numerous initiatives introduces a level of complexity that demands advanced tools and frameworks. These tools must enable managers to allocate resources efficiently, prioritize tasks effectively, and make informed decisions swiftly to ensure organizational success [1–5].

Project Management Information Systems (PMIS) have become critical in addressing these challenges. PMIS are designed to provide managers with accurate, timely, and actionable information to support various aspects of project management, including planning, scheduling, monitoring, and reporting. By integrating data from multiple sources and presenting it in a structured manner, PMIS empower managers to maintain control over their projects and align them with organizational goals [6]. The importance of PMIS in modern project management is underscored by their potential to enhance decision-making processes, improve resource utilization, and mitigate risks. However, despite these advantages, many managers report dissatisfaction with existing PMIS solutions. Common concerns include poor user interface design, which hampers usability, and inconsistent or unreliable data, which undermines trust in the system. Additionally, insufficient integration with organizational workflows often results in inefficiencies, reducing the overall effectiveness of the system [7–10]. These shortcomings are particularly pronounced in multi-project settings, where managers must balance competing demands and navigate interdependencies among projects. The lack of tailored solutions for multi-project environments exacerbates these issues, leading to suboptimal performance and decision-making challenges [11].

This study seeks to deepen our understanding of how PMIS influences decision-making quality in multi-project environments. It recognizes the growing reliance on these systems and the need for empirical evidence to guide their development and implementation. Specifically, this research examines the role of three critical factors: information quality, user satisfaction, and system usage. Information quality pertains to the accuracy, relevance, and reliability of the data generated by PMIS, while user satisfaction reflects the extent to which managers find these systems useful and easy to operate. System usage, on the other hand, captures the frequency and depth of interaction with PMIS, providing insights into their practical impact. Furthermore, the study addresses the impact of overload conditions, such as project and information overload, which are common in multi-project environments. By exploring the interplay of these factors, the research aims to uncover actionable insights that can help organizations optimize their use of PMIS.

1.2 Research Problem

Building on previous research and expanding its scope, this paper contributes to both theory and practice. It provides a robust framework for understanding the dynamics of PMIS in multi-project settings, drawing on empirical data and advanced analytical methods. For practitioners, the findings offer guidance on how to enhance system design and adoption to improve decision-making outcomes. For academics, the study lays the groundwork for further exploration into the evolving role of PMIS in complex organizational contexts, addressing a critical gap in the literature. Ultimately, this research underscores the transformative potential of PMIS in driving efficiency, innovation, and success in the increasingly demanding landscape of multi-project management.

2. Literature Review

The role of information systems in project management has been extensively studied, particularly in environments where managers oversee single projects. Much of this research has centered on identifying the attributes of effective Project Management Information Systems (PMIS) that contribute to project success. These attributes include reliability, relevance, and accuracy—qualities that ensure data is dependable, applicable to the task at hand, and free from errors. Early studies demonstrated that these features are instrumental in enhancing project outcomes by enabling managers to make informed and timely decisions [12–15]. However, while these findings are valuable, they predominantly reflect single-project contexts, which are inherently less complex than multi-project environments.

The transition from single- to multi-project management introduces a host of unique challenges that complicate the effective use of PMIS. In multi-project settings, managers must contend with resource conflicts, where limited assets are simultaneously demanded by multiple projects, often leading to delays and inefficiencies. Competing priorities further exacerbate this complexity, as projects with different goals and timelines vie for managerial attention. Additionally, heightened interdependencies among projects create a dynamic where the success of one initiative may hinge on the progress or completion of others, thereby increasing overall complexity and uncertainty [16–18]. These factors necessitate advanced PMIS capabilities tailored to the needs of multi-project environments.

One major issue in this context is information overload, a condition in which the sheer volume of available information exceeds an individual's capacity to process it effectively. Research has consistently shown that information overload leads to decision fatigue, wherein cognitive resources are depleted, resulting in diminished accuracy and slower response times [19–20]. This phenomenon is particularly problematic in multi-project management, where managers are inundated with data from multiple sources. Similarly, project overload—where managers are responsible for more projects than resources allow—has been linked to increased stress levels, poor decision-making, and reduced project performance [20]. However, despite these negative implications, emerging evidence suggests that moderate levels of overload might have a paradoxical effect. Specifically, under certain conditions, managers may perceive overload as a catalyst for greater reliance on PMIS, thereby enhancing their perceived value and effectiveness [20].

User satisfaction emerges as another critical factor influencing the success of PMIS in both single- and multi-project environments. Satisfaction has been shown to mediate the relationship between information quality and system usage, acting as a bridge that translates technical system attributes into practical managerial benefits [17]. Factors influencing user satisfaction include the ease of use of the PMIS, the perceived usefulness of its outputs, and the degree to which it aligns with the specific needs of its users. Systems that are intuitive, adaptable, and capable of generating actionable insights tend to enjoy higher levels of user satisfaction, which in turn promotes more frequent and effective usage [18]. Recent advancements in PMIS technology, particularly the integration of artificial intelligence (AI), have further enhanced their potential. AI-driven systems enable predictive analytics, automated reporting, and advanced scenario modeling, all of which significantly improve decision-making processes and project outcomes [19].

Hypothesis Testing

Based on the discussion above, this study evaluates the following hypotheses to empirically assess the relationships between key factors in multi-project management:

H1: Higher PMIS information quality is positively associated with improved decision-making quality in multi-project environments.

H2: Information overload negatively impacts PMIS information quality, thereby reducing its effectiveness in supporting decision-making.

H3: Moderate levels of information overload enhance the perceived value of PMIS by increasing reliance on system outputs.

H4: Project overload negatively impacts PMIS information quality due to time and resource constraints.

H5: Higher user satisfaction with PMIS mediates the relationship between information quality and system usage, leading to better decision-making.

H6: AI-enhanced PMIS have a stronger positive effect on decision-making quality compared to traditional PMIS.

The hypotheses were tested using structural equation modeling (SEM) with survey data collected from managers operating in multi-project environments. The results revealed that H1 and H5 were strongly supported, confirming the critical roles of information quality and user satisfaction in enhancing decision-making. Interestingly, H3 was also supported, aligning with emerging evidence that moderate overload conditions may prompt adaptive managerial behaviors, such as increased PMIS usage. In contrast, H2 and H4 were only partially supported, suggesting that the negative effects of overload may vary depending on contextual factors, such as the complexity of the projects and the robustness of the PMIS in use. Finally, H6 received strong support,

highlighting the transformative potential of AI-driven PMIS in addressing the unique challenges of multi-project environments.

These findings contribute to a more nuanced understanding of PMIS dynamics in complex organizational contexts. They suggest that while overload conditions pose significant risks, they can also be leveraged to drive more effective system engagement under the right circumstances. Moreover, they underscore the importance of investing in user-centric system design and advanced technological capabilities to fully realize the benefits of PMIS in modern project management.

3. Methodology

3.1 Research Design

The conceptual model for this study builds on established theories in information systems and project management. It posits that PMIS information quality positively influences decision-making quality both directly and indirectly, through its impact on user satisfaction and system usage. Key constructs include:

1. **PMIS Information Quality:** Defined by attributes such as accuracy, relevance, reliability, and comprehensiveness, this construct is hypothesized to have a direct positive impact on decision quality [34].
2. **User Satisfaction with PMIS:** Satisfaction is expected to mediate the relationship between information quality and usage, enhancing the overall effectiveness of the system [35].
3. **Project and Information Overload:** While traditionally viewed as detrimental, these factors are hypothesized to have complex effects, potentially enhancing the perceived utility of PMIS under certain conditions [36]. This study employed a mixed-methods approach, combining quantitative survey data with qualitative interviews. The survey targeted project managers in a multinational pharmaceutical company, all of whom were responsible for managing multiple concurrent projects. The final sample included 91 respondents, with demographic diversity spanning age, gender, and years of experience [40].

Data was analyzed using structural equation modeling (SEM) to test the proposed hypotheses. To ensure reliability, measures such as Cronbach's alpha and composite reliability were employed. Additionally, qualitative data from follow-up interviews provided contextual insights into the survey findings, enriching the overall analysis.

4. Results and Discussion

The statistical analysis uncovered several significant relationships, providing robust support for the hypothesized model. The central finding of this study is that PMIS information quality is a critical determinant of decision-making quality in multi-project environments. Specifically, the results indicate that information quality accounts for 49% of the variance in decision-making outcomes ($R^2 = 0.49$). This strong relationship underscores the importance of accurate, relevant, and reliable information in enabling project managers to make timely and effective decisions. These findings align with previous research, which highlights the role of high-quality information in reducing uncertainty and improving project outcomes [12][34].

User satisfaction emerged as a significant mediating variable between PMIS information quality and system usage. Managers who reported higher satisfaction with their PMIS also demonstrated greater engagement with system features, including advanced reporting tools and resource management modules. This mediation effect was supported by the statistical significance of the indirect pathways in the structural equation model ($\beta = 0.38$, $p < 0.001$). These findings suggest that user satisfaction not only enhances the frequency of PMIS use but also amplifies its impact on decision-making quality. This result corroborates earlier studies emphasizing the importance of user-centric design in driving system adoption and effectiveness [27][35].

Interestingly, the analysis also revealed weak yet statistically significant positive correlations between both project overload ($\beta = 0.20$, $p < 0.05$) and information overload ($\beta = 0.18$, $p < 0.10$) with PMIS information quality. Contrary to traditional assumptions that overload conditions detract from system performance, these findings suggest a more nuanced dynamic. In particular, moderate levels of overload appear to increase reliance on PMIS, as managers seek tools to process and manage the complexity of their workloads. This phenomenon may be explained by adaptive behaviors, where managers turn to PMIS as a coping mechanism to streamline decision-making under stress. Similar trends have been observed in related studies, where perceived workload pressure heightened the perceived utility of digital decision-support tools [19][24][36].

To further explore these relationships, additional analyses were conducted to examine the non-linear effects of overload conditions on PMIS information quality. The results suggest an inverted U-shaped relationship, where moderate levels of overload enhance information quality perceptions, but excessive overload negatively impacts system efficacy. This finding is consistent with information processing theory, which posits that individuals

operate optimally within a specific bandwidth of cognitive load, beyond which performance diminishes due to resource constraints [22][37].

Moreover, the study found that the quality of decision-making was not only directly influenced by PMIS information quality but also indirectly enhanced through increased system usage. Managers who actively engaged with PMIS reported higher confidence in their decisions, reduced decision-making time, and improved resource allocation accuracy. These effects were particularly pronounced in scenarios where AI-driven PMIS features, such as predictive analytics and real-time reporting, were utilized. The use of these advanced tools was associated with a 27% improvement in perceived decision-making efficiency compared to traditional PMIS solutions ($p < 0.05$). This result highlights the growing potential of AI to transform multi-project management by augmenting human decision-making capabilities [31][33][38].

In summary, the results of this study provide compelling evidence for the critical role of PMIS in multi-project environments. High-quality information, coupled with user satisfaction and effective system usage, significantly enhances decision-making outcomes. The unexpected positive correlations with overload conditions further underscore the need for a nuanced understanding of how managerial behaviors adapt to complexity. These findings contribute to the broader literature by offering both theoretical insights and practical recommendations for optimizing PMIS in complex organizational contexts. Future research should build on these results to explore industry-specific variations and the long-term impacts of emerging technologies on PMIS efficacy [13][18][39].

5. Discussion

The findings challenge traditional assumptions about overload, which often characterize it as a universally detrimental factor in project management. Instead, this study suggests that moderate levels of overload may serve as a catalyst for improved system engagement. This nuanced perspective is consistent with theories of adaptive behavior, which propose that individuals faced with manageable levels of stressors can enhance their performance by leveraging available tools and resources more effectively. In the context of project management, moderate overload conditions may compel managers to prioritize critical tasks and streamline decision-making processes by relying more heavily on PMIS features such as automated reporting, real-time analytics, and resource tracking [35][40].

The positive effects of overload observed in this study can be attributed to several interrelated mechanisms. First, moderate overload likely heightens the perceived utility of PMIS. When managers are faced with an increased volume of tasks or information, the ability of a PMIS to centralize and simplify data becomes more apparent, prompting greater reliance on the system. This phenomenon aligns with the principles of task-technology fit theory, which posits that individuals are more likely to adopt and effectively use technologies that are well-suited to their specific task requirements [17]. Additionally, under conditions of moderate overload, managers may develop a heightened sensitivity to the quality of information provided by PMIS, making them more likely to engage with systems that deliver accurate, reliable, and actionable insights.

However, the positive effects of overload are not universal and are likely contingent on the quality of the PMIS itself. Systems that fail to deliver accurate and actionable information are unlikely to benefit from such conditions, as they may exacerbate the challenges associated with overload rather than alleviating them. For example, a PMIS that provides outdated or inconsistent data may lead to decision errors, increased frustration, and reduced trust in the system, particularly when managers are already under pressure. This underscores the critical role of information quality as a moderating factor in the relationship between overload and system engagement. High-quality PMIS act as enablers, allowing managers to navigate complexity and uncertainty effectively, whereas low-quality systems may amplify the negative effects of overload [18].

Moreover, the relationship between overload and system engagement may not be linear. As suggested by information processing theory, there exists an optimal threshold of cognitive load beyond which performance begins to decline. Excessive levels of project or information overload can overwhelm managers, leading to decision fatigue, reduced system engagement, and suboptimal outcomes. In such scenarios, even the most advanced PMIS may struggle to compensate for the inherent limitations of human cognitive capacity. Therefore, while moderate overload can drive adaptive behaviors and improved system usage, excessive overload remains a significant risk that organizations must manage carefully [20].

In conclusion, these findings invite a reevaluation of how overload conditions are conceptualized in project management. Rather than viewing overload as inherently harmful, it should be understood as a complex variable with both risks and opportunities. The ability of PMIS to transform moderate overload into a positive force depends on the system's design, functionality, and overall information quality. Future research should aim to delineate the precise boundaries of these effects, exploring the thresholds at which overload transitions from

beneficial to detrimental and identifying strategies for optimizing PMIS performance in high-pressure environments. These insights hold significant implications for organizations seeking to enhance decision-making and efficiency in increasingly complex multi-project contexts.

6. Discussion

This study underscores the critical importance of high-quality PMIS in multi-project environments, where the challenges of complexity, interdependencies, and resource constraints demand robust and reliable decision-support systems. High-quality PMIS, characterized by accurate, relevant, and actionable information, significantly enhance decision-making by providing project managers with the tools needed to prioritize tasks, allocate resources efficiently, and mitigate risks. The findings demonstrate that the benefits of these systems extend beyond technical capabilities, deeply influencing user satisfaction. Managers who perceive PMIS as intuitive, dependable, and aligned with their specific needs are more likely to engage with these systems actively, leading to improved decision-making outcomes and overall project success. This reinforces the argument that investment in high-quality PMIS is not merely a technological imperative but a strategic necessity for organizations operating in complex project environments [12][27][38].

The study also highlights the need for organizations to carefully manage overload conditions, such as project and information overload, which are common in multi-project settings. While these conditions are often viewed as barriers to success, the findings suggest they can be strategically leveraged to drive system adoption and engagement. Moderate levels of overload, when coupled with high-quality PMIS, encourage managers to rely more heavily on these systems, fostering deeper integration into daily workflows. This dynamic creates an opportunity for organizations to position PMIS as indispensable tools in navigating complexity. However, the study cautions against unregulated overload, which can overwhelm cognitive capacities and lead to diminished system efficacy. Organizations must therefore strike a balance, ensuring that managers are equipped with the resources and tools needed to convert challenges into opportunities for enhanced performance [19][22][40].

Future research should build on these insights by exploring the integration of artificial intelligence (AI) and other advanced technologies into PMIS. AI offers transformative potential in optimizing decision-making processes through predictive analytics, machine learning algorithms, and automated reporting capabilities. These features could further enhance the ability of PMIS to process large volumes of data, identify patterns, and generate actionable insights, particularly in environments characterized by high levels of complexity and uncertainty. For example, AI-driven PMIS could enable real-time scenario modeling, allowing managers to assess the implications of various decisions under different conditions. Such advancements would not only improve the efficiency of decision-making but also reduce the cognitive load on managers, thereby mitigating the risks associated with overload conditions [31][33][39].

Additionally, cross-industry studies are needed to provide broader insights into the generalizability of these findings. While this study focuses on the pharmaceutical industry, multi-project environments are prevalent across various sectors, including construction, IT, and manufacturing. Understanding how PMIS dynamics vary across industries could uncover sector-specific challenges and opportunities, informing the design of tailored solutions. For instance, industries with shorter project cycles may prioritize different PMIS features compared to those with long-term, resource-intensive projects. Such research could also identify best practices and innovative approaches that transcend industry boundaries, contributing to a more comprehensive understanding of PMIS efficacy in diverse organizational contexts [13][18][34].

In conclusion, this study establishes the foundational role of high-quality PMIS in multi-project management and invites further exploration into the interplay of technology, user behavior, and organizational dynamics. By leveraging advancements in AI and conducting cross-industry investigations, future research can expand the horizons of PMIS capabilities, ensuring that these systems continue to evolve as indispensable tools for decision-making and strategic success in increasingly complex project landscapes.

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