Assessing the Readiness of construction firms to adopt AI-Based Project management tools

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Abstract- ***The integration of Artificial Intelligence (AI) technology in project management in construction has the potential for enormous change in processes like planning, scheduling, costing, and risk analysis. The objective of this research is to examine the level of preparedness of construction firms to implement project management tools based on AI, focusing on the technological framework, manpower, finances, level of awareness, and perceived among other barriers. The study was conducted using a quantitative method whereby construction professionals from different firms were issued structured questionnaires. Responses were analyzed and the preparedness levels were evaluated using descriptive statistics such as frequency and percentage calculations. The results show that firms are increasingly aware of, and have moderate pertaining to, readiness infrastructure gaps, as a significant number of firms are already utilizing some form of digital tools. On the other hand, the lack of training for the workforce, the lack of financial resources, and cybersecurity as well as the integration concerns were key roadblocks. Even though a large percentage of firms expressed willingness to apply AI, systemic gaps constrained readiness. The study proposes strategic readiness gap interventions, such as governmental training programs, financial aid systems, pilot adoption initiatives, and cross-industry partnerships to guarantee success with the robotics integration.***

Index Terms : Construction, AI, Project Management, Data Driven, Robotics

I. INTRODUCTION

The integration of Artificial Intelligence (AI) into Project Management Technology (PMT) represents a significant shift in how firms plan, monitor, and execute complex infrastructure projects. Project management tools that use AI have significant potential in predictive analytics, optimal resource allocation, real-time monitoring, automation of routine tasks, risk management, and other areas (Bock & Linner, 2015; Li et al. 2023). These tools are now acknowledged to aid construction development projects by improving predictive accuracy and control of project execution, reducing project slippage, and improving productivity (Khosrowshahi & Arayici, 2012). Although sophisticated digital technologies are available, construction firms' preparedness to adopt such technologies is heterogeneous by geography and scales of firms. Sacks et al. (2010) have remarked how the construction sector, in spite of its benefits, remains conservative in its approach to the use of technologies. This sector is made up of many businesses in many different areas. Its slow adoption of new ideas, coupled with its highly fragmented, labor-intensive nature, will make the use of AI much more complicated than many people think (Marzouk & Ezzeldin, 2017). Organizational culture, digital literacy levels, workforce skill sets, financial capacity, data infrastructure, and regulatory preparedness all play pivotal roles in determining the level of readiness of a firm (Ghosh et al., 2021). In particular, small and medium-sized enterprises (SMEs) often lag behind large firms in adopting such tools due to limitations in capital, training, and access to AI platforms (Wang et al., 2022).

In addition, the implementation of AI is not a mere question of deployment; it is also a question of strategy. For project management, AI-enabled tools will only be effective if the firms in question have a well-defined digital strategy, a continuous improvement culture, and a personnel development investment plan (Zhao et al., 2020). A firm's readiness can thus be described as a multi-faceted technological system comprising technological maturity, organizational capability, leadership vision, and supporting external frameworks (Akintoye et al., 2000; Mollah et al., 2021). Due to the accelerating pace of urbanization, the global construction industry

is facing increasing complexity, heightened deadlines, and the need for greater environmental sustainability. Because of these factors, there is a significant need for flexible, AI-driven systems for project management (Melo et al., 2022). It is also critical to understand the current state of readiness among construction firms; without this understanding, the digital transformation will result in poorly executed strategies and a squander of resources. Readiness assessment enables the identification of gaps, tailored assistance frameworks, and policy development aimed at increasing the rate of AI adoption.

II. LITERATURE REVIEW

The construction firm's readiness to embrace project management systems that are powered by AI systems is influenced by the specificities of the given technology and AI systems, as well as the internal structure of the company, its economic condition, and the legal sector. This literature review analyzes the literature that has tackled the above questions and attempts to outline the primary trends that impact the construction sector, its obstacles, and motivations toward change.

1. Constructive Digital Framework and Its Growth Potential

The existing technology continues to be one of the key prerequisites when it comes to artificial intelligence adoption. Construction firms need to have a solid digital data framework, to be enabled to leverage AI-powered tools such as machine learning, data analytics, and automation analytics (Marzouk & Ezzeldin, 2017). It has been noted through multiple studies that construction firms that have already incorporated Building Information Modeling (BIM) and enterprise resource planning (ERP) and even Internet of Things (IoT) stand a better chance to leverage AI-based tools (Khosrowshahi & Arayici, 2012; Liu et al., 2021). As mentioned by Li et al. (2023) firms that are spending on digital tools regarding cost estimation, scheduling, and even design integration are likely to adopt AI in a more streamlined manner. However, especially among SMEs, the absence of digital tools and automation technologies is markedly poor, which necessitates more spending toward basic technology infrastructure (Ghosh et al., 2021).

2. Organizational Capability and Human Resource Competence

One of the notable constraints to AI readiness is the shortage of skilled employees. Sacks et al. (2010) proposed that AI adoption is not simply a technological progression; it also involves a change in an organization's culture, its strategic focus, and its human resource competencies. The construction industry's educated but traditionally manual workforce is knowledge poor in data, computer programming, and the use of AI technologies (Zhao et al., 2020). Akintoye et al. (2000) stresses the significance of organizational learning and professional development in addressing these challenges. Moreover, Ghosh et al. (2021) notes that firms that are digitally transformed and led by strong executives tend to offer educational training, workshops, and pilot projects that foster learning through work.

3. Economic Viability and Cost Concerns

Cost still remains a key concern in relation to AI readiness. In price-sensitive markets, firms are particularly deterred by the total cost of AI tools; including their training, software tailoring, and infrastructure rebuilding (Wang et al., 2022). Nevertheless, the research by Bock & Linner (2015) and Melo et al. (2022) shows that AI's long-term advantages, including enhanced predictability of project outcomes and timely completion, compensate for the initial investment. Financially robust firms are thus more inclined to invest in AI, while others await external support or a demonstrable return on investment before proceeding.

4. External Pressure and Client Expectations

The competition in the market, the laws that govern the industry, and the demand from clients also affect the preparedness of construction firms. As stated by Mollah et al. (2021), firms under strain from technologically sophisticated rivals and large clients are more willing to digitize operations. Regions that are being developed as smart cities, for example, in Asia and the Middle East, have also government mandates which have increased the use of AI in construction (Li et al., 2023). On the contrary, in

more traditional markets that have less access to digital infrastructure, and where policies are more conservative, firms do not adopt change simply because there is not enough external demand for it (Zhao et al., 2020).

5. Change Management and Strategic Alignment

The strategic management of the change is essential for AI. Liu et al. (2021) found that firms with a clearly defined digital strategy and advocates at the executive level are better positioned to deploy AI tools than those without them. Adoption is more likely to fail where there is a culture that is resistant to change, because departments that work in silos tend to lock away digital endeavors and stifle teamwork (Marzouk & Ezzeldin, 2017). Therefore, successful adoption is also a result from the combination of strategic alignment and a nonhierarchical governance system that promotes creativity and new ideas.

6. Barriers and Gaps in Adoption

Numerous gaps have been described that deficiencies between AI awareness and its actual use. Melo et al. (2022) lists risk averse behavior, lack of standardized procedures, concerns with cybersecurity, and inadequate pilot initiatives as factors that slow down adoption. Additionally, Zhao et al. (2020) pointed out that numerous companies have a tendency to undervalue the data and its quality required by existing AI models which leads to system underperformance. Furthermore, the lack of specialized AI applications for smaller construction projects limits adoption even on megaprojects.

This literature review highlights the diffrent aspects which construction project management AI readiness encompasses. It demonstrates that there is a growing awareness and interest in AI, but a lack of infrastructure, funding, and skilled personnel continues to hinder adoption. In the remaining parts of the research, the authors intend to build on the existing literature by investigating the firm-level readiness of construction companies and providing contextually tailored suggestions.

III. METHODOLOGY

1. Research Design

This research embraced a quantitative research method by employing a survey questionnaire as the sole data collection tool. It aimed to evaluate the construction firms' readiness to adopt AI-based project management tools by measuring their technological, organizational, and financial preparedness while also assessing the primary barriers and enablers.

2. Study Area and Participants

The construction firms from the public and private sectors located within the metropolitan rim were considered as the study population. A purposive sampling technique was employed to target firms that have embraced or are willing to adopt digital technologies like BIM, ERP, or scheduling tools. Eighty structured questionnaires were issued to project managers, site engineers, IT managers, and senior management within these firms. Seventy-two valid responses were obtained, translating to a 90% response rate.

3. Instrumentation

The questionnaire crafted closed-ended queries using a Likert scale as well as binary answers (Yes/No) and centered on the following five domains:

- Technological readiness
- Organizational and workforce capability
- Financial capacity and cost perception
- Awareness and willingness to adopt AI
- Barriers and perceived challenges

All items were designed to enable manual frequency and percentage analysis.

4. Data Collection

The questionnaire was administered in paper and electronically. Both methods were accessible for a duration of three weeks. Anonymity was assured to participants, and their participation was on a voluntary basis. Response rate was enhanced through the use of follow-up reminders.

5. Data Analysis

Responses were captured and summarized using frequency and percentage. Each response was manually analyzed, and reference drawn based on the readiness level of the respondents on key thematic areas.

IV. FINDINGS

This section presents the analysis of responses obtained through the questionnaire. Each table contains the frequency and percentage of responses for selected indicators of readiness among construction firms to adopt AI-based project management tools. Interpretations follow each table.

Table 1: Technological Readiness of Firms

Response	Frequency	Percentage (%)
Yes – We have modern digital tools	44	61.1%
No – We still use traditional methods	28	38.9%
Total	72	100%

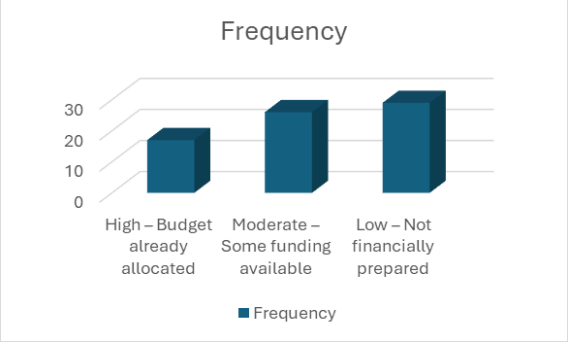
A significant proportion of firms (61.1%) indicated they already use modern digital tools such as BIM or project scheduling software, showing a foundation for adopting AI. However, 38.9% still rely on traditional tools, suggesting that while there is progress, a substantial portion of the industry remains behind technologically. This gap might affect the scalability of AI implementation across the sector.

Table 2: Workforce Skill Level for AI Integration

Skill Readiness Level	Frequency	Percentage (%)
High – We have trained professionals	21	29.2%
Moderate – Training is ongoing	33	45.8%
Low – Skills are inadequate	18	25.0%
Total	72	100%

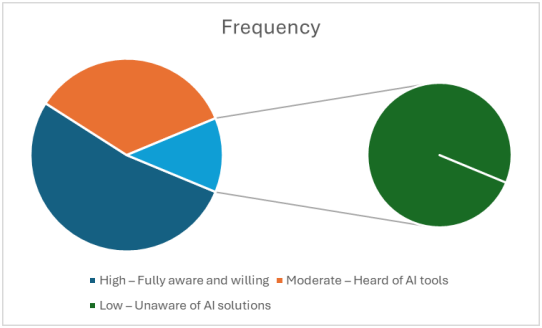
Only 29.2% of firms report having a workforce ready for AI-based tools, while 45.8% are currently undergoing training. A quarter of respondents admitted that their employees lack the skills for AI integration. This indicates that workforce capability remains a major barrier to full-scale AI adoption, underscoring the need for investment in technical education and retraining programs.

Figure 1: Financial Capability to Invest in AI Tools



Only 23.6% of firms have dedicated budgets for AI tools, while the majority (76.4%) are either partially or not financially ready to make investments. This finding highlights the financial limitations as a critical hurdle. Even firms with technological potential may delay AI adoption without adequate budget support or financial incentives.

Figure 2: Awareness and Willingness to Adopt AI



Over half (52.8%) of the respondents are fully aware and willing to adopt AI tools, while another third (34.7%) are moderately aware. Only 12.5% expressed unfamiliarity. This suggests that awareness is relatively high among industry stakeholders, and most firms are mentally ready to embrace AI, if given the right support and tools.

CONCLUSION

This study focused on construction firms to find out how prepared they are to use AI-based project management systems. Some of the indicators included the technology and infrastructure of the firm, the skill set of the employees, financial readiness, awareness levels of the AI-based tools, and perceived challenges. The awareness gap reported by the firms alongside the modest technological readiness presented as some of the challenges the firms are encountering in attempting to adopt technological infrastructure.

In terms of technological readiness, a positive finding was reported by 61.1% of the firms that have digitized some company processes. Such firms form a fair technological base to AI. However, the workforce readiness remains a serious challenge as just 29.2% of the firms reported that their workforce is trained on AI technologies. In addition to the above challenges, the financial readiness reported by more than 76% of the firms as either lacking sufficient funds or marginally financially capable to fully implement AI serves as a critical barrier.

Familiarity with AI tools and the readiness to embrace them was comparatively higher, indicating that the industry recognizes the significance and inevitability of undergoing a digital transformation. However, digital transformation remains hindered by the cost, insufficient proprietary skills, and fears regarding integration with existing systems and the security of data. This analysis indicates that while there is interest and some level of momentum regarding AI integration, the construction industry is only moderately prepared in its current form. Greater industry preparedness will come from a combination of financial aid and support, pilot training programs, and proactive publicity initiatives.

RECOMMENDATIONS

1. Capacity Building Through Training and Workshops.
Professional institutions, private organizations, and government agencies must take the lead in construction industry skills training. Integrating AI modules into Continuing Professional Development (CPD) and tertiary curricula will sharpen workforce readiness.

2. Financial Incentives and Support Schemes.
Government bodies and financial institutions can offer low-interest loans, grants, or tax incentives to construction firms AI-based tools to address the financial hurdle. Smaller firms could also benefit from public-private partnerships to gain access to costly AI tools.

3. Pilot Programs for AI Adoption:
Firms should consider launching small-scale pilot projects to test and familiarize their teams with AI tools before committing to full-scale adoption. This would also serve as a proof-of-concept to stakeholders and clients.

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