

Key Competencies for Effective Project Management in the Context of Digitalization in India



Sherly Christilda D, Kranti Kumar Myneni

Abstract: The construction industry worldwide is experiencing a paradigm shift due to the impact of digitalisation, BIM, AI, IoT, automation, cloud computing, etc. This revolutionises the planning, coordination, and construction approaches currently employed across projects. Nevertheless, India faces challenges, such as fragmented workflows, that may hinder the workforce's ability to fully adapt to the digital revolution. This paper provides an overview of the competencies required in project management in India, in the context of Digitalisation, as opposed to those of the construction industry, and across sectors such as IT, manufacturing, and logistics, which are among the most digitally advanced. A systematic analysis of the available data has identified five distinct areas. These areas are Digital technical competency, Governance competency, digitally enabled project management competency, Behavioural interpersonal competency, and Strategic leadership competency. This study presents a Competency Framework and an Implementation Plan to address the project management industry in India. These findings are significant given the notable shift in the construction industry in India, which is dependent on workforce competency and the establishment of necessary leadership.

Keywords: Digitalization, Project Management, Construction Industry, Competency Framework

Nomenclature:

IT: Information Technology
IoT: Internet of Things

I. INTRODUCTION

The construction industry is at an important juncture in its adoption of new technologies, including BIM, AI, IoT, drone technologies, and cloud environments, to enhance planning, coordination, and decision-making, thereby improving productivity and performance [1]. At this juncture, India is struggling with fragmented processes, low levels of digital literacy, and cultural issues related to the adoption of new technologies [2]. Compared with the construction industry, manufacturing, IT, and logistics exhibit higher levels of digital maturity, particularly in automation, data-driven decision-making, and digital workflows [3]. Against this background, the need to recognise appropriate competencies

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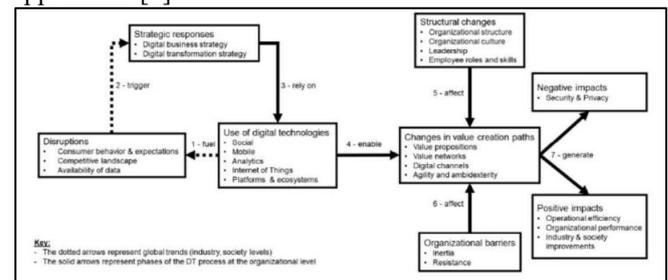
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in Digital Project Management, it assumes significance in the construction industry [4]. Keeping this in perspective, this research aims to develop a competency framework for Digital Project Management and to compare it with its counterparts in technologically advanced industries.

II. LITERATURE REVIEW

A. Digitalization in the Construction Industry

Digitalisation entails moving away from traditional, labour-intensive, paper-based approaches toward data-driven, digital approaches enabled by Industry 4.0 technologies such as IoT, cloud computing, and robotics, which provide real-time information and extensive automation of tasks and processes [5]. It also involves shifting project management from predominantly field-based to more information-based approaches [1].



[Fig.1: Digital Transformation in Construction Industry, [1]]

B. Benefits of Integrating Digital Tools

Also, digital technology has the potential to enhance how projects are planned, managed, and delivered. For example, BIM helps minimise rework in projects [6]. On the other hand, Blockchain technology enhances collaboration [7], and digital twins support predictive maintenance and lifecycle optimisation [8]. Project management is enhanced by shifting from a reactive to a proactive approach.

BIM Capabilities for Project Management	Project Life Cycle					
	Stage 1 Preparation and Briefing Starting Phase	Stage 2 Concept Design	Stage 3 Spatial Coordination Preparing Phase	Stage 4 Technical Design	Stage 5 Manufacturing and Construction Carrying Out Phase	Stage 6 Handover Ending Phase
Collaboration and Communication Based on 3D Visualization	[Active]					
Site Analysis	[Active]					
Phase Planning	[Active]					
Cost Estimation (Quantity/Take-off)	[Active]					
3D Modelling (Architectural, Structural, MEP)	[Active]					
Engineering Analysis (Structural, Lighting, Energy, Mechanical, Other)	[Active]					
Sustainability Analysis	[Active]					
Design Review	[Active]					
Clash Detection	[Active]					
Site Utilization Planning	[Active]					
Construction System Design	[Active]					
Digital Fabrication	[Active]					
Record Model	[Active]					

[Fig.2: Project Efficiency Integrating BIM, [6]]



C. Digital Skill Overlap Between IT and Construction

A strong relationship has been observed between construction digital skills and information technology skills in areas such as data analytics and cybersecurity. Engineering and technology have both been seen in the completion of construction projects.

D. Digitalization's Challenges in the Construction Industry

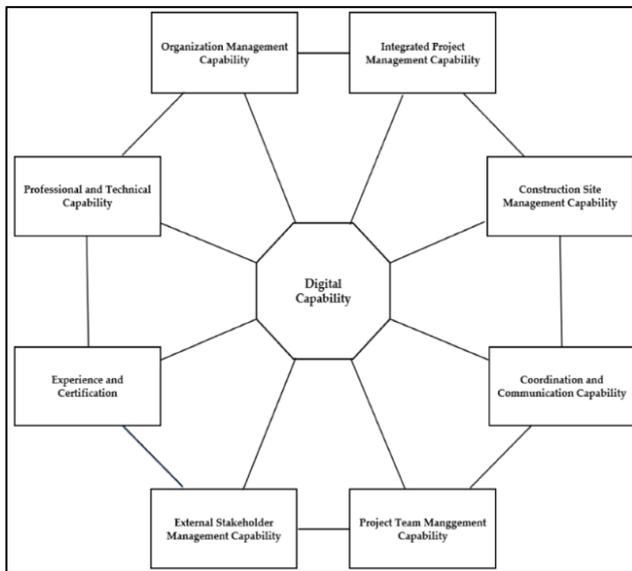
The industry, like any other, faces challenges in its digital transformation, including issues related to attitudes toward organisational change, interoperability, implementation costs, skills, and legal challenges concerning data ownership and cybersecurity [8]. All these issues, therefore, emphasise the importance of building capacity rather than merely using technology.

E. Standards and Policy Frameworks

Standards such as ISO 19650 define a framework for information and collaboration management. Industry studies have highlighted a skills gap, and national digital infrastructure policy recognises that digital transformation is key to business development [2].

F. Essential Competencies for Digital Project Management

Therefore, successful digital project management requires the effective integration of technology, management, strategies, and behaviour, considering factors such as digital and managerial knowledge, analytical thinking, and flexible leadership, particularly in project and collaborative project management [11].

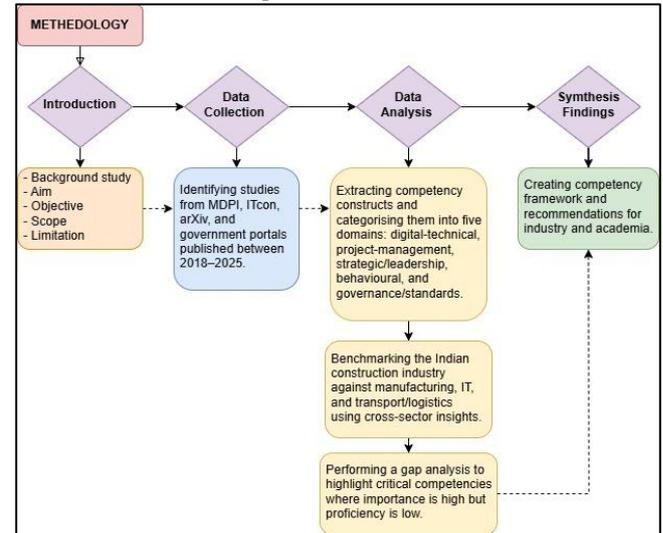


[Fig.3: Diamond Model of PM'S Competencies in Digital Era, Liu et al., 2022]

III. METHODOLOGY

For our research, we conducted a detailed systematic literature search of publications from 2018 to 2025, including scholarly articles, industry reports, and policy briefs. We also examined the transferability of competencies across information technology, manufacturing, and logistics, and conducted a gap analysis of skills lacking in the construction

industry in India. From this, we derived a competence framework and roadmap.



[Fig.4: Methodology Flowchart]

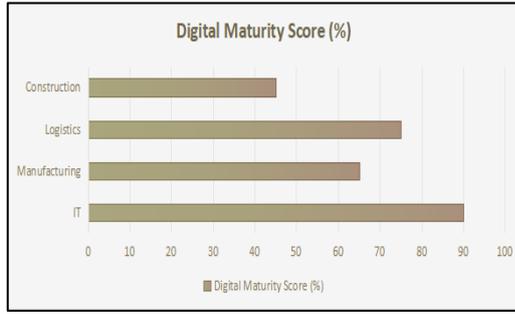
IV. RESULT AND ANALYSIS

A. Cross-Industry Digital Maturity Comparison

Currently, data systems and automation in IT, manufacturing, and logistics are more advanced, placing those sectors higher on the maturity scale. Construction sits in the early to mid-range by contrast [9]. That gap indicates a clear need for the skills that drive digital transformation.

Table I: Overall Digital Maturity Comparison Table

Industry	Digital Maturity / Adoption	Key Technologies & Competency Outcomes
Information Technology (IT)	Very High global AI adoption increased from ~20% in 2017 to ~50% by 2022 and continues to rise [3].	Core competencies include data literacy, AI-driven decision-making, cloud systems management and agile change leadership.
Manufacturing	Approximately 60–66% of firms have adopted at least one Industry 4.0 pillar (i.e., IoT, automation, or analytics).	Competencies focus on process automation, systems integration, robotics and predictive analytics.
Logistics / Transport	High-to-mature rapid digitisation and IoT adoption: most global firms use real-time tracking, cloud logistics, and digital twins to enhance supply-chain visibility [10].	Key skills include data interoperability, cybersecurity, predictive route planning and real-time decision-making.
Construction	Early-to-Mid Maturity, the average construction firm has adopted ~6.2 digital technologies (up from 5.3 the previous year); only a minority are classified as “digital leaders.” Approximately 40% of Indian firms report partial BIM use [2], [9].	Competencies remain in development in BIM, IoT, AI/data analytics, interoperability, and digital procurement.



[Fig.5: Overall Digital Maturity Comparison Graph]

B. Competency Overlap and Differentiation

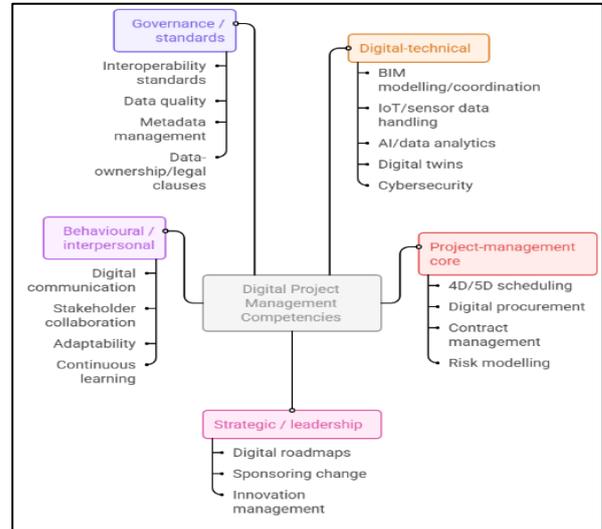
Some key skills are common across sectors, namely data literacy, the ability to relate different systems, security awareness, and the ability to lead change. In the construction industry, key skill gaps identified include a lack of interoperability between systems, poor digital procurement systems, and weak governance skills [10].

Table II: Table of Digital Adoption in Construction

Indicator	Value / Finding	Indicator
Average number of digital technologies used by construction firms	6.2 technologies per firm (up from 5.3 in 2022) [9].	Average number of digital technologies used by construction firms
Proportion of Indian construction firms with partial BIM use	~40 % [2].	Proportion of Indian construction firms with partial BIM use
AI adoption across organizations (global benchmark)	Increased from ~20 % (2017) to ~50 % (2022) [3].	AI adoption across organizations (global benchmark)
Manufacturers adopting at least one Industry 4.0 pillar	60 – 66 % of firms.	Manufacturers adopting at least one Industry 4.0 pillar.

C. Competency Dominance

These have been consolidated into five core skill areas: solid digital technical know-how; proficiency in governance and standards; project management that enables digital outcomes; behavioural and interpersonal skills; and strategic leadership.



[Fig.6: Essential Competency Domains for Digital Project Management]

D. Construction-Specific Gaps

The shortage of digital skills among the construction workforce also results in a shortage of digital skills, including uneven process standardization, unclear data management, weak data integration, and limited digital leadership in the construction industry [9].

Table III: Table of Construction-Specific Gaps in Digitalization

Dimension	IT Industry	Manufactu-ring	Logistics/ Transport	Construction (Gap Identified)
Workforce Digital Literacy	High and uniform	High due to automation	Moderate but improving	Uneven; major deficit at the site workforce level
Process Standardization	Fully standardize	Lean and automated	Protocol-driven workflows	Low standardisation; project-based variability
Data Governance Skills	Strong cybersecuri-ty & IP literacy	Embedded in production systems	Blockchain-enabled traceability	Unclear BIM/IP rights; weak digital ownership awareness
Interoperability Competency	Seamless tool integration	IoT-driven integration	Real-time data linking	Frequent file conflicts; weak ISO 19650 implementation

E. Competency Framework and Implementation Roadmap

We've developed an integrated model that integrates the themes of the five skill areas into a single framework. The

message is clear: upskill personnel, standardise processes, re-engineer digital procurement, empower leaders, and foster a culture of continuous improvement.

Table IV: Table of Construction-Specific Gaps in Digitalization

Stage	What to Do (Focus)	What Will Be Achieved (Output)	How Success Is Measured (KPI)
Capacity Building	Train project teams in digital skills and advanced project management	The workforce can effectively use BIM, IoT, digital tools and PM techniques	% of workforce certified in digital skills
Standardisation & Governance	Apply BIM standards and ISO 19650 protocols in projects	Consistent and standardised digital processes across projects	Number of projects following standardised CDE and protocols
Contract & Procurement Reform	Add digital requirements in contracts and procurement	Contracts ensure data ownership, digital deliverables and compliance	Reduction in disputes; traceability of digital data in contracts
Digital Leadership Enablement	Train leaders to guide digital transformation	Leaders can implement digital change, align policies and drive innovation	% of projects with trained leaders; adoption of digital policies

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V. DISCUSSION

The crux is that digitalisation in construction is about capabilities rather than gadgets and software. Technology is more accessible than ever. Technology is a commodity. Leadership norms within governance structures impede a particular workforce from advancing in digitalisation [3]. Based on our results, our message to you is that growth in digitalisation within India's construction industry, particularly in project management, is a function of skills.

VI. CONCLUSION

The article emphasises the skill sets that require consideration for effective project management in India as the digital revolution takes hold, as well as guideline parameters. The central message of this article and potential future surveys is the need to integrate technology with good governance, behavioural understanding, and leadership in project management in the digital age. The key skill sets that need to be developed in the workforce are training, digital standards, and digital leadership.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

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- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
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AUTHOR'S PROFILE



Sherly Christilda D., an architecture graduate and a postgraduate student majoring in building engineering and construction management. I am currently pursuing the Master of Building Engineering and Management (2024-2026) at the School of Planning and Architecture, Vijayawada, and completed the Bachelor of Architecture (2017-2022) from Ranganathan Architecture College, Coimbatore. My research interests are focused on construction planning and scheduling, fast-track project delivery, project coordination, and sustainable construction practices. I have also acquired industry experience through professional engagement with architectural and project development firms. I worked as a Project Development Service Intern at Cushman & Wakefield, Hyderabad, where I was involved in material handling, logistics planning, quality control, safety management, and project documentation. Before that, I worked as a Junior Architect at Cynosure Architects in Chennai, where I was involved in drafting, 3D modelling, BOQ preparation, and coordination across various stages of project design and execution. I also completed an architectural internship at Sacred Groves in Auroville, where I gained experience in sustainable construction practices, eco-friendly materials, site analysis, and community-driven design approaches. During my undergraduate program, I worked with Coimbatore Smart City and the Institute for Transportation and Development Policy (ITDP) on a non-motorised corridor development project, thus expanding my knowledge of urban planning and sustainable mobility. I also worked on projects for the Tamil Nadu Tourism Development Corporation (TTDC) and the Public Works Department (PWD), thereby gaining experience in government-driven project implementation. I have also completed professional training in Building Information Modelling (Revit) and have participated in workshops on MS Project, BIM, sustainable development, and construction technology. This paper marks the beginning of my scholarly publishing career and is a result of my ever-growing interest in construction management and sustainable built environments.



Dr. Kranti Kumar Myneni received a B. Arch degree from JNTU, Hyderabad, Telangana, India, in 2001, pursued a Master's (M.Sc.) in Construction Management at South Bank University, London, in 2003, and received a doctorate from the School of Planning and Architecture, Vijayawada. Currently working as an Assistant Professor in the School of Planning and Architecture, Vijayawada. Member of the Council of Architecture and a Fellow member of the Indian Institute of Architects. Published nearly 40 articles and presented papers at 5 international conferences. 3 chapters

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