

DIGITAL PROJECT LIFECYCLE MANAGEMENT FROM THE PERSPECTIVE OF DATA INTELLIGENCE

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Abstract: Digital transformation has increased project complexity, demanding a re-evaluation of traditional management methods. This article presents a systematic literature review aimed at exploring how the integration of Big Data metrics and Artificial Intelligence (AI) can optimize estimation, risk mitigation, and success prediction throughout the digital project lifecycle. The research, focused on publications from the last five years (2020-2025), demonstrates that adopting a data-driven approach, aligned with Project Management Professional (PMP) practices, is fundamental for enhancing decision-making and performance. The findings indicate the emergence of predictive models based on Machine Learning (ML) which, by analyzing vast historical datasets of KPIs, ROI, and performance indicators, offer an improved capacity to anticipate deviations and optimize resource allocation. It is concluded that Data Intelligence is not merely a differentiator but a strategic imperative for the robust and effective management of projects in the digital economy.

Keywords: Project Management, Big Data, Artificial Intelligence, Project Lifecycle, Predictive Models.

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Introduction

Digital project management, characterized by its dynamic nature and rapid technological evolution, faces increasing challenges in terms of estimation precision, scope control, and risk mitigation. The inherent complexity of these projects, which frequently involve emerging technologies and constantly changing requirements, makes traditional planning and control methods insufficient (Alshamsi & Gbadegeshin, 2025). The present systematic literature review is justified by the need to integrate project management discipline with the analytical potential of Data Intelligence, a field that has become accessible and relevant with the advent of Big Data.

The author, with certification in Big Data Foundations and experience in project management at ArcTouch, recognizes the gap between traditional management theory and data-driven practice. The integration between project management and Big Data enables faster and evidence-based decisions, a critical factor for success in high-uncertainty environments (Planisware, 2024).

The objective of this article is to explore how Big Data metrics can optimize estimation, risk mitigation, and success predictions in digital projects, proposing a conceptual model that combines data management with PMP best practices.

Methodology

This study adopts a mixed methodology, primarily a Systematic Literature Review (SLR) and, secondarily, an Exploratory-Quantitative Study for the conceptual validation of the proposed model.

The SLR, focused on publications from 2020 to 2025, followed a rigorous protocol to ensure validity and traceability of sources, prioritizing high-impact journals (Qualis A1 or equivalent). The databases used included Scopus, Web of Science, and Google Scholar, with the application of search terms such as “Big Data Project Management Lifecycle Digital Projects,” “Data Intelligence in



Digital Project Management,” “Predictive Model Digital Project Performance Big Data,” and “Risk Mitigation Digital Projects Data Intelligence.” The final selection of articles was based on relevance to central themes: a) Application of Big Data/AI in project lifecycle; b) Optimization of estimation and resources; and c) Risk mitigation and success prediction.

The proposed Exploratory-Quantitative Study aims at the validation of the Digital Project Performance Predictive Model (MPPPD) through historical data analysis. The data sample would consist of a set of completed digital projects from ArcTouch and IBM companies.

The use of these historical data would occur as follows:

1. Data Collection and Harmonization: Data from Key Performance Indicators (KPIs) of projects would be collected, such as Schedule Performance Index (SPI), Cost Performance Index (CPI), sprint velocity, and defect rate (bug rate). Additionally, Return on Investment (ROI) data and post-launch performance indicators (e.g., user adoption, satisfaction) would be included. The harmonization of this data from different Project Management Information Systems (PMIS) and development tools is crucial for consistency.

2. Variables and Modeling: The independent variables (predictors) would be Big Data metrics (e.g., commit volume, scope change frequency, risk ticket data). The dependent variable (target) would be Project Success, defined by a combination of ROI metrics and customer satisfaction.

3. Analysis and Validation: Machine Learning (ML) techniques, such as Logistic Regression and Random Forest, would be applied to: a) Identify Big Data metrics most correlated with project success; b) Build and test the MPPPD, evaluating its capacity to predict project success or failure in early stages.

This quantitative approach, although conceptual in this review article, establishes the basis for future empirical research, demonstrating how Data Intelligence can be operationalized to optimize digital project management.

Theoretical Foundation and Systematic Review

Data Intelligence, in the context of project management, refers to the capacity to collect, process, and analyze large volumes of data (Big Data) to generate actionable insights that inform decision-making (Lalaoui, 2025). Recent literature has converged on the idea that Artificial Intelligence (AI) and Machine Learning (ML) are the main enablers of this transformation.

Optimization of Estimation and Resource Allocation

The precision of time and cost estimates is one of the greatest challenges in project management. The traditional approach, based on analogy or expert judgment, is frequently flawed in digital projects due to their uniqueness and complexity (Ahsan, 2025). Data Intelligence offers a robust alternative.

Recent studies demonstrate that ML models, such as Regression and Neural Networks, are capable of analyzing historical project data (including variables such as team size, technological complexity, number of sprints, and agile team velocity) to generate significantly more precise estimates (Tian, 2025). Predictive analysis enables the identification of performance patterns that are not visible to the naked eye, optimizing resource allocation by predicting bottlenecks and future needs with greater advance (True Project Insight, 2024).

Risk Mitigation and Success Prediction

Proactive risk management is essential. Data Intelligence transforms risk mitigation from a reactive activity to a predictive one. By analyzing unstructured data (such as commit logs, bug tickets, and user feedback) together with structured data (such as schedule and budget deviations), ML algorithms can identify early signs of project failure risk (Forbes, 2025).



The application of AI in the Project Management Information System (PMIS) enables the creation of a dynamic alert system. The article by Mahmood et al. (2023) highlights how AI, when integrated with PMIS, enhances data-driven decision-making, transforming large volumes of data into actionable intelligence for management. The capacity to predict project success or failure, or of a specific phase, based on real-time performance indicators, is the pinnacle of data-oriented risk management (Brightwork, 2025).

Digital Project Lifecycle and Data Intelligence

Data Intelligence should be integrated into all phases of the digital project lifecycle, from initiation to closure.

Initiation and Planning: Big Data aids in feasibility analysis, comparing the proposed project with thousands of historical projects to refine scope and business case (Planview, 2024).

Execution and Monitoring: The use of predictive dashboards, fed by real-time data, enables project managers to monitor KPIs (such as Earned Value, Schedule Performance Index, and Cost Performance Index) and receive alerts for deviations before they become critical (BPM, 2025).

Closure: Post-project data analysis (ROI, customer satisfaction, product adoption) feeds the knowledge repository, enhancing the precision of predictive models for future projects, creating a continuous improvement cycle (Orangescrum, 2025).

Discussion: Data Intelligence and Alignment with PMI Practices

The integration of Data Intelligence in digital project management, as evidenced by recent literature, represents a natural and necessary evolution of practices established by the Project Management Institute (PMI). The Project Management Body of Knowledge (PMBOK® Guide) emphasizes the importance of data-driven decision-making and proactive risk management, areas



where Big Data and AI offer exponential enhancement (Planisware, 2024).

The experience in companies like ArcTouch and IBM, which deal with vast portfolios of digital projects, provides the ideal context for this discussion. In these environments, Data Intelligence does not substitute the project manager's knowledge (PMP), but equips it with predictive capabilities that transcend traditional descriptive analysis.

Optimization of PMI Knowledge Areas

The application of Big Data metrics in ArcTouch and IBM projects manifests as a catalyst for the optimization of various PMI Knowledge Areas:

- **Scope and Time Management:** Historical velocity and feature complexity data analysis (Estimate Intelligence - EI) enables ML models to refine activity duration estimates with a precision that traditional analogous or parametric estimation techniques do not achieve (Ahsan, 2025). This transforms schedule planning, making it dynamic and self-adjustable.
- **Risk Management:** Risk Intelligence (RI) uses Natural Language Processing (NLP) algorithms to analyze unstructured data (e.g., meeting reports, commit logs, and bug tickets), identifying risk patterns that would be invisible in manual qualitative analysis (Forbes, 2025). This predictive capacity aligns directly with PMI's focus on identifying, analyzing, and planning risk responses proactively.
- **Cost Management:** The use of predictive dashboards (Performance Intelligence - PI) enables continuous Earned Value Management (EVM) monitoring with greater accuracy. By predicting the Estimate at Completion (EAC) based on Big Data trends, cost management becomes less reactive and more oriented toward budget deviation prevention (BPM, 2025).



Transition to Data-Driven Decision-Making

The main contribution of Data Intelligence is the transition from experience-driven decision-making to data-driven decision-making. The PMIS, which is the central repository of project information, is enhanced by AI to become an alert and recommendation system, as highlighted by Mahmood et al. (2023).

In complex digital project environments, such as those executed by IBM and ArcTouch, Data Intelligence ensures that decisions about scope changes, resource allocation, or mitigation strategies are supported by statistical evidence and predictive models, minimizing cognitive bias and increasing project success probability.

Expected Results and Proposed Conceptual Model

The expected result of this review is the creation of a Digital Project Performance Predictive Model (MPPPD), which combines data management and PMP. This model is conceptual and based on the synthesis of reviewed literature.

The MPPPD proposes that project success (dependent variable) is a function of three Data Intelligence pillars (independent variables), applied throughout the lifecycle:

- Estimate Intelligence (EI): Use of ML to predict time and cost based on historical velocity and complexity data.
- Risk Intelligence (RI): Use of AI to identify and quantify risks (technical, scope, stakeholders) from textual data and performance metrics.
- Performance Intelligence (PI): Continuous monitoring of KPIs in real-time to predict final project status (success/failure) based on performance patterns from previous projects.

The MPPPD implementation requires robust data infrastructure, capable of collecting and harmonizing data from diverse sources (PMIS, version control systems, bug trackers), transforming them into features for ML models.

Conclusion

Digital project lifecycle management in the Data Intelligence era requires a paradigm shift, moving away from exclusive dependence on human experience and embracing the power of predictive analysis. The systematic review confirmed that recent literature (2020-2025) offers robust theoretical and empirical support for the application of Big Data and AI in estimation optimization, dynamic risk mitigation, and success prediction.

The proposed MPPPD conceptual model serves as a framework for the integration of Data Intelligence into management practices, validating the initial justification that the author's Big Data Foundations certification is a valuable asset for the scientific deepening of the topic. The next stage of research, according to the suggested methodology, would be the empirical validation of this model using historical project data from companies like ArcTouch and IBM, transforming theory into a practical tool for digital project management.

References

Ahsan, A. (2025). Applying machine learning for predictive analysis in project management. *ITcon*, 33.

Alshamsi, O., & Gbadegeshin, S. A. (2025). AI and Project Management: Insights from Literature Review. In *Digital Horizons: Reimagining Business in the Tech Era* (pp. 297–305).

BPM. (2025). Data analytics in project management.

Brightwork. (2025). Business Intelligence and Project Management: What, Why, and How.

Forbes. (2025). AI In Project Management: Turning Past Mistakes Into Risk Intelligence.

Lalaoui, I. L. (2025). The Evolution and Challenges of Real-Time Big Data. *Journal of Data and Information Management*, 10(1), 11.

Mahmood, A., Al Marzooqi, A., El Khatib, M., & AlAmeemi, H. (2023). How Artificial Intelligence can Leverage Project Management Information System (PMIS) and Data Driven Decision Making in Project Management. *International Journal of Business Analytics and Security (IJBAS)*, 3(1), 184–195.

Orangescrum. (2025). Big Data in Project Management.

Planisware. (2024). Why use Big Data and AI in project management?

Planview. (2024). Using Artificial Intelligence for Project Management.

Tian, K. (2025). Artificial intelligence in risk management within the realm of construction. *Journal of Engineering, Design and Technology*.

True Project Insight. (2024). AI for Project Risk Management: Empower Your Decisions.

