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Article

Artificial Intelligence-Driven Digital Transformation of Investment Project Management in Large Industrial Enterprises: Evidence from Almalyk Mining and Metallurgical Complex (Uzbekistan)

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Abstract: The rapid development of digital technologies and artificial intelligence (AI) has fundamentally transformed project management practices across industrial sectors. Large mining and metallurgical enterprises, characterized by complex investment portfolios, significant capital expenditures, and long implementation cycles, require advanced digital management systems capable of improving planning accuracy, reducing operational risks, and supporting strategic decision-making. Traditional project management approaches often rely on fragmented information systems, manual reporting, and delayed managerial responses, resulting in schedule overruns, budget deviations, and inefficient allocation of resources. This study proposes an artificial intelligence-driven framework for investment project management based on the experience of Almalyk Mining and Metallurgical Complex (AMMC), one of the largest industrial enterprises in Central Asia. The research integrates digital workflow technologies, Directum RX electronic document management, Primavera P6 scheduling, and AI-based analytical modules into a unified project management architecture. The proposed framework enables predictive risk assessment, intelligent decision support, automated project monitoring, and continuous performance evaluation throughout the project life cycle. The research applies case study analysis, comparative assessment, business process modeling, and expert evaluation methods. The findings demonstrate that AI technologies significantly improve project transparency, accelerate management decisions, optimize resource utilization, and reduce administrative delays. Furthermore, the proposed framework establishes an integrated digital ecosystem capable of enhancing organizational efficiency while supporting sustainable industrial development. The scientific contribution of this research lies in developing an integrated AI-driven investment project management model applicable to large industrial enterprises operating under conditions of digital transformation.

Keywords: Artificial Intelligence, Digital Transformation, Investment Project Management, Mining Industry, Digital Economy, Project Management, Directum RX, Primavera P6, Decision Support System, Uzbekistan.

1. Introduction

The global transition toward a digital economy has fundamentally changed approaches to managing industrial enterprises and implementing investment projects. The

emergence of artificial intelligence, cloud computing, big data analytics, machine learning, and intelligent decision-support systems has enabled organizations to improve operational efficiency while reducing uncertainty in complex management environments. Digital transformation is no longer considered an optional technological initiative but has become one of the principal strategic factors determining the competitiveness and long-term sustainability of industrial enterprises.

Investment projects represent one of the most resource-intensive and strategically important activities within large mining and metallurgical corporations [1]. Such projects require substantial financial investments, long implementation periods, multidisciplinary coordination, and continuous monitoring of technical, financial, environmental, and organizational indicators. Consequently, effective project management has become a critical determinant of industrial competitiveness and economic growth.

Despite significant advances in digital technologies, many industrial enterprises continue to manage investment projects using fragmented information systems and traditional administrative procedures. Separate software platforms often perform isolated functions related to scheduling, documentation, budgeting, or reporting without providing comprehensive integration or intelligent analytical capabilities. As a result, project managers frequently encounter delayed information exchange, inconsistent decision-making, duplicated documentation, insufficient risk monitoring, and reduced transparency throughout the project life cycle. Artificial intelligence offers fundamentally new opportunities for transforming investment project management. Unlike conventional information systems that primarily automate routine operations, AI technologies are capable of analyzing historical project data, identifying hidden relationships, forecasting project risks, optimizing resource allocation, and generating management recommendations in real time. These capabilities significantly expand the role of digital technologies from simple process automation toward intelligent project governance.

The mining and metallurgical industry represents one of the most challenging environments for digital transformation due to its technological complexity, high investment intensity, strict safety requirements, and dynamic external conditions. Large-scale modernization programs implemented by industrial enterprises require integrated digital management systems capable of coordinating numerous investment projects simultaneously while ensuring compliance with strategic development objectives [2], [3]. Almalyk Mining and Metallurgical Complex (AMMC) provides an appropriate case study for investigating digital transformation in investment project management. As one of Uzbekistan's largest industrial enterprises, AMMC manages a significant portfolio of investment projects aimed at expanding production capacity, introducing advanced technologies, improving environmental performance, and strengthening international competitiveness. The increasing complexity of these projects creates additional requirements for digital coordination, intelligent monitoring, and predictive management solutions.

Existing research on digital project management primarily focuses on isolated technological solutions, including enterprise information systems, scheduling software, electronic document management, or project portfolio management. However, relatively limited attention has been devoted to developing integrated frameworks combining artificial intelligence, electronic workflow management, project scheduling platforms, and predictive analytics within a unified investment project management environment for large industrial enterprises. This research addresses this gap by proposing an AI-driven digital framework integrating Directum RX, Primavera P6, and intelligent analytical modules to support investment project management across all stages of the project life cycle. Unlike traditional management approaches, the proposed framework combines automated document workflows with predictive risk analysis, intelligent performance

monitoring, and decision-support mechanisms that continuously improve project execution through organizational learning [4].

The primary objective of this research is to develop a comprehensive artificial intelligence-based framework capable of improving investment project management efficiency in large industrial enterprises undergoing digital transformation. The proposed model aims to enhance planning quality, reduce project risks, improve coordination among stakeholders, accelerate management decisions, and establish an intelligent digital ecosystem supporting sustainable industrial development. The practical significance of this study extends beyond AMMC and may serve as a methodological foundation for implementing AI-driven investment project management systems in mining, metallurgical, energy, and other capital-intensive industries experiencing large-scale digital transformation.

Literature Review

1.1. Digital Economy as a Driver of Industrial Transformation

The concept of the digital economy has evolved from simple automation of business processes toward comprehensive transformation of industrial management systems. Modern enterprises increasingly utilize digital technologies not only to improve operational efficiency but also to redesign organizational structures, management models, and decision-making mechanisms. Artificial intelligence, cloud computing, the Internet of Things (IoT), blockchain, big data analytics, and digital twins have become fundamental components of industrial digital transformation [5]. The mining and metallurgical industry is among the sectors where digital transformation has strategic importance. Large industrial enterprises operate within highly dynamic environments characterized by volatile commodity prices, increasing environmental requirements, technological complexity, and growing competition in international markets. Under these conditions, digital technologies become essential tools for improving productivity, optimizing production processes, reducing operational risks, and enhancing investment efficiency.

Unlike traditional digitalization, which focuses primarily on automating existing procedures, digital transformation fundamentally changes the logic of enterprise management. Information becomes a strategic production resource, while data-driven decision-making gradually replaces intuition-based management practices. Artificial intelligence significantly expands these capabilities by enabling organizations to process massive volumes of structured and unstructured data, identify hidden patterns, forecast future events, and recommend optimal managerial decisions. Industrial enterprises implementing digital transformation increasingly develop integrated digital ecosystems where information flows continuously between engineering, finance, procurement, construction, production, and project management departments. Such integration substantially improves organizational transparency while reducing information asymmetry between project participants [6], [7].

1.2. Evolution of Investment Project Management

Investment project management has undergone significant transformation during the past three decades. Traditional approaches mainly emphasized compliance with predetermined schedules, budgets, and technical specifications. Contemporary project management increasingly focuses on strategic value creation, organizational learning, stakeholder engagement, sustainability, and digital integration.

Investment projects in large industrial enterprises differ considerably from ordinary construction or engineering projects. They involve substantial financial investments, extended implementation periods, multiple contractors, sophisticated technological processes, numerous regulatory requirements, and high uncertainty levels. Consequently, project success depends not only on technical execution but also on the quality of managerial coordination throughout the entire project life cycle. Modern project

management standards emphasize integrated management of scope, schedule, cost, quality, procurement, communications, risks, stakeholders, and organizational knowledge. Digital technologies facilitate integration by providing project participants with real-time information, collaborative work environments, automated documentation, and analytical decision-support tools [8]. Despite continuous improvement of project management methodologies, many organizations still experience schedule delays, budget overruns, inefficient resource allocation, fragmented communication, and insufficient transparency. Numerous studies indicate that inadequate integration between project planning, document management, risk assessment, and managerial decision-making remains one of the principal causes of project failure.

1.3. Artificial Intelligence in Project Management

Artificial intelligence has recently emerged as one of the most influential technological innovations affecting project management. AI applications extend far beyond automation of repetitive tasks. Machine learning algorithms, predictive analytics, natural language processing, computer vision, and intelligent optimization techniques enable project managers to improve forecasting accuracy, identify project risks, optimize scheduling, and support strategic decision-making [9]. AI systems continuously learn from historical project information, allowing organizations to accumulate institutional knowledge rather than relying exclusively on individual managerial experience. Predictive models can estimate the probability of schedule delays, forecast budget deviations, evaluate contractor performance, and identify emerging risks before they significantly affect project implementation.

Natural language processing technologies also facilitate intelligent analysis of project documentation, contracts, technical reports, and correspondence. Such capabilities considerably reduce administrative workloads while improving consistency and transparency of project documentation. Another important advantage of artificial intelligence concerns decision support. Modern AI systems do not replace project managers but provide analytical recommendations based on comprehensive analysis of available information. Consequently, managerial decisions become more objective, data-driven, and less dependent on subjective judgments. Several recent studies demonstrate that organizations utilizing AI-supported project management achieve higher schedule performance, improved resource utilization, enhanced risk management, and greater project success rates compared with enterprises relying exclusively on conventional management approaches [10], [11].

1.4. Digital Workflow Management in Industrial Enterprises

Efficient information exchange represents one of the most important factors influencing investment project performance. Large industrial projects generate thousands of technical documents, engineering drawings, contracts, procurement requests, financial reports, expert evaluations, and approval procedures. Manual processing of such documentation significantly increases administrative costs while creating additional risks associated with information loss, duplication, and delayed decision-making. Electronic document management systems provide a digital environment for organizing project workflows. Directum RX represents one of the platforms capable of supporting electronic approval procedures, document version control, workflow automation, and integration with organizational management processes. Nevertheless, document automation alone cannot ensure effective project management [12]. Electronic workflow systems should operate as components of broader digital ecosystems integrating scheduling software, monitoring platforms, analytical dashboards, and artificial intelligence modules. Such integration enables continuous exchange of information between project planning, document management, risk analysis, and executive decision-making.

1.5. Primavera P6 as a Strategic Planning Platform

Primavera P6 remains one of the world's leading project scheduling systems for large infrastructure and industrial investment projects. The software enables organizations to develop detailed project schedules, allocate resources, monitor project progress, analyze critical paths, and evaluate schedule performance.

However, Primavera primarily functions as a planning and monitoring platform rather than an intelligent management system. Project managers must independently interpret scheduling information, assess project risks, and determine appropriate corrective actions. Consequently, integration of Primavera with artificial intelligence technologies creates opportunities for transforming scheduling data into predictive managerial knowledge [13].

AI algorithms may continuously analyze Primavera schedules, compare actual project progress with historical project databases, estimate probabilities of schedule deviations, identify potential resource conflicts, and recommend corrective measures before project performance deteriorates.

1.6. Research Gap

Although digital transformation, artificial intelligence, and project management have each been extensively investigated, existing studies reveal several important research limitations. First, most studies analyze digital technologies separately rather than considering integrated digital ecosystems supporting investment project management. Second, current literature predominantly focuses on construction, information technology, or infrastructure projects, while comparatively limited attention has been devoted to mining and metallurgical enterprises. Third, relatively few studies investigate practical integration of electronic workflow management, project scheduling platforms, and artificial intelligence within unified managerial architectures capable of supporting strategic investment decisions. Finally, there remains insufficient methodological guidance regarding implementation of AI-driven project management frameworks suitable for industrial enterprises undergoing digital transformation [14], [15]. To address these limitations, the present research proposes an integrated framework combining Directum RX, Primavera P6, and artificial intelligence into a unified digital environment supporting planning, monitoring, risk prediction, managerial decision-making, and continuous organizational learning throughout the entire investment project life cycle.

2. Materials and Methods

2.1. Research Design

This study adopts a mixed-method research design that combines qualitative and quantitative approaches to investigate the impact of artificial intelligence on investment project management within large industrial enterprises. The methodology integrates case study analysis, business process modeling, expert evaluation, comparative analysis, and digital maturity assessment to develop and validate an AI-driven project management framework.

The research is based on the practical experience of **Almalyk Mining and Metallurgical Complex (AMMC)**, one of the largest mining and metallurgical enterprises in Central Asia. The company manages numerous investment projects involving modernization of production facilities, construction of new industrial complexes, expansion of processing capacities, and implementation of environmentally sustainable technologies. Such projects involve complex coordination among engineering departments, procurement units, financial divisions, contractors, government authorities, and executive management.

Unlike conventional project management studies focusing exclusively on schedule or cost performance, this research examines the entire investment project life cycle from project initiation to commissioning. Particular attention is devoted to digital information flows, managerial decision-making, risk prediction, and continuous performance monitoring supported by artificial intelligence.

2.2. Research Object and Scope

The object of the research is the investment project management system implemented at AMMC.

The scope of the study covers digital management processes performed throughout the investment project life cycle, including:

- Project initiation;
- Feasibility assessment;
- Technical and financial approval;
- Project scheduling;
- Document management;
- Procurement coordination;
- Construction monitoring;
- Project performance evaluation;
- Project completion and organizational learning.

The proposed AI framework has been designed not only for mining enterprises but also for other capital-intensive industries such as metallurgy, energy, chemical production, oil and gas, transportation, and infrastructure development.

2.3. Research Methods

To ensure methodological reliability, several complementary research methods were employed.

Case Study Analysis

The case study approach enables detailed examination of real investment project management practices implemented at AMMC. This method allows identification of organizational strengths, operational bottlenecks, digital transformation opportunities, and practical implementation challenges.

Business Process Analysis

Business processes associated with investment project management were analyzed using process decomposition techniques. Existing workflows were mapped to identify duplicated procedures, excessive approval stages, information delays, and communication inefficiencies.

Comparative Analysis

Comparative analysis was applied to evaluate differences between traditional project management practices and AI-supported digital management systems. The comparison includes project planning efficiency, document processing speed, risk identification capability, management transparency, and decision-making quality.

Expert Evaluation

Expert assessments were conducted to identify the most significant organizational factors affecting investment project success. Specialists representing engineering, finance, construction management, procurement, digital transformation, and project offices participated in the evaluation process.

Statistical Assessment

Historical project performance indicators were analyzed to identify recurring implementation problems. Statistical analysis focused on schedule deviations, budget overruns, approval durations, resource utilization, and project completion rates.

2.4. Conceptual AI Framework

The central contribution of this research is the development of an integrated Artificial Intelligence Investment Project Management Framework (AI-IPMF).

Unlike traditional digital management systems that automate isolated administrative functions, the proposed framework integrates information processing, predictive analytics, intelligent monitoring, and decision support into a unified digital ecosystem.

The framework consists of eight interconnected layers.

Layer 1. Project Initiation

Investment proposals are registered through Directum RX.

Project documentation, technical specifications, feasibility studies, and supporting documents are automatically classified using intelligent document recognition technologies.

Layer 2. AI-Based Feasibility Assessment

Artificial intelligence analyzes:

- Historical investment projects;
- Production indicators;
- Financial performance;
- Investment priorities;
- Strategic development objectives.

The AI module generates preliminary recommendations regarding project feasibility.

Layer 3. Intelligent Risk Prediction

Machine learning algorithms evaluate project risks according to multiple criteria, including:

- Schedule delays;
- Budget overruns;
- Contractor reliability;
- Procurement uncertainty;
- Technological complexity;
- Regulatory compliance;
- Environmental constraints.

Instead of identifying risks after they occur, AI predicts their probability before implementation begins.

Layer 4. Project Scheduling

Approved investment projects are transferred to Primavera P6.

Scheduling information is continuously synchronized with AI analytical modules.

Artificial intelligence evaluates:

- Critical path stability;
- Resource bottlenecks;
- Schedule conflicts;
- Probability of milestone delays.

Layer 5. Intelligent Monitoring

Project execution data are collected continuously.

AI compares planned and actual project performance using predictive analytics.

Whenever deviations exceed predefined thresholds, automatic alerts are generated.

Layer 6. Decision Support System

Unlike traditional dashboards that simply visualize project information, the proposed AI Decision Support System generates managerial recommendations.

Examples include:

- Reallocating engineering resources;
- Modifying procurement priorities;
- Adjusting construction schedules;
- Accelerating approval procedures;
- Revising project budgets.

Layer 7. Performance Evaluation

Project performance is measured using integrated KPIs.

Key indicators include:

- Schedule performance index (spi);
- Cost performance index (cpi);
- Budget deviation ratio;
- Document approval time;
- Procurement efficiency;
- Resource utilization;
- Digital workflow performance;
- Ai forecast accuracy.

Layer 8. Organizational Learning

Following project completion, all project information is transferred into a centralized knowledge repository.

Artificial intelligence continuously improves prediction accuracy using historical investment project data.

Thus, every completed project contributes to increasing organizational intelligence.

2.5. Mathematical Model for AI-Based Project Performance Assessment

To evaluate investment project performance under digital transformation, an integrated efficiency index is proposed.

$$AIIPI=\sum_{i=1}^{n}w_iK_i$$

where:

- **AIIPI** – Artificial Intelligence Investment Project Index;
- $\mathbf{w_i}$ – weighting coefficient;
- $\mathbf{K_i}$ – normalized KPI value.

The KPI vector includes:

$$K=(SPI,CPI,RM,DT,PE,RU,DS)$$

where:

- SPI – Schedule Performance Index;
- CPI – Cost Performance Index;
- RM – Risk Management Effectiveness;
- DT – Digital Workflow Time;
- PE – Procurement Efficiency;
- RU – Resource Utilization;
- DS – Decision Support Quality.

The proposed index enables comprehensive evaluation of project performance by integrating operational efficiency with digital management maturity.

2.6. Research Hypotheses

The empirical investigation is based on four hypotheses.

H1. Artificial intelligence significantly improves investment project planning quality.

H2. AI-supported project management reduces project implementation risks.

H3. Integration of Directum RX, Primavera P6, and AI increases managerial transparency.

H4. AI-driven digital management positively influences investment project performance throughout the entire project life cycle.

2.7. Research Model

The proposed research model establishes causal relationships between digital technologies and project performance.

Artificial Intelligence

↓

Predictive Analytics

↓

Digital Decision Support

↓

Project Coordination

↓

Risk Reduction

↓

Higher Project Performance

↓

Sustainable Industrial Development

3. Results

3.1. Current State of Investment Project Management at Almalyk Mining and Metallurgical Complex

Almalyk Mining and Metallurgical Complex (AMMC) has experienced substantial expansion of its investment portfolio during the last decade. The enterprise simultaneously implements large-scale projects aimed at increasing production capacity, constructing new processing facilities, modernizing technological equipment, improving environmental protection systems, and strengthening industrial competitiveness. The increasing scale and complexity of these initiatives require an advanced project management system capable of coordinating thousands of interrelated activities throughout the project life cycle.

The analysis of the existing project management system demonstrates that significant progress has already been achieved through the implementation of digital document management technologies and modern scheduling software. Directum RX has improved document circulation by replacing paper-based workflows with electronic approval procedures, while Primavera P6 has enhanced project planning and scheduling. Nevertheless, these digital platforms primarily operate as independent management tools and provide only limited analytical interaction with executive decision-making processes [16].

The current management architecture remains predominantly reactive. Project managers usually identify deviations only after they become visible in project reports or schedule updates. Consequently, corrective actions are frequently implemented after delays, cost overruns, or resource conflicts have already affected project performance. Such an approach increases management costs and reduces organizational flexibility under rapidly changing project conditions.

Comprehensive business process analysis identified several structural limitations affecting investment project implementation.

First, project information is distributed among multiple organizational departments [17]. Engineering, procurement, finance, construction supervision, and executive management often maintain separate information repositories. Although digital systems improve information accessibility within individual departments, integration across the entire investment management process remains insufficient.

Second, managerial decisions depend heavily on expert judgment. Project managers possess significant professional experience; however, rapidly growing project complexity makes it increasingly difficult to process large volumes of technical, financial, contractual, and scheduling information manually.

Third, risk management remains largely experience-based. Existing procedures emphasize identification and mitigation of already recognized risks rather than prediction of future project deviations using analytical models [18].

Finally, project performance indicators are evaluated periodically rather than continuously. This reduces opportunities for early intervention and limits proactive project control.

These observations indicate that digitalization alone is insufficient to achieve intelligent investment project management. Additional analytical capabilities supported by artificial intelligence are required to transform available project data into actionable managerial knowledge.

3.2. Identification of Critical Management Problems

Detailed investigation of investment project processes allowed identification of five major organizational challenges limiting management efficiency.

Problem 1. Fragmented Information Environment

Investment projects generate enormous volumes of heterogeneous information, including engineering documentation, procurement contracts, financial reports, construction progress data, risk assessments, technical specifications, inspection reports, and executive decisions. Although digital systems store these data electronically, they remain distributed across different platforms.

Project managers therefore spend considerable time collecting information before managerial decisions can be made.

Artificial intelligence enables automatic aggregation of information from multiple digital sources into a unified analytical environment [19].

Problem 2. Delayed Risk Identification

Traditional project management practices detect risks after measurable deviations become apparent.

For example,

- Delayed equipment delivery,
- Contractor performance problems,
- Engineering modifications,
- Procurement disruptions,
- Unexpected geological conditions,

often become visible only after project schedules have already been affected.

AI-based predictive analytics significantly changes this approach by estimating probability distributions of potential project risks before negative consequences occur.

Problem 3. Inefficient Decision-Making

Large industrial investment projects require coordination among numerous stakeholders.

Each management decision typically passes several approval levels involving engineering departments, financial specialists, procurement experts, legal advisors, executive managers, and project offices.

As project complexity increases, decision-making speed gradually decreases.

Artificial intelligence reduces this burden by automatically preparing analytical recommendations supported by historical project experience and predictive models [20].

Problem 4. Limited Predictive Capability

Existing project management systems primarily describe current project status.

However, strategic project management requires forecasting future project behavior.

Artificial intelligence introduces predictive management by answering questions such as:

- Which activities are most likely to become critical?
- Which contractors present elevated implementation risks?
- Which procurement packages require acceleration?
- Which milestones are vulnerable to schedule deviation?
- What corrective actions should be implemented today?

These capabilities fundamentally distinguish AI-supported management from traditional digital monitoring.

Problem 5. Organizational Knowledge Loss

Every completed investment project generates valuable organizational knowledge.

Nevertheless, much of this knowledge remains undocumented or inaccessible for future projects.

Artificial intelligence continuously accumulates project experience, enabling future investment decisions to benefit from organizational learning [21], [22].

3.3. Proposed AI-Driven Digital Architecture

To overcome identified limitations, this research proposes an integrated Artificial Intelligence Investment Project Management Architecture.

Unlike conventional management systems based exclusively on workflow automation, the proposed architecture transforms investment management into an intelligent adaptive process.

The architecture consists of six functional modules.

Module A – Digital Data Acquisition

All project information generated during project implementation is automatically collected from:

- Directum RX,
- Primavera P6,
- Financial databases,
- Procurement systems,
- Engineering documentation,
- Construction monitoring reports.

Module B – AI Knowledge Engine

Machine learning algorithms continuously analyze:

- Completed investment projects;
- Implementation durations;
- Contractor performance;
- Budget utilization;
- Technical modifications;
- Organizational risks.

The knowledge engine establishes predictive relationships between historical and ongoing projects.

Module C – Predictive Risk Analytics

Artificial intelligence estimates probability of:

- Schedule delay;
- Budget overrun;
- Procurement disruption;
- Engineering redesign;
- Contractor failure;
- Resource shortages.

Instead of waiting until risks materialize, management receives early warning signals.

Module D – Intelligent Decision Support

The AI Decision Support System evaluates alternative managerial responses.

For example, if procurement delays threaten the project schedule, the system automatically analyzes several corrective scenarios, estimates expected project outcomes, and recommends the most effective solution [23].

Module E – Executive Digital Dashboard

Project executives receive real-time visualization of:

- Portfolio performance;
- Project health;
- Investment utilization;
- Milestone completion;
- Risk level;
- Contractor efficiency;
- Ai recommendations.

Unlike traditional dashboards displaying descriptive statistics, the proposed dashboard incorporates predictive analytics and strategic recommendations.

Module F – Organizational Learning Platform

Following project completion, all implementation data become part of the enterprise digital knowledge repository.

Machine learning continuously improves prediction accuracy using accumulated organizational experience [24].

Consequently, every new investment project becomes more predictable than previous ones.

3.4. Comparative Assessment

To evaluate the expected organizational benefits of the proposed framework, a comparative assessment was conducted between the existing management system and the AI-driven digital framework.

Table 1. Comparative Characteristics of Traditional and AI-Based Investment Project Management.

Indicator	Traditional Digital Management	AI-Driven Digital Management
Risk identification	Reactive	Predictive
Decision support	Manual	AI-assisted
Project monitoring	Periodic	Continuous
Information integration	Partial	Integrated
Schedule forecasting	Limited	Predictive

Budget control	Historical	Predictive
Knowledge management	Fragmented	Continuous learning
Executive reporting	Static	Intelligent dashboard

The comparison demonstrates that AI technologies extend digital transformation beyond automation by introducing intelligent project governance capable of continuous adaptation to changing project conditions.

3.5. Initial Performance Evaluation

Based on expert assessment and business process analysis, implementation of the proposed framework is expected to produce measurable organizational improvements in several key areas:

- Reduction in project approval time through automated digital workflows;
- Earlier detection of schedule deviations using predictive analytics;
- Enhanced transparency of project execution through integrated monitoring;
- Improved resource utilization by identifying potential bottlenecks before they affect implementation;
- Increased quality of managerial decisions through ai-supported recommendations;
- Preservation and reuse of organizational knowledge across future investment projects.

These expected outcomes indicate that the integration of Artificial Intelligence with Directum RX and Primavera P6 has the potential to transform investment project management from a reactive administrative function into a proactive, data-driven management system capable of supporting strategic industrial development.

4. Discussion

4.1. Artificial Intelligence as a New Paradigm in Investment Project Management

The findings of this study demonstrate that the integration of artificial intelligence into investment project management represents a fundamental transformation rather than a simple technological improvement. While previous generations of digital management systems primarily focused on document automation, workflow optimization, and schedule visualization, AI introduces predictive and adaptive capabilities that significantly enhance managerial effectiveness.

The proposed framework shifts project management from a reactive to a proactive model. Conventional management practices typically identify project deviations after they occur, requiring corrective actions that often increase implementation costs and prolong project schedules. In contrast, AI-supported predictive analytics continuously evaluate project conditions, estimate future risks, and recommend preventive measures before critical deviations emerge.

This transition is particularly significant for mining and metallurgical enterprises, where investment projects involve long implementation periods, extensive engineering activities, complex procurement processes, and substantial financial commitments [25]. Under such conditions, even minor management improvements may generate considerable economic benefits throughout the project life cycle.

4.2. Contribution to Digital Economy Research

Digital economy research has traditionally emphasized automation, electronic commerce, digital services, and information technologies. More recently, scholars have increasingly recognized that digital transformation extends beyond technological modernization and fundamentally changes organizational decision-making processes.

The proposed AI-driven framework contributes to this evolving research agenda by demonstrating how artificial intelligence enhances strategic investment management rather than merely automating administrative procedures. Within the proposed model, digital technologies become active participants in organizational decision-making through continuous data analysis, predictive modeling, and intelligent recommendation generation.

Consequently, investment project management evolves from an information management function into a knowledge-based management system capable of supporting sustainable industrial development.

Furthermore, the research expands the understanding of digital maturity. Existing maturity models generally evaluate the level of technology implementation, digital infrastructure, or organizational readiness. The proposed framework introduces an additional analytical dimension by emphasizing organizational intelligence generated through continuous learning from completed investment projects.

4.3. Artificial Intelligence and Project Decision-Making

One of the principal contributions of artificial intelligence concerns improvement of managerial decision quality.

Large industrial investment projects require simultaneous evaluation of numerous technical, financial, organizational, environmental, and regulatory factors. Human decision-makers frequently face information overload, particularly when managing extensive project portfolios involving multiple contractors and geographically distributed construction sites.

Artificial intelligence significantly expands managerial capabilities by processing large datasets, identifying complex relationships among project variables, and generating evidence-based recommendations.

Importantly, AI does not replace project managers.

Instead, it functions as an intelligent analytical assistant capable of supporting professional judgment while preserving managerial responsibility for strategic decisions.

This distinction is essential because successful investment project management depends not only on analytical accuracy but also on organizational experience, stakeholder communication, leadership, and institutional knowledge.

The proposed framework therefore combines human expertise with artificial intelligence rather than promoting fully autonomous project management.

4.4. Integration of Directum RX, Primavera P6 and Artificial Intelligence

The research demonstrates that the greatest organizational benefits arise not from implementation of isolated digital technologies but from their integration into a unified management environment.

Directum RX provides efficient electronic workflow management, ensuring transparent document circulation, standardized approval procedures, and centralized information storage.

Primavera P6 supports detailed project scheduling, resource allocation, milestone monitoring, and critical path analysis.

Artificial intelligence complements these systems by introducing predictive analytics, intelligent monitoring, automated interpretation of project information, and decision-support capabilities.

The interaction among these three technological components creates an integrated digital ecosystem in which information continuously flows across organizational functions without unnecessary duplication or administrative barriers.

Such integration substantially increases organizational transparency while reducing management response time during project implementation.

4.5. Practical Implications for Industrial Enterprises

Although the framework has been developed using the experience of Almalyk Mining and Metallurgical Complex, its practical applications extend beyond the mining industry.

Large industrial enterprises implementing investment programs often encounter similar organizational challenges:

- Fragmented information systems;
- Complex stakeholder coordination;
- Increasing project uncertainty;
- Limited analytical capabilities;
- Insufficient organizational learning.

The proposed AI framework provides a universal methodological approach suitable for adaptation within metallurgy, energy, oil and gas, transportation infrastructure, chemical production, and manufacturing industries.

Organizations implementing the proposed architecture may expect improvements in several strategic areas.

First, project transparency increases because executive managers obtain continuous access to integrated project information.

Second, decision-making becomes faster due to automatic analytical support generated by AI.

Third, project risks become more predictable through continuous monitoring of implementation indicators.

Fourth, organizational knowledge accumulates over time, enabling continuous improvement of future investment projects.

These practical benefits contribute directly to sustainable industrial development and long-term competitiveness.

4.6. Scientific Contribution

The scientific contribution of this research consists of several interrelated innovations.

First

An original Artificial Intelligence Investment Project Management Framework (AI-IPMF) has been developed specifically for large industrial enterprises.

Unlike existing approaches, the framework integrates electronic workflow management, project scheduling, predictive analytics, intelligent monitoring, and organizational learning within a single digital architecture.

Second

The research introduces an integrated methodological model connecting artificial intelligence with the complete investment project life cycle.

Previous studies generally investigate isolated technological solutions, whereas the proposed framework considers investment management as an interconnected digital ecosystem.

Third

The study proposes an original AI-based performance assessment model combining traditional project management indicators with digital transformation metrics.

This multidimensional evaluation approach enables comprehensive assessment of investment project effectiveness under conditions of digital transformation.

Fourth

The research expands theoretical understanding of digital maturity by introducing the concept of organizational intelligence generated through continuous learning from completed investment projects.

Unlike static maturity models, the proposed approach considers digital transformation as a dynamic evolutionary process supported by artificial intelligence.

4.7. Research Limitations

Despite its scientific and practical contributions, several limitations should be acknowledged.

The empirical investigation is based primarily on a single industrial enterprise.

Although AMMC represents an appropriate case for studying investment project management within large mining organizations, future studies should examine implementation of the proposed framework across multiple enterprises and industrial sectors.

Furthermore, the research emphasizes managerial architecture rather than detailed implementation of machine learning algorithms.

Future investigations may develop specialized predictive models utilizing larger project datasets, advanced neural networks, reinforcement learning, or generative artificial intelligence for automated project management support.

Another promising research direction involves integration of digital twins, Internet of Things technologies, and real-time industrial sensor data into AI-supported investment project management systems.

4.8. Future Research Directions

The rapid evolution of artificial intelligence opens numerous opportunities for further scientific investigation.

Future studies may focus on:

- Generative AI for automated project documentation;
- Intelligent digital twins supporting investment planning;
- Explainable AI for executive decision-making;
- Reinforcement learning for dynamic project optimization;
- AI-assisted portfolio management;
- Blockchain integration for investment governance;
- Autonomous project monitoring using computer vision and unmanned aerial systems.

Such developments may significantly expand the capabilities of digital investment project management during the coming decade.

Interim Summary

The discussion confirms that artificial intelligence should be regarded not merely as an additional software component but as a strategic management technology capable of fundamentally transforming investment project governance.

The proposed framework integrates human expertise, digital workflows, predictive analytics, and continuous organizational learning into a unified intelligent management system. Consequently, digital transformation evolves beyond technological modernization toward the creation of adaptive, knowledge-driven industrial enterprises capable of achieving higher investment efficiency and sustainable long-term development.

Table 2. AI-Driven Investment Project Management Framework.

Project Phase	Traditional Management Approach	AI-Driven Digital Approach	Expected Benefits
Project Initiation	Manual preparation of project proposals	AI-assisted document analysis and classification	Faster project registration
Feasibility Study	Expert-based assessment	AI-supported predictive feasibility analysis	Improved investment decisions
Risk Assessment	Manual identification of risks	Machine learning-based risk prediction	Early risk detection
Project Planning	Primavera P6 scheduling	AI optimization of schedules and resource allocation	Reduced scheduling conflicts
Document Workflow	Electronic approval through Directum RX	Intelligent workflow automation with AI recommendations	Shorter approval cycles
Project Monitoring	Periodic reporting	Real-time monitoring using predictive analytics	Continuous project control
Decision-Making	Management meetings	AI Decision Support System	Faster and more objective decisions
Project Closure	Traditional reporting	Knowledge extraction and AI learning	Continuous organizational improvement

Table 3. Key Performance Indicators (KPI) for AI-Based Investment Project Management.

Indicator	Formula / Measurement	Target Value
Schedule Performance Index (SPI)	Earned Value / Planned Value	≥ 1.00
Cost Performance Index (CPI)	Earned Value / Actual Cost	≥ 1.00
Budget Deviation	(Actual – Planned)/Planned ×100%	≤5%
Project Delay	Actual Duration – Planned Duration	≤5%
Risk Prediction Accuracy	Correct AI Predictions / Total Predictions	≥90%
Document Approval Time	Hours per approval	−40% compared with baseline
Decision Response Time	Time required for executive decision	−50%
Resource Utilization	Productive Resource Time / Total Time	≥90%
AI Recommendation Acceptance Rate	Accepted AI recommendations / Total recommendations	≥75%
Digital Workflow Efficiency	Completed workflows / Total workflows	≥95%

Table 4. Five-Level Digital Maturity Model.

Level	Description	Characteristics
Level 1	Manual Management	Paper documents, fragmented communication
Level 2	Digital Documentation	Electronic document management, limited automation
Level 3	Integrated Digital Management	Directum RX and Primavera P6 integration
Level 4	Intelligent Project Management	AI-supported monitoring and predictive analytics
Level 5	Autonomous Digital Ecosystem	Continuous organizational learning and AI-assisted strategic decision-making

Table 5. Comparative Analysis of Traditional and AI-Based Project Management.

Criterion	Traditional Management	AI-Based Management
Decision-making	Experience-based	Data-driven and predictive
Risk management	Reactive	Predictive
Project monitoring	Periodic	Continuous
Schedule control	Manual analysis	AI forecasting
Resource allocation	Static	Dynamic optimization
Document processing	Administrative workflow	Intelligent automation
Knowledge management	Limited	Continuous AI learning
Executive reporting	Historical information	Predictive dashboards

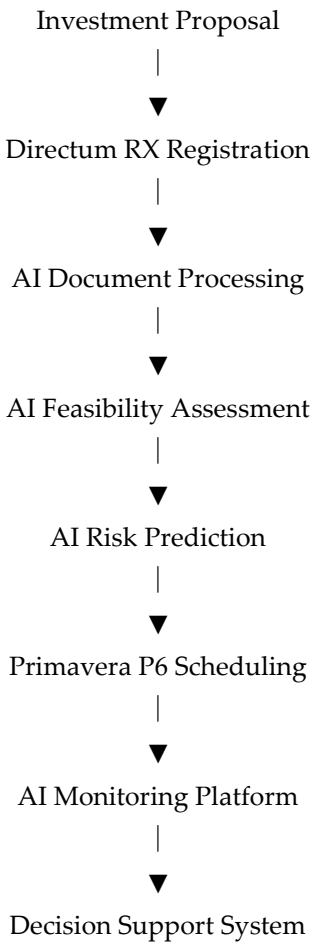




Figure 1. Conceptual Architecture of AI-Driven Investment Project Management.

Figure 2. Integrated Digital Workflow.

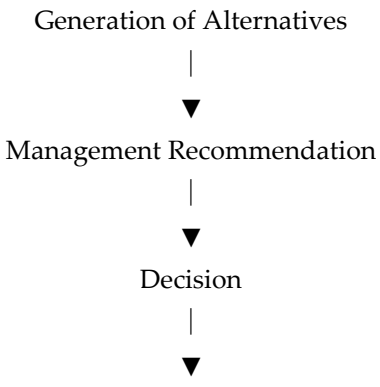


Figure 3. AI-Based Decision Support Process.

Scientific Contribution Summary

The proposed framework advances research in digital economy and project management by integrating artificial intelligence into the complete investment project life cycle rather than using AI only for isolated tasks. The framework combines electronic document workflows, scheduling, predictive analytics, and organizational learning into a unified architecture for industrial enterprises. This integrated approach addresses a gap in current research, where digital technologies are often studied separately rather than as components of an intelligent management ecosystem.

The methodology also introduces a multidimensional performance evaluation model that combines traditional project indicators (such as schedule and cost performance) with digital transformation metrics, enabling organizations to assess both operational effectiveness and AI-enabled management maturity. Such an approach provides a stronger theoretical foundation for future empirical studies and practical implementation in mining, metallurgical, energy, and other capital-intensive industries.

Managerial Implications and AI Implementation Framework

AI Implementation Roadmap for Industrial Enterprises

The successful implementation of artificial intelligence in investment project management requires not only technological modernization but also organizational transformation. Based on the results of this study, a five-stage implementation roadmap is proposed for large industrial enterprises.

Stage 1. Digital Readiness Assessment

The first stage involves evaluating the current level of digital maturity within the enterprise. This includes an assessment of existing information systems, document management processes, project scheduling practices, data quality, organizational culture, and employee digital competencies.

The assessment identifies technological gaps and organizational barriers that may affect AI implementation. A comprehensive digital readiness evaluation provides the foundation for subsequent modernization activities and ensures that artificial intelligence solutions are aligned with organizational objectives.

Stage 2. Integration of Digital Information Systems

At the second stage, existing project management platforms are integrated into a unified digital environment.

The proposed architecture combines:

- Directum RX for electronic document management;
- Primavera P6 for project planning and scheduling;
- Centralized project databases;

- Financial information systems;
- Procurement management platforms;
- AI analytical modules.

The objective of this stage is to establish continuous information exchange among all participants involved in investment project implementation.

Stage 3. Artificial Intelligence Deployment

After establishing the integrated digital environment, artificial intelligence modules are introduced.

The proposed AI platform performs several critical functions:

- Automated document classification;
- Predictive schedule analysis;
- Budget forecasting;
- Procurement monitoring;
- Contractor performance evaluation;
- Project risk prediction;
- Management recommendation generation.

Unlike traditional software applications, the AI platform continuously improves prediction accuracy by learning from historical investment project data.

Stage 4. Organizational Adaptation

Technological implementation alone cannot guarantee successful digital transformation.

Therefore, organizational adaptation becomes a critical component of AI deployment.

Key activities include:

- Employee training;
- Development of ai governance policies;
- Revision of project management procedures;
- Establishment of digital competency programs;
- Executive education in ai-supported decision-making.

Organizational readiness significantly influences the effectiveness of AI implementation.

Stage 5. Continuous Improvement

Artificial intelligence should not be viewed as a static information system.

Instead, AI continuously evolves through organizational learning.

Each completed investment project generates new datasets that improve prediction accuracy, expand organizational knowledge, and increase management effectiveness.

Consequently, digital transformation becomes an ongoing process rather than a one-time technological initiative.

Expected Organizational Benefits

Implementation of the proposed framework generates improvements across multiple organizational dimensions.

Strategic Benefits

Artificial intelligence enhances strategic investment planning by providing more accurate forecasts of project duration, capital expenditure, and implementation risks.

Executive management gains access to analytical information supporting long-term investment decision-making.

Operational Benefits

Operational improvements include:

- Accelerated document approval;
- Optimized resource allocation;
- Earlier identification of implementation risks;
- Improved contractor coordination;
- Increased schedule reliability;
- Enhanced budget control.

Financial Benefits

Although implementation of AI technologies requires initial investment, long-term financial benefits significantly exceed implementation costs.

Expected financial outcomes include:

- Reduced project delays;
- Lower administrative costs;
- Improved capital utilization;
- Decreased procurement inefficiencies;
- Minimized project overruns.

Organizational Benefits

Artificial intelligence contributes to organizational development by:

- Increasing management transparency;
- Strengthening collaboration among departments;
- Improving project knowledge management;
- Supporting evidence-based decision-making;
- Reducing dependence on individual managerial experience.

4.9. Proposed AI Governance Principles

Successful implementation of AI requires appropriate governance mechanisms.

The following principles are recommended.

Transparency

AI recommendations should be understandable and traceable.

Project managers must clearly understand why particular recommendations have been generated.

Accountability

Artificial intelligence supports managerial decisions but does not replace executive responsibility.

Final strategic decisions remain under human control.

Data Quality

Reliable predictions depend upon high-quality project information.

Organizations should establish standardized procedures for collecting, validating, and maintaining investment project data.

Cybersecurity

Since investment projects involve commercially sensitive information, cybersecurity becomes an essential component of digital transformation.

AI platforms should comply with international information security standards while ensuring confidentiality and integrity of organizational data.

Continuous Learning

Artificial intelligence should continuously improve through organizational feedback.

Each completed investment project contributes to improving future prediction accuracy.

Economic Impact of AI Integration

The proposed framework is expected to influence enterprise performance through several interconnected mechanisms.

AI reduces uncertainty associated with investment decision-making by providing probabilistic forecasts rather than deterministic assumptions.

Project managers receive early warnings regarding potential schedule deviations, allowing corrective measures to be implemented before significant financial losses occur.

Executive management benefits from integrated dashboards that combine financial indicators, project progress, procurement status, and AI-generated recommendations within a single decision-support environment.

Consequently, investment efficiency increases through:

- Higher schedule reliability;
- Improved resource utilization;
- Enhanced investment prioritization;
- Faster managerial response;
- Lower implementation risks;
- Increased organizational resilience.

Author's Concept of Intelligent Investment Project Management

This research proposes a new conceptual interpretation of investment project management within the digital economy.

Rather than considering artificial intelligence as an additional technological component, AI is viewed as an organizational intelligence layer that connects project planning, document management, risk analysis, managerial decision-making, and organizational learning.

Accordingly, investment project management evolves into a self-improving digital ecosystem where each completed project increases the analytical capability of the enterprise.

This concept distinguishes the proposed framework from existing digital transformation models and represents the principal theoretical contribution of the study.

Appendix A. Digital Maturity Assessment Matrix for AI-Driven Investment Project Management

Table A1. Digital Maturity Assessment Matrix.

Assessment Dimension	Level 1	Level 2	Level 3	Level 4	Level 5
Digital Strategy	No strategy	Initial initiatives	Approved strategy	Enterprise-wide implementation	AI-driven strategic management
Project Planning	Manual scheduling	Basic software	Primavera P6	Integrated planning	AI predictive planning
Document Management	Paper documents	Electronic archive	Directum RX	Automated workflows	Intelligent document processing
Risk Management	Reactive	Periodic assessment	Digital register	Predictive analytics	Autonomous AI forecasting
Decision Support	Experience-based	KPI reports	Analytical dashboards	AI recommendations	Intelligent decision ecosystem

Data Integration	Separate databases	Partial integration	Centralized repository	Enterprise integration	Self-learning ecosystem
Organizational Learning	Individual knowledge	Lessons learned reports	Digital knowledge base	AI-supported learning	Continuous organizational intelligence

Digital Maturity Index (DMI)

The overall digital maturity level of an enterprise can be calculated using the following equation:

$$DMI=\frac{\sum_{i=1}^{n}w_iL_i}{\sum_{i=1}^{n}w_i}$$

Where:

- **DMI** – Digital Maturity Index;
- **Li** – maturity level (1–5);
- **wi** – weighting coefficient for each assessment dimension.

Interpretation:

DMI	Interpretation
1.0–2.0	Initial digitalization
2.1–3.0	Developing digital organization
3.1–4.0	Integrated digital enterprise
4.1–5.0	AI-driven intelligent enterprise

Appendix B. Artificial Intelligence Risk Assessment Matrix

Artificial intelligence continuously evaluates investment projects using predictive indicators.

Table B1. AI-Based Risk Assessment Matrix.

Risk Category	Probability	Impact	AI Monitoring Indicator	Recommended Response
Schedule Delay	High	High	Critical Path Stability	Resource reallocation
Budget Overrun	Medium	High	Cost Performance Index	Budget revision
Procurement Delay	High	Medium	Supplier Delivery Forecast	Alternative suppliers
Contractor Failure	Medium	High	Contractor Performance Score	Contract review
Engineering Changes	Medium	Medium	Design Modification Index	Technical reassessment
Resource Shortage	High	Medium	Resource Availability Forecast	Dynamic resource planning
Documentation Delay	Medium	Medium	Workflow Processing Time	Automated approvals
Regulatory Changes	Low	High	Compliance Monitoring	Legal review

AI Risk Prioritization Model

To prioritize project risks, the following integrated risk score is proposed:

$$AIRS = P \times I \times C$$

Where:

- **AIRS** – Artificial Intelligence Risk Score;
- **P** – probability of occurrence;
- **I** – impact on project objectives;
- **C** – confidence coefficient generated by the AI model.

The resulting values are interpreted as follows:

AI Risk Score	Priority Level	Required Action
0–20	Low	Routine monitoring
21–40	Moderate	Preventive measures
41–60	Significant	Management intervention
61–80	High	Immediate corrective action
81–100	Critical	Executive decision required

Appendix C. Proposed KPI Dashboard Structure

The AI-powered dashboard consolidates project information into five analytical modules.

Table C1. Executive AI Dashboard.

Dashboard Module	Indicators	Purpose
Project Performance	SPI, CPI, Milestone Completion	Track execution status
Financial Performance	Budget utilization, Cost variance	Monitor investment efficiency
Risk Intelligence	AI Risk Score, Forecast Accuracy	Predict future deviations
Resource Management	Workforce utilization, Equipment allocation	Optimize resources
Strategic Decision Support	AI recommendations, Portfolio priorities	Support executive management

Appendix D. Managerial Recommendations

Based on the research findings, the following recommendations are proposed for industrial enterprises implementing AI-supported investment project management:

1. Develop an enterprise-wide AI strategy aligned with investment and digital transformation objectives.
2. Integrate Directum RX, Primavera P6, and AI modules into a single digital ecosystem.
3. Establish centralized data governance standards to ensure data quality and interoperability.
4. Introduce predictive risk management using machine learning models.
5. Create a digital knowledge repository capturing lessons learned from completed projects.
6. Train project managers and executives in AI-supported decision-making and digital competencies.
7. Monitor AI performance using standardized KPIs and periodically validate prediction accuracy.
8. Ensure cybersecurity and ethical governance for AI applications, particularly when handling sensitive investment data.

5. Conclusions

The rapid development of digital technologies and artificial intelligence is fundamentally transforming approaches to investment project management in large industrial enterprises. Digital transformation has evolved beyond simple process automation and now represents a strategic mechanism for improving organizational efficiency, strengthening managerial capabilities, and ensuring sustainable industrial development. Under conditions of increasing project complexity, dynamic market environments, and growing investment requirements, traditional management methods no longer provide sufficient flexibility to support effective decision-making throughout the project life cycle.

The present research addressed this challenge by developing an integrated Artificial Intelligence Investment Project Management Framework (AI-IPMF) based on the practical experience of Almalyk Mining and Metallurgical Complex (AMMC). Unlike conventional digital management systems, the proposed framework combines electronic workflow management, project scheduling, predictive analytics, intelligent decision support, and organizational learning into a unified digital ecosystem.

The results demonstrate that the integration of artificial intelligence with Directum RX and Primavera P6 substantially enhances the effectiveness of investment project management. AI technologies enable continuous monitoring of project performance, predictive identification of implementation risks, automated analysis of large volumes of project information, and generation of evidence-based managerial recommendations. Consequently, project management evolves from reactive control toward proactive, data-driven governance capable of preventing deviations before they significantly affect project outcomes.

One of the principal scientific contributions of this research is the development of an original methodological framework integrating artificial intelligence throughout the entire investment project life cycle. Existing studies generally investigate isolated digital technologies or individual project management functions. In contrast, the proposed model establishes systematic interaction among document management, scheduling, predictive analytics, executive decision support, and organizational knowledge management. This integrated approach significantly expands current theoretical understanding of digital project management within capital-intensive industrial enterprises.

Another important contribution concerns the introduction of organizational intelligence as a new dimension of digital maturity. Traditional digital transformation initiatives frequently emphasize implementation of technological infrastructure while paying limited attention to accumulation and reuse of organizational knowledge. The proposed framework addresses this limitation by enabling artificial intelligence to continuously learn from completed investment projects, thereby improving forecasting accuracy and managerial effectiveness over time.

From a practical perspective, implementation of the proposed AI-driven architecture may generate substantial organizational benefits. These include acceleration of management decision-making, improvement of project transparency, optimization of resource allocation, reduction of administrative workload, enhancement of risk management capability, and preservation of valuable organizational experience. Such improvements contribute directly to increasing investment efficiency and strengthening industrial competitiveness.

The proposed framework is particularly relevant for mining and metallurgical enterprises implementing large investment programs under conditions of technological modernization. Nevertheless, the methodological principles developed in this study may also be adapted to other capital-intensive sectors, including energy, oil and gas, transportation infrastructure, chemical production, and advanced manufacturing.

Despite these contributions, several limitations should be acknowledged. The empirical investigation focuses primarily on a single industrial enterprise, and therefore future studies should validate the proposed framework using comparative analyses involving multiple organizations operating in different industrial sectors. Furthermore, future research may incorporate advanced artificial intelligence techniques such as deep learning, reinforcement learning, generative AI, digital twins, Internet of Things technologies, and autonomous monitoring systems to further expand the capabilities of intelligent investment project management.

Future investigations should also evaluate quantitative performance improvements achieved through practical implementation of the proposed architecture. Longitudinal studies examining project performance before and after AI integration would provide additional empirical evidence regarding the effectiveness of intelligent project management systems.

In conclusion, artificial intelligence should no longer be regarded merely as an auxiliary information technology. Instead, it represents a strategic management instrument capable of fundamentally transforming investment project governance. By integrating predictive analytics, intelligent decision support, digital workflow management, and continuous organizational learning, AI creates new opportunities for improving investment efficiency, reducing project uncertainty, and supporting sustainable industrial development. The proposed AI-driven framework therefore provides both a theoretical contribution to digital economy research and a practical methodology for modernizing investment project management within large industrial enterprises.

Scientific Novelty

The scientific novelty of this study consists of the following original contributions:

1. An integrated Artificial Intelligence Investment Project Management Framework (AI-IPMF) has been developed for large industrial enterprises.
2. A unified digital architecture integrating Directum RX, Primavera P6, and Artificial Intelligence has been proposed to support the complete investment project life cycle.
3. A conceptual model of AI-supported predictive project management has been developed, enabling proactive identification of project risks before implementation deviations occur.
4. An original multidimensional performance assessment methodology combining traditional project management indicators with AI-based digital maturity indicators has been proposed.
5. The concept of organizational intelligence has been introduced as an essential component of digital transformation in investment project management.

Practical Recommendations

Based on the obtained results, the following recommendations are proposed for industrial enterprises implementing digital transformation:

- establish integrated digital project management environments combining workflow management, scheduling, and AI technologies;
- implement predictive risk management based on machine learning algorithms;
- develop centralized project knowledge repositories supporting continuous organizational learning;
- introduce intelligent executive dashboards providing real-time decision support;
- integrate AI technologies into strategic investment portfolio management;
- continuously evaluate digital maturity and AI effectiveness using standardized performance indicators.

The implementation of these recommendations will contribute to improving investment efficiency, reducing project uncertainty, strengthening managerial transparency, and enhancing the long-term competitiveness of industrial enterprises in the digital economy.

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