



**PROJECT MANAGEMENT OFFICE AS AN INSTITUTIONAL TOOL  
FOR GREEN TECHNOLOGY IMPLEMENTATION IN LARGE MINING  
COMPANIES**

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**Abstract:** The study argues that green technology implementation in mining requires more than technical modernization; it demands coordinated governance, project prioritization, resource allocation, digital monitoring and cross-functional communication. The Project Management Office can act as a central mechanism for connecting strategic goals, technological projects, environmental requirements and economic results. Using the logic of large-scale mining management, the thesis shows that an effective PMO reduces fragmentation, accelerates decision-making, improves accountability and transforms green technology from isolated initiatives into a structured innovation portfolio.

**Keywords:** Project Management Office, green technology, mining companies, project governance, digital monitoring, innovation portfolio, ESG, resource efficiency.

**Introduction**

Green technology implementation in large mining companies is not a single technical decision. It is a long, complex and institutionally demanding process. Mining enterprises operate through multiple interconnected production stages: extraction, transportation, crushing, grinding, beneficiation, metallurgical processing, energy supply, water management, waste disposal and environmental monitoring. When a green technology is introduced into one part of this chain, its effect is rarely limited to that specific unit. It may influence production continuity, cost structure, maintenance schedules, energy consumption, ecological risk and investment priorities.

This complexity creates a governance problem. Many green technology projects fail not because the technology itself is ineffective, but because the organization cannot coordinate departments, evaluate project benefits, monitor implementation or connect ecological improvements with economic outcomes. In large mining enterprises, responsibility for innovation is often distributed across technical, financial,



environmental, digital and production units. If these units act separately, green modernization becomes fragmented.

The Project Management Office can solve this problem by acting as an institutional coordination center<sup>1</sup>. It can help identify priority projects, evaluate their financial and environmental effects, assign responsibilities, monitor implementation and report results to strategic management. In this sense, the PMO is not merely an administrative unit. It is a governance mechanism that transforms green technology into a structured project portfolio.

The purpose of this thesis is to analyze the Project Management Office as an institutional tool for implementing green technologies in large mining companies. The study focuses on how a PMO can reduce organizational fragmentation, improve project discipline, support digital monitoring and connect green innovation with measurable economic results. This topic is especially relevant for resource-intensive mining enterprises where green technologies require large investment, cross-functional coordination and long-term evaluation.

### **Conceptual Background**

Green technology in mining includes energy-efficient equipment, water recycling systems, renewable energy facilities, dust-gas cleaning technologies, tailings reprocessing, digital monitoring platforms and circular resource management solutions [1]. These technologies can reduce resource intensity and ecological pressure, but only when they are implemented as part of a coordinated management system.

Project management theory emphasizes that complex innovations require clear objectives, timelines, budgets, responsibilities, risk control and performance indicators [2]. In mining, this is particularly important because green projects usually affect several departments at the same time. For example, a water recycling system concerns production, ecology, engineering, finance and safety. A renewable energy facility concerns energy supply, investment planning, procurement and ESG reporting. A digital monitoring platform concerns IT, production, maintenance and environmental control.

The Project Management Office provides the institutional basis for managing this complexity. It creates a single coordination platform where projects can be selected, evaluated, implemented and monitored according to unified criteria. In large mining

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<sup>1</sup> In this thesis, the Project Management Office is understood as a coordination unit that integrates project selection, resource allocation, implementation monitoring and performance evaluation.



enterprises, the PMO can also function as a “call point” mechanism<sup>2</sup>, meaning that project-related information, problems, decisions and performance signals are concentrated in one management node rather than scattered across departments.

**PMO Functions in Green Technology Implementation.** The first function of a PMO is **project selection and prioritization**. Large mining enterprises may have many possible green projects: energy-saving motors, solar power units, water reuse systems, tailings recovery, dust-gas purification, digital dashboards, equipment diagnostics and waste reduction technologies. However, not all projects can be implemented at once. A PMO helps evaluate which projects are strategically urgent, financially feasible and environmentally significant [3].

The second function is **economic and environmental evaluation**. A green technology should not be assessed only by its purchase cost. Its real value depends on energy savings, reduced downtime, lower emissions, water savings, avoided penalties, ESG credibility and long-term competitiveness. Therefore, the PMO should use a multi-criteria evaluation system that combines economic, technical and ecological indicators<sup>3</sup>.

The third function is **cross-functional coordination**. Green technology projects often fail when departments do not share information. For example, engineers may focus on technical feasibility, economists on payback, environmental specialists on compliance, and production managers on output stability. The PMO creates a common coordination field where these perspectives are integrated into one project logic.

The fourth function is **digital monitoring**. Implementation cannot be effectively managed without data. Digital dashboards, real-time indicators, energy meters, equipment diagnostics and environmental sensors help the PMO track whether a green project is producing the expected results. In the case of large mining enterprises, integrated dashboards can help management observe resource efficiency, energy use, ecological risk and production stability in one system [4].

The fifth function is **scaling successful projects**. Green technology implementation should not stop at pilot testing. If a project proves effective in one production unit, the PMO can evaluate whether it should be expanded to other units. This prevents successful innovations from remaining isolated.

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<sup>2</sup> The “call point” mechanism refers to a centralized managerial node where project-related information, risks, decisions and performance signals are collected and processed.

<sup>3</sup> Multi-criteria evaluation is necessary because green technology projects usually generate both direct economic effects and indirect ecological or reputational benefits.

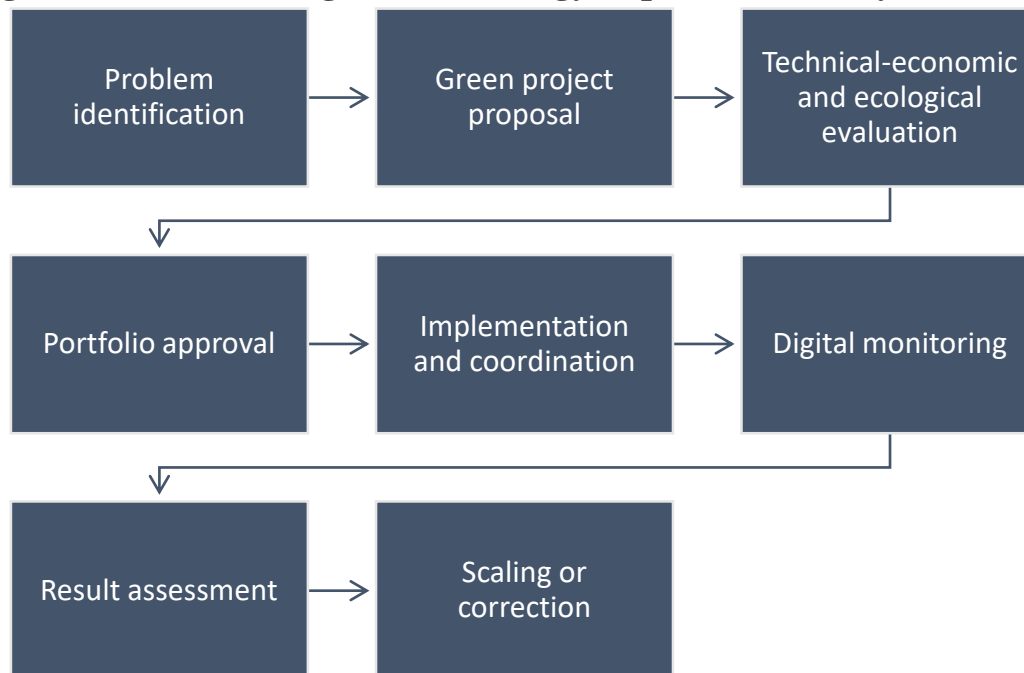
**Table 1. Key PMO functions in green technology implementation**

PMO function	Practical meaning	Expected result
Project selection	Choosing priority green projects	Investment resources are used efficiently
Multi-criteria evaluation	Assessing economic, technical and ecological effects	Better project justification
Cross-functional coordination	Connecting production, finance, ecology, IT and engineering	Lower fragmentation
Digital monitoring	Tracking project performance through data	Faster corrective decisions
Scaling	Expanding successful pilot projects	System-level green transformation

This table shows that the PMO is not only a control unit. It is a transformation platform that connects technology, finance, ecology and strategy.

For large mining companies, green technology implementation can be described as a cycle. The PMO should manage each stage of this cycle: identification, evaluation, approval, implementation, monitoring and scaling.

**Figure 1. PMO-based green technology implementation cycle**



**Results and Analytical Interpretation**

The cycle starts with identifying a concrete problem: high energy consumption, water losses, dust emissions, equipment downtime, tailings accumulation or excessive maintenance cost. Then a project proposal is developed. At the evaluation stage, the PMO examines technical feasibility, required investment, expected savings, ecological effect, risk and implementation schedule. If the project is approved, the PMO coordinates implementation and monitors results. Finally, the project is either scaled, corrected or discontinued.

This cycle is important because it prevents random modernization. Green technology adoption becomes evidence-based. Projects are not selected only because they are modern or environmentally attractive; they are selected because they solve a specific production and ecological problem.

The PMO also provides a bridge between strategic and operational levels.

**Table 2. PMO linkage between strategic and operational management**

<b>Management level</b>	<b>Main question</b>	<b>PMO contribution</b>
Strategic level	Which green technologies support long-term competitiveness?	Aligns projects with corporate strategy
Investment level	Which projects justify capital allocation?	Compares cost, savings and risk reduction
Operational level	How should the project be implemented?	Coordinates departments and timelines
Monitoring level	Are expected results being achieved?	Uses digital indicators and reports
Scaling level	Should the project be expanded?	Evaluates replication potential

This linkage is crucial in mining because strategic goals are often broad, while operational decisions are specific. The PMO translates broad green transformation goals into manageable project actions.

**Conclusion**

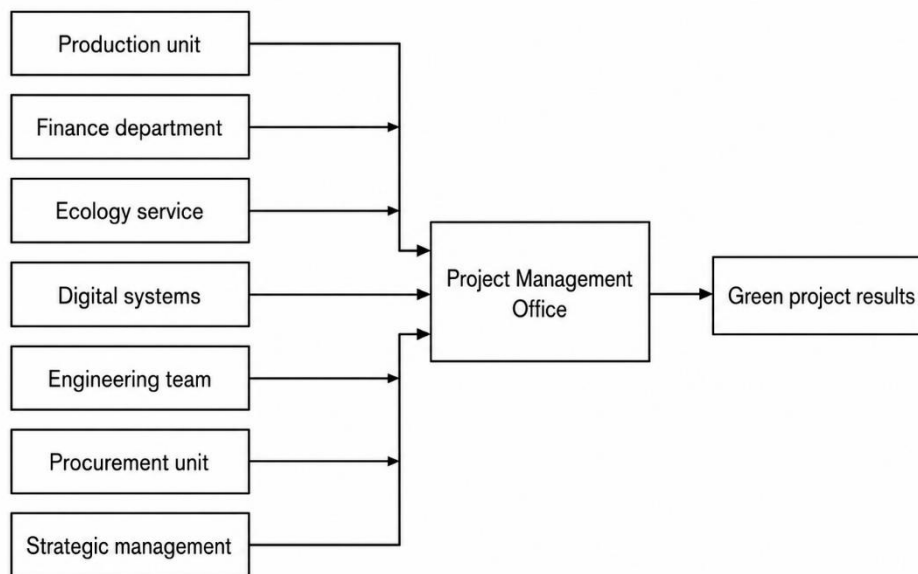
The Project Management Office is especially important in large mining companies because green technology implementation faces three coordination gaps. The first gap is between strategy and production. Corporate strategies may declare green transition,

resource efficiency or ESG improvement, but production departments need concrete technologies, budgets and deadlines. The PMO converts strategic language into project structure.

The second gap is between ecology and economics. Environmental departments may prioritize emissions reduction, water protection or waste management, while finance departments may focus on cost and return. The PMO can integrate both views by showing how ecological improvements produce economic value. For example, energy-saving projects reduce emissions and lower operating costs. Water recycling reduces ecological pressure and protects production continuity. Tailings recovery reduces waste and may create secondary resource value.

The third gap is between data and decision-making. Digital systems may collect large amounts of information, but this information must be interpreted and converted into management decisions. The PMO can use dashboards and performance indicators to determine whether a project is on track, whether savings are real and whether corrective action is needed<sup>4</sup>.

In large mining companies, green technology implementation also requires risk management. A project may fail because of technical incompatibility, underestimated cost, weak training, procurement delays or insufficient monitoring. The PMO can reduce these risks by using standardized project documentation, responsibility matrices, milestone control and post-implementation evaluation.



<sup>4</sup> Digital indicators should be used not only for reporting, but also for operational correction, risk prevention and project portfolio management.

### **Figure 2. PMO as a coordination hub**

**Practical Implications.** The first practical implication is that mining companies should establish a **green project portfolio**. Instead of treating each technology separately, the enterprise should group projects by purpose: energy efficiency, water management, waste reduction, digital monitoring, emissions control and circular resource use.

The second implication is the need for **multi-criteria project evaluation**. Each project should be assessed by investment cost, payback period, energy savings, ecological effect, production continuity, ESG value and scalability. This helps avoid narrow financial evaluation and supports long-term decision-making.

The third implication is the importance of **digital performance dashboards**. PMO decisions should be based on real data. Energy use, equipment downtime, water circulation, emissions and resource savings should be monitored continuously. This allows the PMO to detect delays, inefficiencies and unexpected results quickly.

The fourth implication is **clear responsibility allocation**. Every green project should have a project owner, technical responsible person, financial evaluator, environmental evaluator and digital monitoring specialist. This reduces ambiguity and improves accountability.

The fifth implication is **post-implementation learning**. After each project is completed, the PMO should compare expected and actual results. This helps improve future project selection and reduces repeated mistakes.

### **Conclusion**

Green technology implementation in large mining companies requires more than modern equipment. It requires institutional coordination. The Project Management Office can serve as a central mechanism for transforming green technologies from isolated initiatives into a structured innovation portfolio. It connects strategic objectives, investment decisions, technical implementation, ecological requirements, digital monitoring and economic evaluation.

The thesis concludes that a PMO can reduce organizational fragmentation, improve project discipline, accelerate decision-making, support ESG transparency and increase the economic effect of green technologies. In resource-intensive mining enterprises, such coordination is essential because green projects influence production continuity, energy costs, environmental risks and long-term competitiveness.

A PMO-based model allows mining companies to manage green transformation systematically. It helps identify priority projects, evaluate their impact, coordinate



departments, monitor results and scale successful solutions. Therefore, the Project Management Office should be considered not only a management unit, but also an institutional foundation for sustainable and competitive mining development<sup>5</sup>.

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<sup>5</sup> In large mining companies, institutional coordination is often as important as technological modernization because green projects affect several departments simultaneously.