Driving outcomes through transformational mine closure program delivery

B Kalisch *Turner & Townsend, Australia*

T Dunow *Turner & Townsend, Canada*

Abstract

The mining industry has a significant role to play in delivering the commodities society needs, and producing them in a way that minimises adverse impacts on the environment and local communities. At the same time, mineral resources are finite, making the operation, and ultimately closure, of mining inevitable.

While progressive rehabilitation of mine sites has been done well by some companies, the same can't be said for the entire sector and mining companies need to showcase leading rehabilitation practices to shift public perceptions. This is more critical than ever as consumers, manufacturers, and investors in energy transition metals and minerals want to know every step of production has been respectful towards the environment and affected communities.

Mine closure must examine the complexities of regulatory and environmental compliance, strategies for post-mining land use, socio-economic planning, rehabilitation of the site, and support to communities through the transition. Due to these factors, mine closures can become major programs that provide significant opportunities but carry huge responsibility. Considering what is at stake for the companies, communities, and environment, failure is not an option.

There is an opportunity for organisations and the industry to break the mould of delivering closure from a 'project to project' asset-based approach to a programmatic approach. In evolving their approach, the mining industry can drive improved governance, performance, and continuous improvement while reducing risk and eventually helping to define and refine future direction. In adopting a programmatic approach, through a global Closure Programme Management Office (CPMO) the following opportunities can be realised:

- *Improved governance.*
- *Opportunities to drive standardisation.*
- *Enhanced scope management.*
- *Improved value and risk management.*
- *Proper change management.*
- *Improved reporting and performance management.*
- *Collaboration and engagement with the supply chain in a consistent and effective manner.*
- *Creating an environment of lessons learned and continual improvement.*

The paper will focus on improving global perspectives and best practices in mine decommissioning, closure, and reclamation through implementing a global CPMO.

Our methodology incorporates our experiences working on global mine closure programs for major clients, which has enabled us to amass significant experience in how to establish and maintain control over large and complex programs of work, reduce risk and deliver opportunity. Additionally, our methodology will incorporate our findings from a comprehensive literature review, as well as a collaborative research survey and interviews where we explored what it takes to deliver successful outcomes in mine closure.

Keywords: *delivery methods; program management; technology; mine closure; predictability*

1   Introduction

Multiple sectors and industries globally adopt a programmatic approach to drive better outcomes across major programs. This article provides details on the opportunity to improve mine closure success by providing insight, including lessons learned and current leading innovation in the setup of global closure portfolios. Evidence shows a lack of consistency across major mine project formation and delivery at program level, and this article will showcase opportunities to help drive change.

With reference to leading practices that reflect on program governance frameworks, best practice methodologies and technology, this article will outline how a programmatic approach to mine closure that has a strong focus on governance, standardisation, cost, scope management, risk management, performance management, change management and continual improvement can positively transform the delivery of global mine closure programs.

2   Introducing the Closure Programme Management Office (CPMO)

The complete and successful closure of a mine remains problematic. The lack of clear assigned responsibilities as well as the absence of criteria and standards for rehabilitation are major causes for delays in closure. (Mhlongo & Amponsah-Dacosta 2016, p. 279).

Furthermore, miners closing mines across different regions face increased risk. Closure remains an elusive mining phase due to unclear roles and responsibilities, inaccurate closure management data, and the inability of stakeholders to conceptualise and integrate closure information into business processes (van Druten & Bekker 2017).

In recent years, major mining houses have looked to implement a program management approach to mine closure. Program management is the process of managing programs mapped to business objectives that improve organisational performance. According to the Project Management Institute (PMI 2017, p. 15), program management enables organisations to more effectively pursue their strategic goals. Furthermore, the value of PMOs is rarely questioned by the organisation, and they are more likely to engage in tasks that impact strategic planning, governance, and portfolio management.

> *"PMOs delivered a 33% improvement in projects delivered under budget, a 27% improvement in customer satisfaction, a 25% increase in productivity, and a 25% reduction in failed projects, resulting in approximately USD175k cost savings per project."* (Project Management Solutions, Inc. 2016, p.3 and p. 5)

A CPMO is a key enabler to driving a programmatic approach across mine closure programs.

Miners can use a CPMO to implement standardised procedures to manage projects, supporting improved governance, performance and continuous improvement. In achieving a well-thought-out process, miners can improve mine closure delivery and success rates, reduce cost and risks, and deliver savings though optimisation.

Establishment of a CPMO will also drive reporting efficiencies, keeping senior stakeholders informed. Furthermore, as miners collaborate with industry, government and community stakeholders to strengthen liabilities into opportunities, a CPMO or programmatic approach can support improved outcomes in environmental recovery, economic and social sustainability initiatives, collating lessons learned to leave a legacy project after project so that the mining region should become more socially and economically equitable after the mine has closed (Strambo & Thazin Aung 2019).

A CPMO is responsible for ensuring that the strategic objectives of the wider opportunity are being met and steering the opportunity to adapt to changing business needs. The CPMO often acts as a gatekeeper between projects and the wider business; distilling risk, financial, and performance data into a program or portfolio level view.

As mining organisations become more data focused, the CPMO plays an increasingly important role in providing a consistent source of 'truth' across the closure program. For example, CPMO reporting can evolve from many non-standard siloed reports created using different programs to one standardised live dashboard. This can enable reporting standardisation across global mines, enabling faster and more informed decision-making across the projects, program and enterprise.

The purpose of any CPMO evolves as the lifecycle progresses and the CPMO matures. Figure 1 provides a overview of how a Closure Programme Management Office can evolve from delivering on a project by project basis through to improved outcomes at a program level, to reducing risk and eventually helping to define and refine future direction. As an organisation's program management maturity increases, it it expected move from left to right on Figure 1.
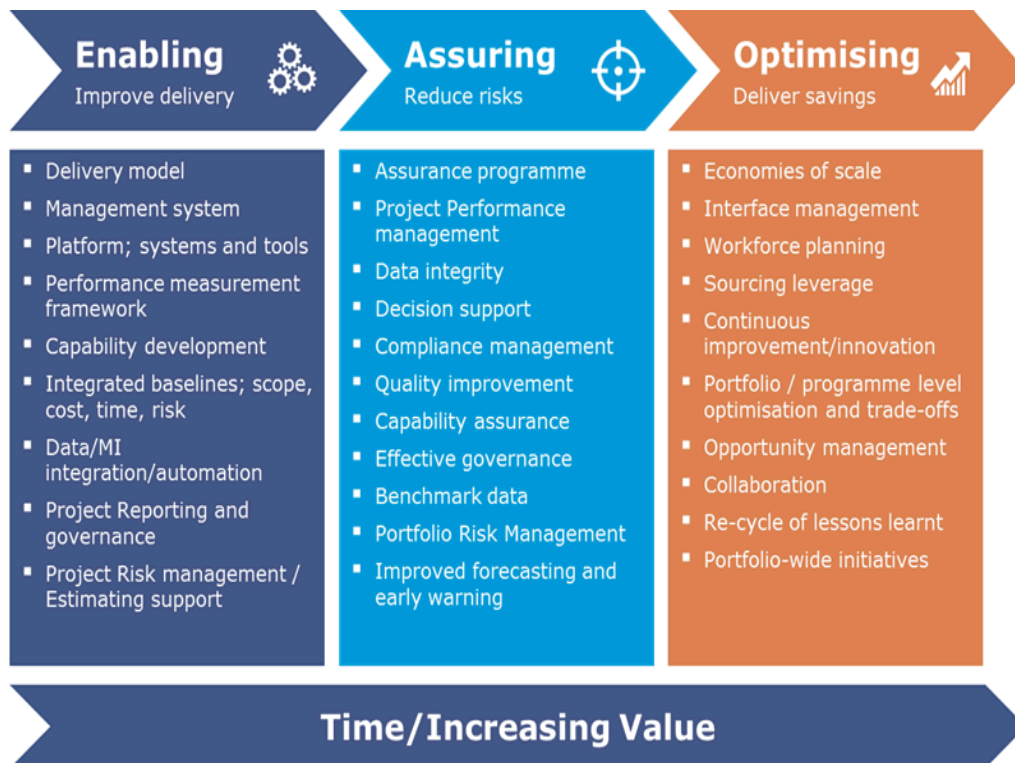

Enabling — Improve delivery

- Delivery model
- Management system
- Platform; systems and tools
- Performance measurement framework
- Capability development
- Integrated baselines; scope, cost, time, risk
- Data/MI integration/automation
- Project Reporting and governance
- Project Risk management / Estimating support

Assuring — Reduce risks

- Assurance programme
- Project Performance management
- Data integrity
- Decision support
- Compliance management
- Quality improvement
- Capability assurance
- Effective governance
- Benchmark data
- Portfolio Risk Management
- Improved forecasting and early warning

Optimising — Deliver savings

- Economies of scale
- Interface management
- Workforce planning
- Sourcing leverage
- Continuous improvement/innovation
- Portfolio / programme level optimisation and trade-offs
- Opportunity management
- Collaboration
- Re-cycle of lessons learnt
- Portfolio-wide initiatives

Time/Increasing Value

Figure 1   Closure Programme Management Office maturity model

3   Industry insights to mine closure

In a recent survey (Cann 2020) conducted in partnership with Mining Journal Intelligence, Turner & Townsend and SRK Consulting explored what it takes to deliver successful outcomes in mine closure planning, delivery and sustainability.

The report shared the opinions of more than 400 mining industry professionals across all the major mining geographies (Table 1). Analysis of the survey revealed unique insight into predominant mine closure practices, and their shortcomings.

Table 1   Sample of survey questions and responses

Survey question	Percentage of respondees	Key responses identified
Mine closure's ability to transform community infrastructure if properly executed	85%	Collaboration is at best 'somewhat' effective
How often is adequate capital set aside for closure?	92%	Of projects are inadequately funded
How often do mine closures overrun initial estimates?	20–100%	84% of respondents said 1 in 2 projects are inadequately funded. The data, quoted in the report, tells us that most mines overrun the initial cost estimate by a minimum of 20% and at worst case 100%
Are closure/remediation projects attracting sufficient talent to meet future challenges?	67%	Agreed there is inadequate capability and capacity to meet future closures
Does your organisation have the right benchmarks to provide confidence for future mine closure?	40%	Stated they do not have access to the right benchmarks to provide confidencefor future closure and remediation projects, and while 75% of respondents believe they do have the right data and modelling technology/tools to improve mine closure, it was suggested that companies are overly protective of what they have developed in-house to deal with closure costs, and this should change for the industry to truly move forward
What drives your closure plan?	55%	Stated limiting cost to mine is the most important factor
What is the most important KPIs for closure		Schedule management is in the top three most important KPIs for mine closure across all respondents. In scheduling mine closure programs, the timing and interdependencies within each stage are critical to avoid delays to program execution, dissatisfied stakeholders and the possibility of claims and disputes. Budget management was in the top four KPIs in 6 of 7 regions. Scare resource management was also in the top four KPIs for 6 of 7 regions

4   A mine closure CPMO strategy/program governance framework

Turner & Townsend has been responsible for the Programme Management Office implementation and operation, and the program maturity assessment for several major mining clients and other industries globally. Ideally, a CPMO should cover an organisation's full portfolio of operating assets and therefore, as new mines transition into operations, reporting from a closure perspective should occur to ensure an organisation's full liability is captured.

With reference to a CPMO strategy, the aim is to:

- Provide processes, procedures, and templates for managing programs within the mine closure.

- Plan and control the project management resources needed to maintain and deploy the closure projects.

- Review function areas and associated execution processes to ensure they are fit for purpose, fully embedded, and applied consistently.

- Improve communication across corporate functions and project teams and to have greater alignment and visibility of strategic priorities and project delivery needs.

- Enhance integration across the corporate and program organisation structure.

- Establish a maturity framework to drive capability improvement.

- Boost the team's equity, diversity and inclusion.

In the CPMO delivery model, and in treating the projects as a program of work, the aim is to provide a consistent approach to closure scope management, cost data, schedule visibility and risk management, while helping mine closure programs adapt to changing priorities.

Organisations are also required to understand the needs and concerns of the local communities around its mining operations, building relationships for effective communication. The sensitive management of mine closures in both environmental and socio-economic ways is fundamental to that work. Through the visibility of performance data, CPMO's provide the opportunity to manage scope, drive cost efficiencies, manage closure schedules, reduce risk and improve standards. The CPMO can enable a high level of cost confidence through driving more consistent ways of working and continual improvement across all disciplines.

According to Hickson & Owen (2015, p. 23), good project governance facilitates decision-making, timely and optimum decisions made by the right people, and decisions that meet the needs of the project and its stakeholders. Mine closure programs are not different and must have the governance framework established and maintained.

5 Best practice methodology

The aim of this section is to describe current leading practice based on the company's experience and global best practice methodologies in the setup of PMOs across various industries. To optimise the value to be added to stakeholders through improved outcomes, the methodology includes the following aspects.

5.1 Setting up for success

5.1.1 Assessing maturity

Each organisation needs to determine what level of performance is reasonable at the current time based on business needs, resources available for engineering change, and organisational ability to accept change (McCormick 2016). An organisational CPMO is best developed cognisant of an organisation's maturity. A maturity assessment will help a mining organisation review and benchmark performance associated with capital program and project delivery. The output will not only provide a quantities view of capital program and project delivery maturity, but a direct comparison of maturity against other similar organisations. This will enable an implementation roadmap to deliver improvements on how capital programs are delivered, gain insight into the requirements for efficient delivery, and align the corporate operating model with strategic plans. Experience shows that achieving high levels of performance typically takes several years and making progress is what counts (McCormick 2016).

The remainder of this section details key considerations required on CPMO methodology in terms of key success factors.

5.2   Robust governance

The CPMO requires governance that refers to the set of policies, regulations, functions, processes, procedures and responsibilities that define the establishment, management and control of projects, programs and portfolios.

> *"A governance framework naturally follows from the implementation of an institutionalised investment management process. Whereas the investment management process is formally created and organised, the governance framework will evolve within the existing operating culture."* (McCormick 2016)

Lack of, ineffective or inappropriate governance is often a root cause of failure or delivery issues for organisations. Program governance is the performance domain that enables and performs program decision-making, establishes practices to support the program, and maintains program oversight (PMI 2017).

Results described in Table 1 indicate that disparate closure projects are particularly susceptible to poor governance.

The goals of governance for the CPMO should:

- Provide a system of good practice by which projects, programs and portfolios will be managed through their lifecycle.

- Ensure lifecycle decisions are documented and supported by appropriate approvals.

- Balance the differing needs of all stakeholders.

- Monitor the actions of management to mitigate the risk of inappropriate actions.

- Clearly define roles and responsibilities and ensure they are performed by competent people.

- Ensure ethical behaviour and promote transparency.

- Describe the proper flow of information to all stakeholders.

- Ensure expected value and benefits are realised through delivery.

Good governance can be demonstrated through:

- The adoption of a disciplined lifecycle governance that includes approval gates at which viability is reviewed, approved and documented.

- The acceptance of responsibility by the organisation's management board.

- Procedures that allow a management board to call for an independent scrutiny of projects, programs and portfolios.

- Giving members of delegated bodies the capability and resources to make appropriate decisions.

- Ensuring that business cases are supported by information that allows reliable decision-making.

5.3   Opportunities to drive standardisation

CPMO technical teams and functional teams are expected to follow mine closure specific policies, procedures, and guidelines. The standardisation of specific tools to assist in creating planning and execution documents is the next step to supporting strong governance and conformity in the way the CPMO operates.

> *"A good analogy is a coaches 'play book'. If you have a defined offence and defence that works, you want to ensure that the team executes as close to the 'play book' to increase the probability of a win. Having a standard set of tools and processes is the PMO's 'play book'. The more your learn and refine, the increased chance of positive outcomes."* (Majik 2018)

The main lessons learned have been to start the engagement with the mines as early as possible to enable deployment and uptake of standardised policies, procedures and guidelines, and adoption of tools and software to bring consistency to planning and reporting processes. This enables standardised reporting frameworks that cascade from project to program to portfolio level. Furthermore, a programmatic approach can drive a culture of improved performance data capture to provide continual improvement both internally and across the broader mine closure industry.

Additional examples of best practice standardisation include:

- Developing an on-boarding Handbook to provide a CPMO induction including the necessary governance, information and links to all resources and training required for anyone joining the global CPMO team. Best practice would be to contain an information management section including tools overview, general instruction on folder structures and communication channels as well as a finance overview. The CPMO technical section and CPMO project controls service model should include links to the standardised procedures, work instructions, calendars, and work lists.

Using standardisation helps ensure that deficits in capability, capacity and the ability to benchmark (see Table 1) across closures in both planning and execution can be reliably mitigated.

5.4 Enhanced scope management

After the basics of managing the schedule, managing scope is the most important activity required to control a project (McCormick 2016). Scope planning and control activities include the effective communication to stakeholders, engineers, and constructors of what is, and what is not included in the mine closure program, and who has responsibility for the remediation and rehabilitation works. The CPMO requires development of a scope book, work breakdown structure (WBS), project charter and project execution plan to enable day-to-day activities to be carried out efficiently. CPMO main deliverables will include assistance and developing, defining, and compiling the project scope and defining how the scope follows the project WBS structure. A key lesson learned involves the scope book being implemented in the early stages of the mine closure process so that teams are clear on the 'what' they must deliver for the closure plan to be successful.

5.5 Value and risk management

PMI (2017, p. 41) states that successful delivery of the program roadmap depends on a well-defined program risk strategy. Risk exposure across a CPMO is dynamic and should be continually assessed to allow stakeholders to have an accurate view of the risk profile. Effective value and risk management is the proactive identification, analysis and management of threats and opportunities that will help organisations make better investment decisions, improve delivery certainty and enhance operational performance. Application of programmatic risk management places a focus on external stakeholders and drives a methodical approach to collaboration, which historically have only been 'somewhat' effective (Table 1).

The CPMO requires risk-based decision-making mechanisms to ensure that only solutions which support the strategic objectives of the CPMO, and have the best chance of being delivered are adopted. Ultimately, organisations need a robust risk management capability to improve delivery certainty and increase the quality of their decision-making.

For successful delivery of risk management, the following areas need to be addressed:

- Enterprise: achieve regulatory compliance.
- CPMO: improve investment decision-making and achieve regulatory spend targets.
- Project: to achieve scope, quality, cost, and schedule targets.

5.6   Change management

Change control on a project or program is a structured and methodical process implemented for managing variations from a controlled baseline and updating this to a required future state. As reported by PMI (2017, p. 29), change management is a key activity in programs.

Change control ensures the project baseline is adequately maintained, providing the organisation with full visibility of adjustments to scope, schedule and cost. The demonstrability of change control allows organisations to manage stakeholder expectations, to ensure that changes are acceptable for the projects long-term goals and identifies where intervention and corrective action is required.

Change control relies on an approved and accepted control baseline as a prerequisite. It is vital to understand the many components of the baseline (e.g. scope, schedule (time), cost (resources & pricing)). The control baseline must align with common project data structures (WBS and control accounts, etc.) so that a common 'language' is utilised across all aspects of the change control service. The integration between the organisations and their supply chains change management processes is a key requirement and invaluable lesson learned in setting up a CPMO.

Key areas to consider:

- Define the terms of reference for appropriate change forums and governing boards.
- Provide guidelines for contingency management.
- Ensure tools and systems are in place including an appropriate change record database (register).
- Record comprehensive impact assessments by nominated individuals.
- Consider appropriate approval time-scales and responsibilities for implementing changes to update baselines and performance reporting.

5.7   Reporting and performance management

Performance reporting lies at the heart of the CPMO. It consolidates performance data from all disciplines into a 'single source of truth' reporting system that provides timely, accurate, objective, and pertinent performance data to promote, assist and track management decisions.

> *"If the right people receive the right information from the PMO at the right time in the right way and they understand it, then they can make informed decisions and act on them which will increase the likelihood of the organisation delivering the planned benefits from its projects and programmes."* (Bysouth 2017)

Key areas to address:

- Consider the organisations governance, stakeholders and methods of communication and how reporting supports these and drives action.
- Understand legislation, culture, or market drivers of the organisation.
- Right-size your target reporting data – so the effort of gathering and processing data is proportionate with the benefits. Apply Level of Control methodology where applicable.
- Consider both lead indicators and lag indicators – being able to trend and forecast is key in enabling positive management action.
- Recognise that much of the reporting data comes from suppliers – properly specify your needs and ensure that assurance checks are in place to assure validity and accuracy.
- Cause effect recovery narration is a key component of the framework.

- Understand hierarchy of success measures with information required at project, sub-program, program, portfolio and executive board level.

- Develop a 'performance measures dictionary' of all the measures and key performance indicators (KPIs) you expect to use in the program – cost, schedule, earned value, risk, health, safety and environment, change, compliance, sustainability, predictability, resource, milestones, benefits etc.

- Narration and actions tracking is as key as reporting data.

- Understand the frequency of reporting required e.g. weekly, four weekly, monthly, quarterly, bi-annually.

5.8 Collaboration and engagement with the supply chain in a consistent and effective manner

With productivity and cost-effectiveness a key issue in delivering major closure projects and programs working collaboratively with the supply chain provides an alternative approach in lieu of adversarial traditional forms. Whilst traditional contracts set-out to provide certainty to the owners and transfer risk effectively, delayed and/or incorrect decision-making can result in 'best for project and program' decisions not being adopted which can result in erosion of value.

Collaborative contracting is an effective commercial environment that provides the opportunity to stimulate innovation and reward the supply chain for the value it creates. Enablers to effective collaborative contracting include balanced commercial terms, early contractor involvement, co-located teams, collaborative working environments, high performing team behaviours and a project and program specific performance framework.

When adopted properly, collaborative contracting can result in productivity improvements, cost reductions, duration reductions and improvements in safety. This is achieved through:

- Improved risk managements through early risk identification and effective mitigation/elimination of risks before they become issues.

- More effective resolution of issues.

- Innovative approaches to improve productivity and efficient use of resources.

- Creating a high performing team where project and program outcomes are always priority.

From a human resources perspective, collaborative contracting can also improve employer satisfaction by creating an environment that they want to be part of. This supports staff retention and the onward benefits of continuity of resources.

5.9 Creating an environment of lessons learned and continual improvement

A crucial governance activity that should take place to ensure CPMO's are constantly improving is a lessons learned review. To achieve this, it is leading practice for CPMO's to establish a lessons learned framework across their program. There is significant benefit of this being undertaken by an independent team so unbiased analysis can be undertaken (Vignos 2014). These learnings are normally documented and maintained by the CPMO for future reference. By completing this process organisations will learn:

- Approaches that delivered successful outcomes and should be repeated.

- Identification of root cause issues, which can be used to initiate problem solving sessions to mitigate future occurrence.

KPIs and their weightings may vary across projects, but performance needs to be captured and analysed in a standard manner to understand areas of success and poor performance across the CPMO. Key performance data includes:

- Cost and schedule performance data.

- Collation of safety and environmental statistics.

- Quality control and assurance information should also be documented (materials non-conformance, completed work packs, completions processes fully implemented).

6   Conclusion

The application of PMO has been well documented to support better governance, standardisation, scope management, cost validation and controls, governance, and risk-level determination across organisational portfolios. If set up correctly in the closure space, the CPMO can also be a framework through which to manage more than the traditional portfolio requirements of time, cost and quality. Taking a programmatic approach can support improved outcomes in closure performance, environmental recovery, economic and social sustainability initiatives, collating lessons learned to leave a legacy project after project. It allows a mechanism to reliably evaluate holistic and standardised approaches to closures.

Success will rely on building capability within CPMO teams so they can define the strategy and operating model for delivery of the closure program and build the program culture. It is essential to set up governance, processes, authorities and a standard way of working across all projects – enabling all decisions to be made through a consistent lens. Finally, applying standardisation, including, critically, a common digital, data and reporting environment that enables effective control – regardless of program scale or complexity.

This article articulated the opportunity for organisations and the industry to break the mould of delivering closure from a 'project to project' asset-based approach to a programmatic and lessons learned based approach. Through adopting a programmatic approach, the following opportunities can be realised:

- Improved governance.

- Opportunities to drive standardisation.

- Enhanced scope management.

- Improved value and risk management.

- Proper change management.

- Improved reporting and performance management.

- Collaboration and engagement with the supply chain in a consistent and effective manner.

- Creating an environment of lessons learned and continual improvement.

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