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Building the business case for closure

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Abstract

A business case provides the framework for the planning and management of an entire project, and assists in systematically assessing the strengths and weaknesses of a project proposal. It includes justification for undertaking the project based on its anticipated risks, expected benefits and estimated costs.

Business cases are used to assist in decision making processes, obtain management commitment and gain investment approval by providing sound rationale for the investment. A business case should address all phases of a project including closure; to do otherwise risks making a poor project investment.

The need for mine closure to be an integrated part of the complete project life cycle, including business planning, is well documented. However, the information required by mining companies and project managers, and the tools that can be used to develop the business case for closure, are less well understood. Consequently, many industry personnel experience difficulty in developing an effective business case for closure.

To provide guidance on how to successfully integrate mine closure planning and valuation into the business planning process, this paper draws on experience in the mining industry in Australia and Asia from the perspective of mining companies. This paper does not attempt to list all of the requirements for building a successful business case for closure, but discusses six key aspects in this regard: motivation, project design, risk assessment, legal compliance, closure valuation and teaming.

1 Introduction

Every mining project, no matter how large or small, proceeds through a life cycle with a series of similar phases. A typical project life cycle comprises:

- Concept or scoping.
- Planning.
- Pre-feasibility study.
- Feasibility study.
- Authorisation.
- Execution (or implementation).
- Operation.
- Closure.
- Post closure care and maintenance.

The need for mine closure to be an integrated part of the complete project life cycle, including business planning, is well documented. For example, see the mine closure planning guidelines by the Department of Industry, Tourism and Resources (DITR, 2006). Indeed, planning for closure is considered to be fundamental to the responsible operation of any mining company with closure integrating across a range of aspects including health and safety, environment, community and financial factors (Dowd and Slight, 2006). However, the information required by companies and project managers, and the tools that can be used to develop the business case for closure, are less well understood and many industry personnel experience difficulty in developing an effective business case for closure. This was clearly enunciated at the Life After

Mining workshop held immediately prior to the Third International Seminar on Mine Closure held in Johannesburg, 14–17 October 2008, where delegates discussed the difficulties they had experienced in getting their managers to take seriously the need to consider closure planning as part of the business case for a project, particularly in relation to the socio-economic implications of closure.

The development of a business case requires correct information, the right people to be involved, appropriate supporting systems and integration into the business planning process. This paper does not attempt to list all of the requirements for building a successful business case for closure, but discusses six key aspects in this regard:

- Motivation.
- Project design.
- Risk assessment.
- Legal compliance.
- Closure valuation.
- Management and teaming.

2 What is a business case?

A business case provides the framework for the planning and management of an entire project and assists in systematically assessing the strengths and weaknesses of the project proposal. It includes justification for undertaking the project based on its anticipated risks, expected benefits and estimated costs. In assessing the business case for a project proposal, a company will review project value against its investment criteria and also consider how the proposal compares with competing investment opportunities.

Business cases are used to assist in decision making processes, obtain management commitment and gain investment approval by providing sound rationale for the investment. A business case should address all phases of a project including closure; to do otherwise risks making a poor project investment. Ultimately companies aim to optimise their investments to gain maximum revenue for an investment made. Failing to account for mine closure can add significant costs to a project – so if closure is ignored, business decisions may be flawed.

Once a company is confident that a viable mineral resource has been identified, it commences its project studies. Studies are staged to allow a progressive and considered assessment of the project, with an increasing level of detail and accuracy as the assessment moves from the scoping or concept study, to a pre-feasibility study, and then to a full feasibility study.

A pre-feasibility study is used to evaluate several project alternatives and then select the preferred alternative. To do this, studies are conducted to define the alternatives and their strengths and weaknesses. Once the preferred alternative has been selected, the feasibility phase commences. This phase of the project life cycle comprises more detailed studies which are conducted to provide a high level of assurance that the project can be completed successfully. These studies produce the scopes, schedules, assessments of risks and benefits, and budgets used by an organisation during the authorisation phase to justify the allocation of the funds required to implement the project. In essence, the feasibility study deliverable is a report that documents the business case for a project and is used as the basis for making a decision on whether to proceed with the proposed project investment.

3 Key considerations in building the business case for closure

3.1 Motivation

During discussions with the project managers of feasibility studies over many years of being involved with closure planning in the mining industry, the authors of this paper have asked what factors the project managers consider when deciding if and how they will incorporate closure planning into business planning for a new project or project modification. As a result of these discussions, it is apparent that a wide range of

factors is considered to be important and that these vary between project managers according to the project for which they are responsible. However, a common theme is that it is important to understand what motivates companies to integrate closure planning into the business case, or how to motivate a company if there is reluctance to do so.

The aim of taking a systematic approach to closure at an early stage in a project's life is to maximise the revenues earned from a project and minimise the costs associated with closure. Figure 1 shows that with careful and systematic closure planning, the revenues earned over the life of a project can be increased (refer to lines 1 and 3 on the graph), and the costs decreased (refer to lines 2 and 4). The information portrayed in Figure 1 and the planning and evaluation tools that support the closure planning processes form the basis of the business case for closure.

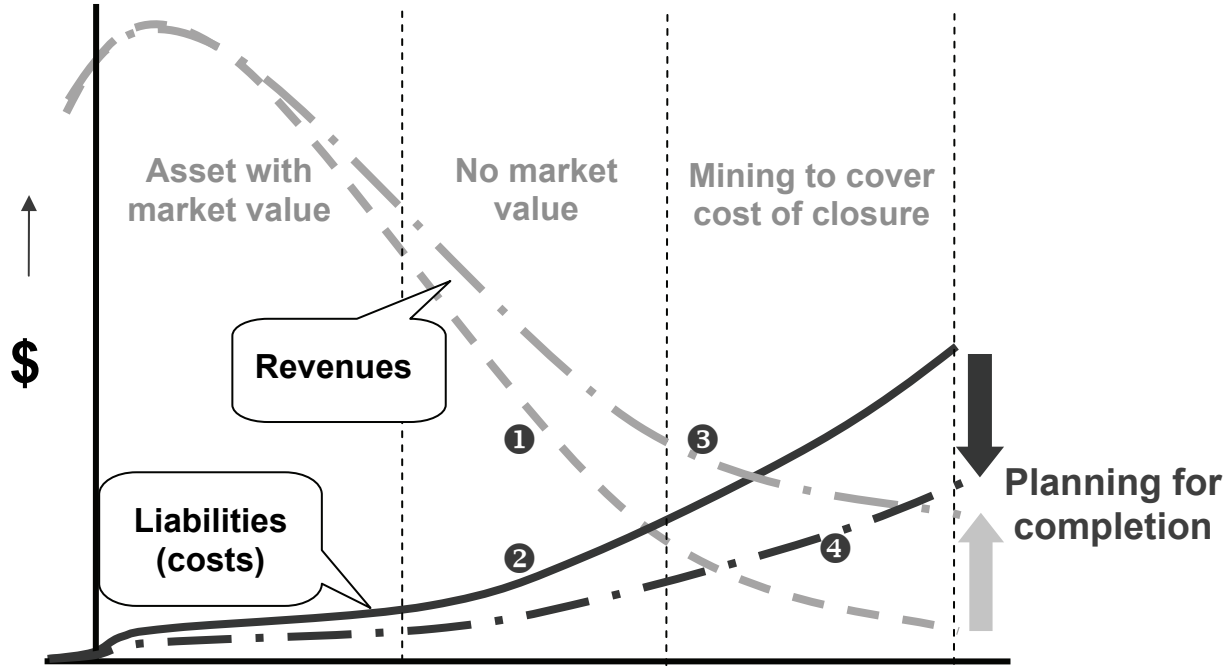

Figure 1 Relationship between project revenue and costs

Generic checklists of the benefits for including mine closure planning as part of business planning are widely available in industry guidelines such as those produced by the DITR (2006) and the International Council on Mining and Metals (2008), as well as company standards such as BHP Billiton (2004) and Rio Tinto (2004). These are useful when motivating to the Board or key decision makers to include closure planning as part of a project's business case and provide adequate resources for this component of the project study. However, it is important to define the project-specific motivators and not to rely on a generic list of risks and benefits.

Experience suggests that the key factors in this regard relate to:

- How closure considerations could affect the design of a project.
- The project's risk profile (including its ability to demonstrate legal compliance).
- The capital and operating cost of a project.

To address these factors, project managers often go to significant lengths to develop project teams with appropriate experience and expertise. These factors are discussed in the following section.

3.2 Taking the right design path

Organisations often choose a mine or process design and then think about closure, rather than integrating closure considerations into the process of assessing project alternatives and options. This approach limits the alternatives that can be considered for closure and potentially reduces a company's ability to optimise the life

of asset costs and revenues. During the planning phase, projects have the most freedom to influence conceptual project design decisions and associated closure costs. For example, choosing a bauxite refining process that produces a residue that has been neutralised and has minimal moisture content, rather than one that is still highly caustic, can result in very different complexities and costs for closure. While the initial costs for the process might be much higher, when the costs of closing the residue area are taken into account, the overall life of mine cost is lower. Similarly, the process chosen to treat some ores containing vanadium will influence the type of tailings and the ease with which the associated tailings storage facility can be closed. For this example, decisions needed to be made during the planning phase as to whether to include a vanadium circuit in the process plant or to treat the vanadium being pumped to the storage facility to ensure that it is in a form that is not easily mobilised into the groundwater.

Later, during operations, changes to project design processes to achieve better closure outcomes become incremental and the ability of closure considerations to fundamentally influence the profitability of a mine diminishes as the life of a project progresses. Consequently, it is important that environmental and social scientists work with the project design team to identify the best options for closure as part of the option selection phase. A number of mining companies are starting to run multidisciplinary mine closure workshops as part of the design option selection phase for a project. For example, during a recent feasibility assessment of a gold mine expansion it was identified that there was potential to use waste rock from the additional mining operations to cap a tailings storage facility on closure instead of developing a new waste rock dump. This triggered an environmental and engineering cost-benefit assessment which had the potential to significantly change waste rock disposal methods and the costs of sourcing capping material for the tailings storage facility.

3.3 Risk assessment

Closure planning is generally conceptual during the early stages of a mine's life and there are often many unknowns including:

- How revegetation will respond on reconstructed landforms.
- How much soil or water contamination may need to be remediated and what types of contamination might be present.
- Final characteristics of the tailings.
- What the requirements of the community or regulators might be with respect to agreeing to tenement relinquishment.

Risk assessment is a way of identifying these potential issues and prioritising actions that need to be taken to reduce the risks. Typical issues and associated actions that arise from risk assessment processes are as follows:

- Lack of understanding of how to propagate local flora species, requiring research into revegetation techniques.
- Lack of understanding of the geotechnical and geochemical characteristics of the materials at the site, and how they will behave following rehabilitation, requiring research into the characteristics of the different materials at the site and the most suitable construction of the final landform for waste dumps, tailings storage facilities and drainage structures.
- Lack of topsoil to cover the reconstructed landforms at the site, requiring investigation into other materials that can be used as a growth medium at the site.
- Whether process liquors stored in evaporation ponds can be evaporated or whether additional treatment of the liquor remaining in the ponds will be required at closure. Often assumptions are made about the ability of process waters to be evaporated. However, the build-up of salts in the ponds and local climatic conditions may mean that additional treatment of the remaining liquors is required. Therefore, research is required on techniques for treating the residues.

- Regulatory and community expectations regarding achievable closure standards evolve over time, requiring ongoing consultation to ensure that the closure criteria and associated assumptions regarding level of effort and cost for closure are still valid.

While the risks identified at the conceptual level of closure planning can be reduced following a careful research programme during operations, there will still be unplanned occurrences that add to the cost of closure. One way of allowing for these unplanned issues is to develop an assessment of risk cost and incorporate this into the closure cost. Risk costs can be calculated in a number of ways. Some organisations use a probabilistic modelling approach. Other companies use a simple calculation of expected value by multiplying the probability of a risk occurring with the cost of the consequences of the risk event should it occur. Whichever process is used, the value in the process lies in identifying what could go wrong and incorporating a suitable contingency into the closure cost to allow for one or more of the identified risks to occur.

The key to identifying a suitable contingency lies in striking the right balance between conservatism, i.e. making the contingency too large by assuming that all the risk events will occur, and being overly optimistic, i.e. making the contingency too small such as assuming that all risk events are of such a low probability that none will occur. As the chief financial officer (pers. comm., 2007) of a mine in the Hunter Valley remarked,

> *"...unplanned events with a cost implication always occur and the closure of this particular mine is no different."*

3.4 Legal compliance

Legal compliance is an important business driver for carefully reviewing the closure aspects of a project at an early stage. One of the main problems for mine sites trying to comply with closure requirements formulated during the approvals process for a project is that some of the closure commitments were made or agreed to when the project design was still at a conceptual stage and little work had been done to investigate the practicality of implementing these commitments. This may not be a problem if the mine closes according to a scheduled timetable as there is plenty of time to investigate practical alternatives for closing the mine and to agree on these approaches with the regulators. However, if there is an early unplanned closure, with research by Laurence (2002) suggesting that almost 70% of the mines that have closed in Australia have been unexpected or unplanned closures, then mines may be left with requirements to implement impractical and expensive methods for closing the mine. Examples of commitments that have been made at the approval stage which have become subsequently difficult or expensive for sites to implement include:

- Removal of all industrial materials from site. This can be time-consuming and costly and there are often acceptable alternatives such as building disposal cells at the site for the on-site disposal of demolition waste.
- Removing tailings or waste rock from temporary above ground storage and disposing in the pit. In one instance, a company committed to relocating potentially acid-forming tailings from a temporary above ground to a pit once mining was completed, but then realised that the cost of this procedure had been underestimated. However, leaving acid forming residues on the ground surface could potentially cause contaminated runoff in the future.
- Achieving a certain revegetation outcome before any studies have been conducted on whether local species are likely to grow on reconstructed landforms.
- Using a certain type of material to achieve rehabilitation outcomes. For example, one site specified that it would use a clay cap for its tailings storage facility. However, there was no clay available on site, so the material would need to be imported at a high cost.

These situations could be avoided if commitments are designed to achieve an outcome rather than prescribing actions. In other words, where there is uncertainty, commitments need to focus on "what" needs to be achieved rather than "how" to achieve it. However, even with a focus on closure outcomes rather than prescriptions, it is still important to conduct sufficient work on project designs and conceptual rehabilitation plans at the earliest stages of a project to understand what closure commitments can be achieved, what the

approximate cost of achieving these outcomes will be and whether the project is still viable taking into account the costs of closure.

One of the key roles of a closure plan is to maintain a record of legal obligations for closure. These obligations should be regularly reviewed throughout the life of the mine and where closure concepts start to depart significantly from the obligations as a result of new knowledge or technology, approval for updated approach should be sought. It is important to keep up-to-date with the regulatory approval of any departures between original closure obligations and plans, as unplanned closure can force a site into having to implement a less optimal closure plan to comply with legal requirements if suitable discussions and agreements with regulators to the implementation of alternative approaches have not occurred. This potentially increases the costs of closure and post-closure maintenance, and decreases the effectiveness of closure.

3.5 Closure valuation

Feasibility studies usually assess the technical, economic, environmental and social practicality of a project against a range of screening criteria, of which financial indicators tend to feature prominently. Although it has long been recognised that the cost of closure can be substantial, it is usually a distant future expense so it often has little effect on the key financial indicators used in feasibility studies such as the net present value (NPV) of the project and the internal rate of return (IRR). Consequently, closure costs are unlikely to make a material difference to feasibility study financial outcomes so there is little motivation to quantify closure costs with any particular rigour at the feasibility stage (ICMM, 2008; Sutton et al., 2008). However, there are other important reasons to develop detailed closure cost estimates as part of the business case for a project, as discussed below.

Under international accounting standards, companies are required to declare mine closure liabilities in their annual financial reports. Therefore, it is important that these closure liabilities are properly assessed and reported to comply with financial disclosure requirements. Accounting firms are starting to question the validity of closure costs and are requesting that these be properly reviewed.

Historically, many mines have not worried about the true cost of closure until near the end of the mine's life. Often there is no real effort to research closure techniques to identify more cost-efficient ways of closing the mine. With the requirement to report closure liabilities to an appropriate level of accuracy in financial statements, closure costs have a direct impact on the profit and loss statement for a company and consequently there is a driver to carefully research closure to optimise the costs associated with achieving required financial and social outcomes.

In the past, many mine sites have underestimated the costs of closure significantly. The adoption of a rigorous approach to the assessment of closure cost, at the urging of an organisation's external auditors, has had a significant impact on the quantum of closure cost estimates. Examples of the change in closure cost estimates once a rigorous approach was taken are provided in Table 1. These examples are drawn from case studies by URS Australia Pty Ltd and exclude demolition costs.

Table 1 Comparison of closure cost estimates for selected mining projects in the Asia-Pacific region

Project	Date of Last Closure Cost Estimate	Original Closure Cost Estimate	Updated Closure Cost Estimate	Difference Between Cost Estimates
Case study 1	2004	$2,399,898	$3,867,135	61%
Case study 2	2005	$4,273,960	$8,571,125	101%
Case study 3	2004	$1,938,500	$3,571,666	84%
Case study 4	2005	$12,012,400	$21,850,673	82%

Examples of closure cost elements that are typically poorly addressed in closure cost estimates are as follows:

- Availability of suitable materials for use in closure and their locations in relation to the landforms that require them, e.g. waste dumps, tailings storage facilities.
- The amount of earthworks required to re-profile waste dumps and tailings storage facilities.
- The cost to clean the process plant prior to demolition.
- The requirement for tailings storage facilities to dry out prior to closure and the consequent need to remobilise equipment and pay a sub-contractor to conduct the earthworks; at a higher cost than using own equipment already on-site.
- The cost of demolishing the process plant. Many organisations use 'rule of thumb' methods. For example, percentage of the insurance value of buildings or percentage of the construction cost, that result in inaccurate cost estimates. In addition, a number of companies significantly overestimate the cost of demolition by using a deconstruction estimate. This deconstruction approach assumes that equipment will be taken apart in a manner that allows salvage of parts and resale. The only reason that an organisation would adopt this approach is if the salvage value of the equipment outweighed the costs of deconstruction. Given that the accounting standards do not allow the potential value that might be gained from the sale of equipment to be recognised in the closure cost estimate, it does not make sense to use a higher deconstruction cost estimate as opposed to a demolition cost estimate in the overall closure cost.
- Costs of off-site waste disposal or of constructing properly engineered on-site disposal facilities.
- Costs of treating residual process liquors.

Given that there is often uncertainty around a number of factors relating to the cost of closure (such as the quantities of materials that will need to be moved during the rehabilitation of waste dumps and tailings storage facilities, the extent of contaminated soil or groundwater that will need to be remediated and the unit cost rates), probabilistic or range analyses should be used when assessing costs. These techniques involve identifying the range of values that might be applied to any variable to develop a cost estimate that represents a suitable level of conservatism which is not overly pessimistic or optimistic.

ICMM (2008) notes that financial motivation to include closure costs in feasibility studies may be gained by undertaking a cash flow analysis for the life of an operation, yet this is rarely practical at this early stage of a project for those mines with more than five to seven years of operational life so it is important to ensure adequate provisioning of funds for closure. However, given the structure of capital investments necessary for most mining operations, mining companies tend to be reluctant to put aside large sums of money early in the life of the mine for closure (World Bank and International Finance Corporation, 2002) unless required to by, for example, legislative requirements. As a result, there is often inadequate funding available in the event of unplanned or unexpected closure. Development of a reasonable closure cost estimate as part of the business case for a project would position a company better to cope financially if its project was to close earlier than expected.

3.6 Developing the closure team

The development of effective closure plans and cost estimates requires a multi-disciplinary team with key people including the site's management team, project estimators and schedulers, mine planners, geological and geotechnical personnel, metallurgists and process engineers, civil and other engineers, health and safety officers, environmental and community relations personnel, and others. However, one of the difficulties facing companies is that often those personnel involved in feasibility studies and developing the business case for projects have a project development focus and have limited operational experience. Further, those study team members who do have operational experience tend to have little or no experience in actually closing a mine. Consequently, the project teams tend to be focused more heavily on initiating projects and facilitating operations than on closing them, so the challenges of closure are invariably poorly defined and often understated. This is particularly the case for a greenfields site where it is usual that the operational

personnel are not appointed until project construction is well underway or project operations are due to commence.

To avoid this situation, the team utilised in preparing the preliminary closure plan for a copper project in the Pilbara region of Western Australia included personnel who not only had operational experience but were planning to be part of the site operations team when the project was implemented. This core team was supplemented by consultants with experience in specific technical aspects such as acid drainage, rare flora, endangered fauna, hydrology, hydrogeology and other aspects to ensure comprehensive coverage of all factors relevant to closure planning for the project. A similar approach has been adopted recently by another mining company aiming to develop a project in Western Australia. This particular company has mobilised experts from around the globe to participate in a workshop to define the best closure option for a proposed development.

4 Conclusion

Experience suggests that the following are the key building blocks for the business case for mine closure in relation to the topics discussed in this paper:

- The benefits of incorporating closure planning into business planning are generally well understood, but need to be project-specific for this process to be effective.
- Development of a closure concept at the early stage of a design process enables fundamental changes to designs to be made to improve the overall value gained from the life of the asset. A number of organisations are starting to adopt the approach of organising a workshop of multidisciplinary experts to define closure concepts for a site early in planning for a project. The outcomes from the workshop are then used to help inform the design selection process.
- Risk assessments associated with mine closure should be conducted at the early stage of mine planning so that an appropriate programme of research can be embarked upon to reduce closure costs and achieve improved environmental and social outcomes.
- Effort should be put into identifying and agreeing realistic and achievable closure commitments at the environmental approval stage of a project to facilitate future compliance with legal obligations.
- Closure costs have a direct impact on the profit and loss statements of companies as a result of the international accounting standard requirements to report closure liability in annual financial statements. Financial auditors are now taking a more rigorous approach to the assessment of the adequacy of a company's closure cost estimation process, so it is important that closure costs are auditable and assumptions used to develop the cost are clearly documented. The potential for mine closure costs to directly impact the profit and loss statement of the organisation provides the driver for integrating mine closure into the early stages of project planning.
- Mine closure costs can be most effectively reduced and environmental and social outcomes enhanced at the early stages of a project, e.g. design selection. The ability to influence costs and social and environmental outcomes at closure reduces as the mine life progresses. Improvements in closure costs and social and environmental outcomes become more incremental as a mine comes to the end of its life.
- The risk of understating or misunderstanding a project's closure issues and challenges can be significantly reduced through the use of a multidisciplinary team with relevant project and operational experience.

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