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CONFERENCE PAPER

## Investigating coal-mining expenditure projects to increase investment value

Benjamin Skerman<sup>1\*</sup>, Barrie Todhunter<sup>2</sup>

<sup>1</sup>University of Southern Queensland. [w0077491@umail.usq.edu.au](mailto:w0077491@umail.usq.edu.au)

<sup>2</sup>University of Southern Queensland. [todhunter@usq.edu.au](mailto:todhunter@usq.edu.au)

**\*Corresponding author:** Benjamin Skerman, University of Southern Queensland. [w0077491@umail.usq.edu.au](mailto:w0077491@umail.usq.edu.au)

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### Synopsis

Anecdotal evidence from stakeholders in the Australian coal-mining industry suggests that there are shortcomings in the outcomes of expenditure projects involving the inability of current practices and processes to deliver the intended investment value and benefit to the business. This problem appears to extend across a wide range of capital and operational expenditure portfolios, from small operational projects to major capital investments, with investment value and benefits being diminished by poor management and definition of project requirements.

### Research design

The research is based on the exploratory sequential mixed method.

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## Relevance for practice and education

This paper explores the background to this problem and outlines a proposed methodology for a research project to provide an appropriate framework for a methodology to improve project outcomes in the Australian coal-mining industry.

## Main findings

The research paper identifies existing research in the relevant domains and highlights the lack of direct research that links these concepts together and specifically relates them to requirements management in the Australian coal-mining industry.

## Research implications

Management of the project value to deliver the project potential value or benefit to operations in the project delivery phases are possible implications of this research..

## Keywords

**Benefits management, Requirements Management, Value Management, Project Management, Coal Mining**

## Background of the research problem

The Australian coal-mining capital expenditure investment has been significantly reduced since 2012 and is expected to decline further (RBA 2016). This reduction in capital investment highlights the importance of maximizing the value of project outcomes and eliminating project shortcomings and failures in an environment where reduced funding is available to achieve the strategic objectives of the client coal-mining organization. In terms of project failures, Ernst & Young (EY 2015, p. 3) identified that “every overrun impacts total shareholder return, ROCE [return on capital employed], capital productivity, corporate performance and strategic outcomes.” Maximizing project value is essential in order to achieve capital productivity, which is defined as “a measure of the effectiveness and efficiency of capital investments in generating operational outputs” (EY 2015, p. 5). In short, capital productivity assesses “value for money” on a multibillion-dollar scale (EY 2015, p. 5), with the intent to achieve more with less through a minimal payback period and a high Net Present Value (NPV).

Observations from the author over an extended period from stakeholders in the Australian coal-mining industry provide anecdotal evidence that there are shortcomings in the outcomes of expenditure projects that are eroding the potential project and investment value and that many of the issues can be traced back to the respective stages of requirements management. This problem appears to extend across a wide range of capital and operational expenditure portfolios in the coal-mining industry, from small operational projects to major capital investments.

## Analytical framework

To research this perceived problem, a preliminary analytical framework was developed and is shown in figure 1. The framework consists of three core elements:

1. Determination of project requirements from the business strategy and objectives
2. Management of the project requirements in the portfolio management and project delivery phases of the project life cycle
3. Management of the project value to deliver the project potential value/benefit to operations in the project delivery phases of the project life cycle

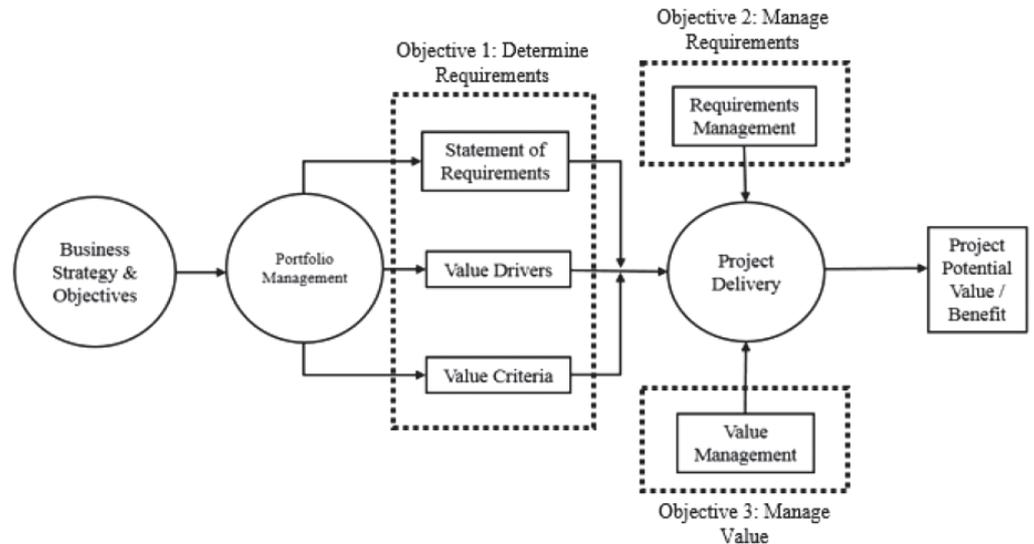


Figure 1 Analytical framework. Source: developed by the author for this paper

Based on the framework, four domains have been identified for carrying out the literature review:

1. Project management practices and methodologies – the first domain deals with project management practices and methodologies used for project delivery in the coal-mining industry. Project management practices and methodologies are concerned with the systems, procedures, controls and processes used across the project life cycle, and are potentially related to the project success or failure. They also determine the approach to defining sponsor requirements in the initial stages of the project.
2. Requirements management – the second domain is requirements management, which is related to the identification, recording and management of project requirements from key stakeholders for capital projects in the coal-mining industry, as well as their possible effect on project outcomes.
3. Value management – the third domain is value management and is concerned with managing the value requirements, benefits and outcomes of the project throughout the life cycle.
4. Coal-mining project overruns – the fourth domain covers capital and operational investment in the coal-mining industry and the occurrence of project overruns.

## Literature review

### PROJECT MANAGEMENT PRACTICES AND METHODOLOGIES

Project management practices and methodologies in the mining industry appear to be well established with mature procedures, manuals and guidelines (Wittig 2014). A study by Steffen, Couchman & Gillespie (2008, p. 3) indicated that “several of Australia’s coal-mining companies have robust capital project management processes in place, and some of these organizations have moved further to the forefront of world’s best practice over the past few years as they look to manage larger project portfolios in a time of volatile market conditions.”

In spite of these views, other research indicates that project management factors do contribute to project cost and schedule overruns in the mining industry (EY 2015), with anecdotal reports suggesting that inappropriate project management practices and methodologies may be occurring in coal-mining capital projects with many large mining projects experiencing cost and schedule overruns. Findings from the literature review indicate that there has been significant research into project management methodologies in the construction and engineering sectors (Chan, Scott & Chan 2004; Hundertmark, Olinto do Valle Silva & Shulman 2008; Ling 2004; Mahmoud-Jouini, Midler & Garel 2004; Öztaş & Ökmen 2004), but few, if any, related to Australian coal-mining capital projects.

### VALUE MANAGEMENT

Value management is the strategic process implemented to harness the value opportunity and should examine all options of the project, which include the social, political, economic and environmental impacts, and develop benchmarks for future decision-making (Hayles, Graham & Fong 2010), with the benefits of the project associated with the performance of an organization (Chih & Zwikael 2015). In a market review, Deloitte (2013, p. 22) stated that “mining companies fail to capture the full value potential that a mining project can offer, either due to the fact that they don’t know what that full potential is (lack of knowledge/ expertise) or because they refuse to undertake activities, no matter how value-accretive they are, that deviate from their expertise (ego and pride)” and that “success is more than simply delivering a project on time and on budget.” The use of value management in the early stages of the briefing process can assist in optimizing the project outcomes (Yu et al. 2005) and is an essential factor in achieving quality engineering planning (Park & Kwon 2011). However, Bowen, Edwards et al. (2010) established that consulting engineers in South Africa, although aware of value management, do not undertake value management to any significant extent and that there are insufficient training material and programs in the value management education field (Fong 2004). Research by Martinsuo & Killen (2014, p. 66) into value management in project portfolios revealed that “project portfolios may have strategic value beyond financial benefits, but such value is not sufficiently accounted for in project portfolio evaluation frameworks and decision makers’ collective sense-making.” There is evidence of some research in value management in the construction and engineering industries (Bowen, Cattell et al. 2010; Bowen, Edwards et al. 2010; Cha & O’Connor 2005; Fan, Shen & Luo 2010; Maniak et al. 2014; Park & Kwon 2011; Shen & Liu 2004; Yannou & Bigand 2004; Yu et al. 2005); however, there appears to be minimal research in the general mining area, nor is there any specifically in the Australian coal-mining industry.

## REQUIREMENTS MANAGEMENT

A study by KPMG (2013) revealed that 79% of respondents feel that change in project scope/design leads to project schedule overruns in the execution phase in Indian infrastructure projects. (Yang, Chen & Wang 2015) state that “requirements management is crucial to the successful delivery of construction projects,” with a major cause of project failure being inadequate requirements management, and that enhanced project outcomes are achievable with better documentation of project requirements. Furthermore, poor systematic processes for the stakeholder identification and requirements management are linked to schedule and cost overruns (Aapaoja & Haapasalo 2014). It has also been established that there is an issue with the management of client requirement information throughout the project life cycle in the construction industry (Karim Jallow et al. 2014). Lopes and Forster (2013, p. 142) acknowledged problems “such as imprecise plans, loss of information and information recorded in ambiguous or incomplete form” are related to requirements management and can lead to cost overruns.

Delays in the South African coal industry include delays caused by too many owner changes (Lee 2012). Similarly, in the building and infrastructure construction industry, multiple changes in owners’ requirements or definitions have been determined as a root cause of cost overruns (Rosenfeld 2014). A study by Smith (2014, p. 5) determined that “47% of unsuccessful projects fail to meet goals due to poor requirements management,” and this highlights the potential value opportunity for improved requirements management in the Australian coal-mining industry.

There are strong overlaps between coal-mining projects and the construction industry with similar procurement and contractual processes used to execute capital projects in the coal-mining sector. Lee (2012) provides a good illustration of the overlap between the construction industry and the South African coal industry, where there are multiple similar causes of project delays. In Australia, major construction contractors in the coal-mining sector include Bechtel who are a global construction company and which delivered the new Daunia and Caval Ridge coal mines in Queensland (Bechtel 2016). The TMM Group has delivered projects in the coal-mining sector, including the Baralaba North Coal Mine levee and associated site infrastructure in 2013–2014 for Cockatoo Coal (TMM 2016). The links between the mining and construction sectors confirm the growing perception that requirements management is not being successfully implemented in coal-mining projects, leading to shortcomings in project value and benefits. A lack of literature relating to requirements management in coal-mining industry capital projects confirms the need for further research in this area.

## COAL-MINING PROJECT OVERRUNS

Research by Singh (2010) provides evidence of overruns in the coal industry in India, with over 60% of projects having a schedule overrun and over 20% having a cost overrun. The 2013 Major Projects Report Queensland Engineering Construction Outlook (Hart et al. 2013) highlights that many projects have experienced large cost overruns in the resources sector. The EY (2015, p. 3) study “revealed that overruns to the sanctioned budget and schedule commitments are the norm with our global mega-project sample group showing an average budget overrun of a staggering 62%” in the global mining sector. There is anecdotal evidence that the mining industry globally has cost and schedule overruns, and this is supported by research by Lee (2012) into project delays in the South African coal sector. However, there is

no recent or relevant literature on the actual extent of schedule and cost overruns occurring in Australian coal-mining capital projects.

## Further research

This research investigation is currently being undertaken as part of doctoral studies with an Australian university. The research problem has been identified based on personal experience and observations of the principal author, and the research questions have been derived in order to find a solution to the problem. Undertaking this research project is intended to provide an improved conceptual framework for the management of coal-mining projects in Australia, which in turn will lead to improved project outcomes across a range of quantitative and qualitative dimensions. It is anticipated that many of the dimensions of this problem relate to poor requirements management throughout the project, and this will be confirmed or disconfirmed as a result of this research project. Given the small number of large coal-mining projects currently under construction, the project will primarily involve investigation of case studies to gain the relevant insights into the problem, as well as possible solutions.

## Research method

This research project will use exploratory sequential design with three phases. The first phase of the study collected qualitative data to gain information and insights into what stakeholders perceive as “value”; its importance; the metrics used to determine, measure and assess it; and how project management practices and methodologies align to achieve this intended “value.” The study will use semi-structured interviews involving a minimum of six and a maximum of ten experienced stakeholders from mining companies and construction contractors operating in Queensland and New South Wales. Recent anecdotal feedback received from industry indicates that issues leading to project value erosion include design changes (due to omissions, inadequate, incorrect project solutions), specification changes, poorly defined scope and specification, stakeholder changes and constructability issues. These issues will be included in the topics to be explored during stage 1 interviews.

The results of the first phase will inform the second phase by providing a better picture of the requirements and value management variables. They will be explored through a broader-based survey instrument that will be sent to approximately 200 stakeholders in the sector, targeting a wide cross-section of the industry of key stakeholders in the Australian coal-mining industry. The third phase of the study will develop a draft framework to address the research problem, and this will be evaluated through a series of focus groups with key stakeholders. The population for this research is coal-mining companies, consultants and construction contractors operating in Queensland and New South Wales.

## Scope of project and challenges and limitations

The scope of this research is limited to expenditure projects undertaken by coal-mining companies and delivered by construction contractors working in the Queensland and New South Wales coal sector. This research is concerned with the perceived failure of expenditure projects to deliver the potential value of the project to the sponsor.

Challenges anticipated include the availability of company documentation due to disclosure and privacy concerns. It is recognized that detailed project information, including costs, schedules and project data, are unlikely to be available due to sensitivity issues;

however, the research methodology for this study has taken into account the absence of such project information, and this will not detract from the intended research outcomes. Typical documentation that will provide benefit to the study includes project standards, guidelines and procedures. There may also be challenges in gaining access to coal-mining company personnel due to availability and willingness to reveal information. Another issue that might occur is achieving adequate responses from the survey as, historically, surveys achieve low response rates within the industry.

## Validity

Qualitative validity will be completed by applying a member checking approach in stage 3, where the findings will be summarized and presented to the stage 1 focus group to confirm the accuracy of the results. The quantitative validity will be achieved by using a construct validity process where the results are reviewed against the research problem to verify that the intended aims have been measured.

## Aim of the research

This research will provide five key contributions:

1. Determining whether the intended project value and benefits are being achieved in Australian coal-mining projects
2. Ascertaining the predominant reasons for any failure to achieve the intended project value and benefits
3. Determining whether, and to what extent, the investment value and benefits are being lost due to poor management of project requirements in expenditure projects
4. Providing a framework that leads to better management of project requirements in the coal-mining industry, to achieve the intended value and benefits
5. Enabling the above-mentioned framework to be transposed to other areas of the coal-mining industry, including mine planning process and operational planning, where requirements are the basis to achieve value and benefit to the mine site in order to deliver revenue to the business. The framework may also provide benefit to other sectors outside coal mining, for example the public infrastructure, engineering and construction industries, as the broad principles may be applicable.

## Conclusion

This paper has outlined the literature review, proposed methodology and the contribution to research for the perceived problem of shortcomings in the outcomes of expenditure projects that are eroding the potential project and investment value of those investments. The findings from the literature review have identified that existing research in the relevant domains has highlighted the lack of direct research that links these concepts together and specifically relates to requirements management in the Australian coal-mining industry.

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