THE AUSTRALIAN QUARRYING INDUSTRY: INVESTIGATING ITS STRATEGY-LEVEL LEADERSHIP AND THE INDUSTRY'S POSSIBLE FUTURES TOWARD 2029

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ABSTRACT

Research related to the quarrying industry globally, is very rare. As such there is a lack of evidence-based practice knowledge that informs the development of the industry. The Australian Quarrying Industry is not immune from the lack of evidence informing the leadership, strategy, and futures of the industry. Most related literature can be traced to the mining sector, but the mining sector is materially different to that of the extractive industries. As such, there is a significant need to address this gap in knowledge.

The researcher, as a senior executive in the Australian Quarrying Industry association, sought to address this gap by conducting a work-based research study as an insider researcher. The study was exploratory with the purpose of conducting a futures studies analysis of the Australian Quarrying Industry by 2029. The study adopted a sequential mixed methods design a set of scenarios that would provide a roadmap of possible futures and thereby inform the decision making by leaders at both the organisational and industry levels. Based on the results of the work-based research, the project artefact was an educational institutional blueprint for the industry: The Australian Academy of Quarrying.

The study sought to answer the research question: *What are the possible futures of the Australian Quarrying Industry by 2029?* In order to answer this question two sub-questions were addressed: *What are the foresight and strategic thinking capabilities of current strategy-level leaders in the Australian Quarrying Industry and how may they reflect the possible futures of the industry?* And *What are the drivers of the future that are associated with the futures of the Australian Quarrying Industry?* The study, therefore, had the main aim to develop a set of scenarios illustrating the possible futures of the industry in order to make an original knowledge contribution to professional practice. The purpose of the study was not to predict ‘the future’ of the industry. Rather, it served to increase the scope of future possibilities which would reveal opportunities, threats, desirable outcomes and roadmaps. Scenarios aim to provide a narrative account that is easy to remember and thereby create a ‘memory of the future’ informing future decision making.

The research design included both qualitative and quantitative research methods and assimilated two lines of enquiry. The first line of enquiry was aligned with futures studies methods typically associated with the development of futures scenarios. These included a PESTEEL analysis and Delphi study which identified and triangulated an environmental scan. The environmental scan served to analyse the industry operational environment and identified internal and external drivers of change; trends and patterns of change; linear forecasts, and low likelihood high impact events (wild cards). The second line of enquiry has not been specifically used in scenario planning before. It incorporated the Strategic Leadership theory which states that the cognitions and abilities of leaders are reflected in how organisations and industries evolve in the future. In other words, based on proxy measurements of the cognitions and abilities of leaders, the future of their organisations or industry can be extrapolated. In the case of this study, the latent variables of foresight and strategic thinking capabilities of leaders was measured and used to compliment the scenario development process.

The environmental scan and Delphi study identified key drivers, trends and wild cards across the political, economic, social, technological environmental and legislative dimensions of the quarrying industry's operational environment. The study expanded the analysis framework to include the 'ethics' dimension of the environmental scan. This resulted in significant insights that informed the identification of drivers, trends and wild cards that would inform the scenario development.

The online survey collected quantitative data using previously validated and reliable measurement of foresight and strategic thinking capabilities in leaders. Foresight and strategic thinking are among a broad range of important leader capabilities that inform decision making. However, it is argued in previous studies that these capabilities are closely associated to strategic decision making and therefore notable proxies can be used in terms of applying Strategic Leadership Theory to the development of scenarios.

The quantitative leadership survey measured the industry baseline of the average foresight and strategic thinking capabilities of senior leaders in the industry. The analysis revealed that leaders had a dominant orientation to the present and a

dominant ‘adapter’ style of foresight. This is explained by the dynamic nature of the industry and emphasis on optimising daily operations, production and profitability. While the measures revealed that leaders did have the ability to be more futures-orientated, stakeholder expectations, operational demands and industry culture suppressed these capabilities.

The analysis also revealed that the industry leaders primarily relied on analytical outputs in their strategy formulation and decision making. However, strategic thinking theory suggests that both analytical and conceptual inputs to strategy formulation are equally necessary. Conceptual inputs include thinking that is generative, exploratory and creative such as that associated with innovation. This was limited in the analysis and thus the industry baseline.

A traditional four-quadrant matrix approach was used to develop the scenarios. However, in addition to the identification and allocation of drivers, trends and wild cards in the matrix, each scenario was primarily informed by three versions of leaders’ foresight and strategic thinking cognitions and abilities: the industry baseline as measured, an ‘ideal’ industry leader profile and a ‘worsening’ leader profile.

Three scenarios were developed: the “Same future, same industry”, “Involuntary administration” and “Smart Quarrying scenarios”. The scenarios informed the formulation of an industry education and talent development blueprint in the form of the Australian Academy of Quarrying aimed toward achieving the talent development objectives associated with the “Smart Quarrying” scenario.

Numerous limitations of the study were recorded including disciplinary, theoretical, sampling, sample size and researcher bias. Steps that can be taken in future research to address the limitations were noted.

Contributions to knowledge were primarily to professional practice as was the purpose of the study. These included providing evidence-based practice insights that are rare, providing advanced knowledge to inform decision making (especially strategic), providing advanced knowledge to inform professional practice and providing an educational blueprint for industry talent development. The original contributions to theory include utilising empirical measurements of leader cognitions and abilities as an input to scenario development, including strategic leadership

theory in mainstream futures studies methods (scenario development), and initial findings toward the development of a Futures Leadership Theory.

CERTIFICATION OF THESIS

This Thesis is entirely the work of Paul Sutton except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Principal Supervisor: Associate Professor Luke van der Laan
Associate Supervisor: Dr Gail Ormsby
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For my mother, Colleen Shirley Sutton and my father, Lance Sutton.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1 INTRODUCTION

1.1 Introduction

This study is about the future of the Australian Quarrying Industry. The industry needs capable leaders to deal with the unpredictable nature of complex environments associated with the industry (Hase & Davis 1999). Research by Hase & Davis (1999) suggests that Australian organisations, require capable leaders and managers who can empower others, to share information, and develop capability of their workers. Further, it is essential to develop work-place environments that enable people to exercise their capabilities in meaningful ways (Tiwari 2015). The issue of enabling capability is important and confronts the issues of power and control that populate the dominant theories of organizations no matter what their espoused position (Argyris & Schön 1997). This is especially important when considering the futures of an organisation or industry.

As the Chief Executive Officer of the Institute of Quarrying Australia, during 2011-2018, this study of strategy-level leader capabilities has been of great interest to the researcher. The work-based practice setting provided an opportunity to analyse the current operations and assess the stakeholder's perspectives as an insider researcher and make recommendations for the future sustainability of the industry. As such it was framed as a work-based research study. By adding a theoretical framework to the study, it was anticipated that a rigorous research process would be beneficial to the overall quarrying industry. Thus, the researcher undertook the Doctor of Professional Studies program at the University of Southern Queensland, because of the program's work-based learning pedagogy and practice-based research focus. Its purpose was to make an original knowledge contribution to professional practice.

The study undertook an analysis of the Australian Quarrying Industry's strategy-level leadership, conducted a futures analysis and developed scenarios of the Australian Quarrying Industry by 2029 (10-year horizon) based on the core premise that leader capabilities would shape the future of the industry within a clearly defined operational environment. This premise was informed by strategic leadership theory (van der Laan & Yapp 2016) which states that the characteristics and abilities of leaders are indicative of how organisations may evolve.

In this chapter, the background setting of the Australian Quarrying Industry is provided. The work-based learning context is explained followed by an outline of the aims of the study and the definitions relating to the study. The Research Questions are listed along with the thesis structure.

1.2 Background context

The quarrying strategy-level leader of the future will be defined by his/her professional identity. 'Professions' can be broadly defined as occupations that are at least nominally self-governing, require a level of knowledge and have traditions of autonomy, ethics and independent judgement (Turner & Knight 2015). In return, for the advantages of being a profession there is an assumption that professionals are adequately proficient and they exercise this proficiency in a fair and ethical manner (Lester 2017). Professional Associations are therefore concerned with, among other things, the conditions for signing off members as fit to practise and with maintaining a minimum standard of ongoing competence. The Australian Quarrying Industry's professional association is the Institute of Quarrying Australia. The function of maintaining a minimum standard of ongoing competence has traditionally been fulfilled by stipulated education and training routes, with a more recent trend towards defining the competencies for practice rather than insisting on specific routes for achieving them (Lester 2017). Up to now, the notion of competence has defined much of the professional identity of quarrying strategy-level leaders but it faces the limitation of being defined by task parameters, whereas the nature of contemporary leadership requires abilities that extend beyond task parameters.

Developing competency is a minimum standard for dealing with rational, linear systems and clearly defines work tasks (Gritti & Foss 2010). However, a key premise of the study is that the Australian Quarrying Industry needs capable strategy-level leaders to deal with the unpredictable nature of complex environments (Hase & Davis 1999). The Australian Quarrying Industry is premised to develop work environments that enable capable strategy-level leaders to exercise their capabilities (Tiwari 2015). The issue of enabling capability is important and confronts the issues of power and control that populate the dominant theories of organizations no matter what their espoused position (Argyris & Schön 1997). Strategy-level leaders in organisations need to be capable people to facilitate the capability of others (Lester 2014). Highly

directive managerial styles usually reflect high levels of anxiety or the need for power on the part of the manager. A study of several Australian organisations showed that the most important characteristic of a capable organisation was the capacity for strategy-level leaders to empower others, to share information, and develop capability (Hase et al. 1998). These are not new concepts, of course, and are endorsed by many contemporary management writers (Hamel 2009; Drucker 2012; Peters et al. 2012).

There is a heavy emphasis in management schools and in organisations on the technical aspects of management and work and this is expressed through an emphasis on the attainment of competence (Hamel 2009). Similarly, the plethora of short management training programs attest to the simplistic approaches taken to developing strategy-level leaders despite there being little evidence to demonstrate behaviour changes as a consequence (Griffiths & Boisot 2006). It can be argued that more innovative approaches to fully enabling strategy-level leaders to express their capability (and further develop it by doing so) are needed, such as those found in mining and construction companies and in other Australian commercial and government organisations (Tiwari 2015).

Capability can be viewed as key clusters of good management competencies (Dora 2015). Kushwaha & Rao (2015) see capabilities as the skills, knowledge, experience, attributes, and behaviours that individuals need to have to perform a job effectively. Hoskisson et al. (2004) refer to capabilities as duties a capable person can achieve at a high standard and in an integrated way. Remidez & Fodness (2015) suggest that capability can be defined by the fact that capable people have confidence in their ability to take effective and appropriate action, explain what they are about, live and work effectively with others, and continue to learn from their experiences, both as individuals and in association with others, in a diverse and changing society.

Capability is also referred to as a future-oriented capacity to respond to the future change (Gratton 2000). This suggests that capabilities are closely associated with the cognitive ability of foresight. Brown & Glasner (2003) also view capability as being future-oriented. In their view, capability is concerned with future potential performance tasks and decision making. Lester (2015) states that capability is the application of management and management development in two broad areas: the potential needed for the acquisition of skills and knowledge; and the content an

individual has learned to do. The study focuses on the practice of leadership as an indicator of how the future of an industry may evolve as per strategic leadership theory (Hambrick 2007). Closely associated with anticipating how an industry may evolve is the notion of foresight.

As an extension of foresight capability, Montgomery (2008) suggests that strategy-level leaders are organisational stewards that define what a firm is and what it will become. In order to achieve value, it is proposed by Montgomery (2008) that leaders allow themselves to think with foresight and learn from it. She suggests that through an organic cognitive process that is adaptive, holistic and open-ended, leaders can create value in the future. For this to occur the leader needs to have the capabilities to view time as continuous and open-ended i.e. see the future as a continuous extension of the past. Montgomery (2008) concludes that the concept of strategic thinking captures the capabilities such as foresight that typify the fit-for-future strategy formulation by modern leaders.

Montgomery (2008 p. 58) highlights that, "creativity and insight are key as is the ability to make judgements about a host of issues that can't be resolved through analysis alone". Strategic thinking is therefore proposed to encapsulate the capabilities to respond effectively to rapid change, high competition and the need to develop new value through innovation and is supported by numerous studies and necessarily follows foresight (Hamel & Prahalad 1994; Liedtka 1998; Tavakoli & Lawnton 2005; van der Laan & Yap 2016).

Lester (2014) goes further to focus on capability as an attribute for innovation and sustainability. He states that capable people can build innovative, compelling, sustainable, and engaging visions, with a sense of the future to engage in strategic thinking and to manage people toward the future goals. A key premise of the study reflects Lester's assertion that the capabilities of foresight and strategic thinking of anticipating, framing and planning are key indicators of success and the future of an organisation or industry. Further, these capabilities adequately capture a broader spectrum of key capabilities that are essential in contemporary strategy-level leadership.

The notion that innovation is not necessarily related to problem solving, it is usually related to improving competitiveness and economic success, and it is often pushed by

technology (Nooteboom 2000) is refuted by van Kleef & Roome (2007). They draw out the capabilities that are embedded in the fields of innovation and sustainability. These capabilities relate to systems thinking, learning, combining and integrating, thinking inventively, networking and coalition building. These are closely related to the dimensions of strategic thinking (Liedtka 1998). Hargadon & Sutton (2000) argue that companies strengthen their core competency to innovate by developing the capabilities or employees within the organisation.

Given this background context, this study adopts the construct that strategy-level leaders require the capabilities needed to navigate complex rapidly changing operational environments. It is proposed that the concepts of foresight and strategic thinking are prominent in describing the capabilities of strategy-level leaders. Underpinned by strategic leadership theory, this study seeks to consider the possible futures of the quarrying industry in Australia as reflected in the capabilities of its leaders. These will include demographic proxies and the foresight and strategic thinking capability profiles of current leaders.

1.3 Work-based learning context of the study

The Professional Studies program offered at the University of Southern Queensland is appropriate for this study as it is designed to enable the researcher to continue their current employment position and design a work-based research project pertaining to the researcher's work-based setting where proposed changes are seen as necessary for the sustainability of an industry. As an 'insider' researcher (Unluer 2012) it provided an opportunity to address the challenging and 'wicked' problems associated with the futures of the Australian Quarrying Industry. Further, the Professional Studies program enabled the researcher to set personalised and professional goals as well as contributed to preparing for the futures of the Australian Quarrying Industry through the conduct of the study as practice-based research. As such it combines the notion of the reflective practitioner as learner, inside researcher and contributor to professional practice.

1.4 Purposes

Given the context that the sustainability of the Australian Quarrying Industry has been called into question, the purpose of this study was to:

- Identify the capabilities required for strategy-level leadership of the industry by conducting an industry analysis.
- Benchmark the key capabilities of foresight and strategic thinking in the industry's strategy-level leaders.
- Investigate the possible futures of the Australian Quarrying Industry by developing scenarios of the Australian Quarrying Industry 2029 within the context of a futures studies methodological approach.
- Develop scenarios that inform the Australian Quarrying Industry talent development, attraction and retention strategies in the context of understanding possible ways in which the industry can evolve.

1.5 Contribution

If high-level capability is achieved by combining both research- and practice-based knowledge, then the integration can provide most advantageous outcomes, especially in terms of adapting and forming new perspectives (Nilsen et al. 2012). This study made the following academic and industry practice contributions:

- Professional and personal development of the researcher.
- An original knowledge contribution related to the professional practice of the quarrying industry based on Australian data within the context that such research is rare, if it exists at all.
- Contribution to industry to support emerging quarrying leaders as well as establish communities of practice.

1.6 Research questions

The overall purpose of the research is to answer the following question:

- Research Question 1: What are the possible futures of the Australian Quarrying Industry by 2029?

To answer the overarching question, two sub-questions were addressed:

- Sub-Research Question 1.1: What are the foresight and strategic thinking capabilities of current strategy-level leaders in the Australian Quarrying Industry and how may they reflect the possible futures of the industry?

- Sub-Research Question 1.2: What are the drivers of the future that are associated with the futures of the Australian Quarrying Industry?

These questions were based on the assumptions that:

- According to strategic leadership theory, the futures of an organisation or industry reflect the abilities and values of its strategy level leaders; and
- That a rigorously applied futures research methodology can develop feasible alternative futures of an industry.

1.7 Thesis structure

The thesis is presented in eight chapters. Chapter 2 is based on a literature review of the Australian Quarrying Industry, strategy-level leadership, defining capability, capability of foresight and capability of strategic thinking. The conceptual framework is provided at the conclusion of Chapter 2. A methodology for the research is presented in Chapter 3, providing the research questions, strategy of enquiry, and the research design. Chapter 4 provides the analysis and interpretation of the Delphi data. The PESTEEL environmental scan and its analysis is presented in Chapter 5. Chapter 6 provides an overview of the work-based project, SMART QUARRYING within which the research was embedded. Three future scenarios are presented in Chapter 7 with the conclusion of the study presented in Chapter 8. Table 1.1 provides the overall structure of the thesis.

Table 1.1 Overall Thesis Structure

Chapter 1	Introduction
Chapter 2	Literature Review
Chapter 3	Methodology
Chapter 4	Data Analysis and Interpretation (Delphi)
Chapter 5	PESTEEL Analysis
Chapter 6	SMART QUARRYING Project
Chapter 7	Scenarios
Chapter 8	Conclusion

1.8 Conclusion

The first chapter of this thesis provided a brief overview of the research project. The thesis premises and assumptions were described, the research questions were listed, and the thesis structure was outlined. Upon completion of the study an original

contribution was made to the leadership knowledge of the quarrying industry, to the professional practice and the professional development of the researcher. Chapter 2 provides a review of the available literature.

Chapter 2 LITERATURE REVIEW

2.1 Introduction

Chapter 1 introduced this study by providing the rationale and structure. Chapter two provides a literature review of the Australian Quarrying Industry, Futures Studies, Strategic Level Leadership Theory, Capability, Capability of Foresight, Capability of Strategic-Thinking and introduces the Conceptual Framework of this study.

2.2 The Australian Quarrying Industry

Quarrying is quite simply the extraction of natural resources from the earth, usually via some form of surface working at a quarry site. Quarries produce a range of useful materials, including limestone, dimension stone and rock (Bloodworth et al. 2009). In Australia, the most common materials extracted are construction aggregates, such as crushed rock, sand or gravel. These abundant, yet essential, raw materials are the foundation of our homes, schools, hospitals, roads and almost every aspect of the built environment that we depend on. People have relied on quarry material for thousands of years because of their strength, durability and dependability, and while the technology and processes have improved, these materials are as important to modern society as they have ever been (Lam et al. 2000). In 2019, the Cement Concrete Aggregates Association (CCAA) reported that Australian quarries support vital building and construction industries, which generate over $200 billion in revenue each year. The building and construction industry demand more than 200 million tonnes of construction aggregates each year to meet the need for the construction of homes, workplaces, public buildings and critical infrastructure (CCAA). Every Australian requires 8 tonnes of stone, sand and gravel each year to build the buildings and other infrastructure needed (CCAA). To build one kilometre of a two-lane highway requires 14,000 tonnes of construction aggregates (CCAA). As well as providing these essential materials, quarries stimulate local communities through investment and by providing jobs. In fact, the quarry industry creates over 10,000 jobs directly and supports another 80,000 indirectly, often in rural and regional locations (CCAA).

A search of available literature suggests that there is very little evidence-based research available pertaining to the quarrying industry. It should be noted that the

quarrying industry is highly associated with the mining industry where there are similar conditions and as such knowledge in mining research may reflect similar phenomenon that occur in the quarrying industry. For this literature review, reference is also made to the mining industry and the quarrying and mining industries are referred to as surface extraction.

Surface extraction activities, including prospecting, exploration, construction, operation, maintenance, expansion, abandonment, decommissioning and repurposing of a quarry can impact social and environmental systems in a range of positive and negative, and direct and indirect ways. Surface extraction exploration, construction, operation, and maintenance may result in land-use change, and may have associated negative impacts on environments, including deforestation, erosion, contamination and alteration of soil profiles, contamination of local streams and wetlands, and an increase in noise level, dust and emissions (Dudka & Adriano 1997; Appleton et al. 2006; Warhate et al. 2006; Sonter et al. 2014). Quarry abandonment, decommissioning and repurposing may also result in similar significant environmental impacts, such as soil and water contamination (Mchaina 2001; Veiga & Hinton 2002; Navarro et al. 2008). Beyond the quarries, infrastructure built to support surface extraction activities, such as roads, ports, railway tracks, and power lines, can affect migratory routes of animals and increase habitat fragmentation (Johnson et al. 2005; Anttonen et al. 2011). It is for these reasons that the quarrying industry is heavily regulated by all levels of government. However, there appears to be little investigation into the long-term repercussions and sustainability of the industry.

Surface extraction can also have positive and negative impacts on humans and societies. Negative impacts include those on human health and living standards (Loayza & Rigolini 2016). Surface extraction is also known to affect traditional practices of Indigenous peoples living in nearby communities (Gibson & Klinck 2005) and conflicts in land use are also often present, as are other social impacts including those related to public health and human wellbeing (Shu et al. 2011). In terms of positive impacts, surface extraction is often a source of local employment and may contribute to local and regional economies (Knobblock & Pettersson 2010; Fleming & Measham 2014). Remediation of the potential environmental impacts, for example through water treatment and ecological restoration, can have positive net

effects on environmental systems (Jain et al. 2016). Quarry and mine abandonment, decommissioning and repurposing can also have both positive and negative social impacts. Examples of negative impacts include loss of jobs and local identities (Mitchell & O'Neill 2017), while positive impact can include opportunities for new economic activities (Mitchell & O'Neill 2017), e.g. in the repurposing of mines to become community attractions.

Further pressure for change has come from the environmental and sustainability agenda. Despite the acknowledged need to increase the number of recycled materials and decrease environmental impacts there remains a need to continue extracting primary aggregates (Bennett et al. 2015). Quarry product customers are seeking higher quality products at minimum costs while also responding to their own environmental and sustainability agendas. Quarries must minimize aggregate extraction through increased use of recycled materials, minimize the environmental effects from past, present and future quarry operations, and abide by occupational health and safety regulations, acts and other mandatory requirements for employees, contractors and visitors (Knobblock & Pettersson 2010).

Most innovations developed over the past century were reliant on guidance by a human operator, but this is rapidly changing with the development of remotely operated and autonomous equipment (Bellamy & Pravica 2011). These technologies represent a broad class of innovations that involve a step-change in the research and development effort and are likely to profoundly change how quarry products are excavated, transported and processed in the future (Bellamy & Pravica 2011). Automation can be broadly defined as the intelligent management of a system using appropriate technology so that its operation can occur without direct human involvement (Lynas & Horberry 2011).

Automated and remote machines are increasing productivity as excavation and logistics equipment becomes more reliable, moves faster and covers longer distances, removes shift change requirements and requires fewer operators (Hilbert & López 2011). Until recently, most automation effort has been concentrated on the component or subsystem level, and at a relatively small scale relative to the number of mines, transport infrastructure, processing plants and export facilities in Australia (Conolly & Orsmond 2011). The surface extraction industry has been involved in developing and

trialling several automated technologies over the past decade. In many cases these trials are now complete and automated equipment is now permanently utilised across many extractive sites (Durrant-Whyte 2010).

By 2014, autonomous haul trucks were demonstrating an average of 14 percent higher effective utilisation than manned trucks indexed across all manned sites (Lumley 2014). The higher effective utilisation of autonomous trucks has generally resulted in significant cost savings for all sites using autonomous trucks. Utilisation improvements stem from autonomous trucks being able to operate for longer periods within each shift due to avoidance of breaks, absenteeism, and shift changes. There have been no significant safety incidents in haul truck operations, and incidents relating to property damage have also been reduced (Lumley 2014). Information derived from use of autonomous trucks has also assisted in improving the manned fleet performance. The lessons learned from the deployment of autonomous haulage have led, among other things, to better pit design across company operations leading to spin-off benefits from the automation program (Tinto 2015).

In the wake of successes with implementing various types of autonomous surface extraction equipment, several surface extraction organisations are now shifting to developing the autonomous systems that can carry out tasks automatically or with a minimum of external control (Tinto 2015). The goal for this type of automation is to allow collection, analysis and use of large amounts of disparate information to deliver unified end-to-end interlinked processes from the extraction site to market (Lumley 2014). The requirements to develop and operate these technologies are correspondingly complex and rely on high-level interdisciplinary skills of the people associated with the industry (Bellamy & Pravica 2011).

Hills (2008) listed four main internal influences of these technologies on businesses:

- The core strategy of the business.
- The quality of the organisation’s people and their ability to deliver the strategy.
- The quality of leadership in the organisation.
- The quality of execution of the policies, processes and projects needed to meet strategic goals.

All four influences involve people. Therefore, quarry's human resource function is about talent attraction, development, and retention, it has the ability and responsibility to make a significant contribution to the organisation's success at strategic, management and functional levels. It relies on both employees and contractors; people to drive, create and shape the operations and technologies that sustain production (Ednie 2004). A worker in today's quarrying industry must be more versatile, better educated and better trained than ever before. Research by MITAC (2005) indicated the following key human resources challenges facing the surface extraction industry:

- Aging and retirement of workforce.
- Lack of labour force diversification.
- Competition for workers from other industries.
- Poor industry image to attract new talent.
- Volatile business cycle to retain talent.
- Changing skill requirements.
- Need for national occupational standards and certification.

These human resources issues are equally applicable to the Australian Quarrying Industry and continue as on-going challenges. The responses to these challenges are largely assumed to be dependent on industry leader's capability in addressing what are recognised as wicked problems (Edmonstone, Lawless & Pelder 2019).

Supply and demand of surface extraction commodities are historically volatile, and boom and bust periods within short timeframes are not uncommon. The traditional surface extraction company approach in periods of declining resource demand has been to slash staff to reduce costs (Hathaway-Smith 2009). However, one simple strategy to increase organisations effectiveness is to make use of whatever existing assets and people they have (Hathaway-Smith 2009). Therefore, surface extraction organisations must identify and retain the talent within the organisation whilst also training and developing that talent to lead the firm into the next boom. In a downturn economy, strategy-level leaders need to emphasise to their organisations to shore up the long-term value and sustainability of the business (Wingfield 2009). This includes recognising the link between leadership and performance, hence ensuring that

leadership talent is retained, developed and, most importantly, allowed to lead through the challenging times (HRL 2009). This is especially true in this age of rapid and non-linear change (Hamel 2009).

Surface extraction organisations must manage their human capital to create a competitive advantage. Therefore, a goal for a strategy-level leader in the quarrying industry during times of flux is to harness corporate intelligence, to ensure that the quarry does not just downsize but maintain the right size (Wingfield 2009). In response to the challenging demographics of an aging quarrying workforce, organisations must launch succession planning and professional development programs or recruit people with the right skill sets and experience. Surface extraction organisations need to look at exemplar peers, including in the mining sector, to identify strategies that attract and retain key personnel (Wylie 2005). The above literature suggests that local Australian surface extraction organisations can reduce some of the anxiety and uncertainty that surround employment issues during periods of downturn by considering the above aspects. A quarrying organisation's human capital is one item that an organisation can manage and mould to provide a competitive advantage that will ensure its survival and set the organisation up for success. A structured and strategic investment in an organisation's people can provide the foundation for a quarrying organisation to lead the industry through to 2029.

It is no longer enough to just be productive in the Australian Quarrying Industry. The demand from the industry shareholders, not unlike other industries, is that quarries must always be increasing not only productivity but profitability, safety and demonstrating corporate social responsibility. The latter two aspects are necessary and 'good' for business. This often can be done with smaller budgets, tighter teams, and fewer resources, as quarry managers are compelled to commit the cliché: doing more with less. This is complicated by rapidly changing technologies and non-traditional material and infrastructure planning.

Daily surface extraction operations are one of the most dangerous of all industries because of the nature of the job; They are high-risk, in terms of both safety and health, and in all their specific activities, the use of high technology, work hazards, and due to their inherent dynamic risks (Komljenovic et al. 2017). The incidence of mine and quarrying accidents in Australia since 2011 has shown an upward trend (S.W.A

2016). Accident and injury anticipation and prevention efforts need to be controlled to realize a zero-accident rate in Australia's surface extraction industry.

Most surface extraction accidents are the result of human error, unsafe worker behaviour and lack of organization and management systems that have unsafe effects on workers. Such behaviours have a significant impact on workplace accidents. One way to reduce human error is to apply and develop effective safety leadership, safety communication, training procurement, and incentives (Shu et al. 2011; Du & Sun 2012). The strategy-level leaders' approach to safety is one of the factors that affects an organisations safety performance, because the leadership is responsible for providing safe working opportunities for its employee (Du & Sun 2012). Safety leadership demonstrated by the strategy-level leader must be applied to all organizational levels to ensure that all areas have a high commitment to safety, as workers' pay careful attention to a leader's behaviours, attitudes, and actions on safety and then imitate them. Poor leadership behaviour can lead to subordinates and others in the organization not performing well, and it can bring about psychological distress (Patterson & Shappell 2008; Andrew Hopkins et al. 2012; ICMM 2012).

The development and assessment of safety leadership should be expanded to systematically accommodate the efforts that companies must achieve to have a positive impact on workplace safety (Kim & Gausdal 2017). Errors in defining safety leadership have contributed to the inadequacy of safety measures. This has led to weakening of the firm's overall safety program, negative effects on injury rates, and hindered firm's success (Daniel 2015).

Daniel (2015) notes that there is an inevitable convergence of organisational needs and the future. He refers to the fact that organisations are increasingly very sensitive to shareholder concerns and that these concerns not only refer to bottom line returns but increasingly demand better social responsibility, innovation, environmental conservation and generally a great focus on ethical concerns and values. The dramatic growth of scenario and contingency use in organisations suggest that organisations are finding value as never before in planning for an uncertain future and the alternative images of the futures (Rigby & Bilodeau 2007). This growth reflects the changing needs of organisations towards futures thinking and are defined in term of four key needs (Hines 2002):

- To be more future-orientated.
- To think more deeply and systematically.
- To be more creative.
- To better deal with change.

Hines (2002 p. 339) submits that "being competent in innovation and foresight will come to be seen as perhaps the most important source of competitive advantage for organisations in tomorrow's knowledge economy. This entails decision making with the future in mind."

The key assumption that Hines makes is that a study on what an industry future may look like, in this case the Australian Quarrying Industry, will improve the quality of decision making. The capabilities of foresight and strategic thinking should arguably be part of the education and development of strategy-level leaders informs the background and is the focus of this study.

New and current surface extraction projects are expected to incorporate the lessons from past activities to solve their detrimental effects on the environment and health and safety. Surface extraction laws and legal and technical capacity in many countries still need to be enhanced to include new internationally recommended good surface extraction practices. Responsible surface extraction companies tend to adopt operational procedures according to the best international standards, although this might be far from being the general behaviour yet.

Moreover, emerging technological developments allowing for intense automation of many tasks, may change the entire process of quarrying significantly. Societal implications of automation are vast and require advanced foresight and planning to carry out quarrying in many regions of the world. Developments in society values, in particular the growing value ascribed to environment and life quality, makes unavoidable that future quarrying depends on achieving better conservation of the environment, long-term management of natural resources, and fair social-economic impacts in the life of local communities combined with improved safety in quarrying activities.

Quarrying activities need to be intertwined with sustainable development goals to ensure present and future generations have resources or alternative means to satisfy

their basic needs. This implies that quarrying material recycling may increase, and alternative sources of energy are likely to be tapped in order to decrease environmental impacts and depletion of conventional energy resources. There is a need for a coordinated management of quarrying resources to avoid jeopardy of non-renewable resources and implementation of sustainable development at global scale.

2.3 Futures studies

Futures studies is a relatively new and emerging discipline endeavouring to develop a future consciousness as well as seeking a systematic and pattern-based understanding of the past and present with the aim to determine the likelihood of future events and trends (Princeton University 2015). Bell (2007, p.73) defined the purpose of futures studies as, "*The purposes of futures studies are to discover or invent, examine and evaluate, and propose possible, probable and preferable futures*." Futures studies is the systematic study of possible, probable and preferable futures including the worldviews and myths that underlie each future (Inayatullah 2008). Futures studies covers a broad field of inquiry and combines the insights of a range of disciplines to provide a fresh outlook on the future (Slaughter 2005). Futures studies promotes inquiry on how current activities will become the reality of the future (Slaughter 2005). This includes endeavours to analyse the causes, sources and patterns of stability and change with the intention of creating foresight and alternative futures (Robson 2015).

It is critical to acknowledge that futures studies does not seek to predict the future but rather seeks to create different images of what the future may become, what is most likely given the current reality, and how an entity's idealized design can fit into images of a preferred future (Van der Laan & Yap 2016). In the past fifty years, the study of the future has moved from predicting the future to mapping alternative futures to shaping desired futures, both at external collective levels and inner individual levels (Bell 2005; Inayatullah 2008; Sardar 2010).

Futures studies recognises that images of the future are among the causes of present behaviour. Organisations and decision makers either adapt to what they perceive as likely outcomes of their present action or act in a fashion to create the future they want. This is an inherent feature of all constructive action whether long or short-term. It should be the foundation for all planning as it is proactive and future orientated

(Van der Laan & Yap 2016). Bell (2005) and Slaughter (2005) identified several specific assumptions and rationales that are a distinctive part of the futures studies perspective. These assumptions are listed in Table 2.1.

Table 2.1: Assumptions and Rationale of Futures Studies

Bell (2005)	**Slaughter (2005)**
Time moves unidirectional and irreversibly from the past toward the future.	Some decisions have long-term consequences. When following a futures consciousness approach, it has significant implications for decision-making. Each decision made implies a potential change in direction with potential noteworthy future consequences. Some decisions are trivial and turn out to be insignificant in the context of larger events, while others are strongly conditioning the present and the future.
Not everything that will exist has existed before or does exist now. The future may contain things that have never existed before. These may invite new thoughts, new understandings, new developments and new reactions.	Future alternatives imply present choices. As humans become conscious of diverse future alternatives, it is possible to gain access to new preferences in the present. Should an unacceptable futures scenario be detected appropriate action can be taken to avoid this. Similarly, if a preferable future scenario is identified, action be set in motion with the view towards creating it. The possibility of future alternatives implies present choices, because it takes time to focus effort on and mobilise the resources involved to achieve a particular outcome or avoid undesirable consequences.

The future is not totally predetermined. The future does not already exist.	Forward thinking is a preferable alternative to crisis management. While it is not possible to predict the future state of affairs of social systems, it is possible to take a strategic view, to explore alternatives and options, to anticipate eventualities, and to prepare for contingencies. Forward thinking is a structural alternative, especially for societies in transition. This remains preferable to crisis management as the latter is wasteful and expensive.
Futures thinking is essential for human action. Reaction might be possible without futures thinking, but not action, because to act requires anticipation. Images of the future are part of the causes of present action.	Future transformations are certain to occur. The potential changes over the next 100 years are probably as significant, if not more significant, that those which have occurred over the last 1,000 years. The future is a mental construct. On a basic level it derives from the way humans interpret the past the present. The future also drives action.
Future outcomes can be influenced by individual and collection action, and by the choices people make.	
Global interdependence invites a holistic perspective and a multidisciplinary approach. Futurists view the world as so interrelated that no system or unit can be viewed as totally isolated. Futurists argue that every unit that is the focus of futures research should be considered to be an open system.	

Source: Developed for this research from Slaughter 2005 and Bell 2005

Futures studies is useful as long as it assists in future planning and does not make planning difficult (Inayatullah 2008). Futures studies can be disruptive by challenging the current situation in order to make strategy more effective (Inayatullah 2008; Van der Laan & Yap 2016). Using methods such as emerging issues analysis and scenario planning can enhance strategy effectiveness during the period of disruption (Inayatullah 2008). These methods ensure that future strategy plans are more robust and resilient (Inayatullah 2008).

Futures studies is primarily concerned with the understanding of the social constructs that shape the future and the development of viable forward-looking view to inspire and lead societies and organisations (Slaughter 1999). Futures studies can be undertaken at different levels. The levels include: superficial level extrapolating trends, pragmatic level which tends to be quite empirical and focused on problems, or deeper epistemological or critical level focusing on the assumptions that frame worldviews (Slaughter 1999). The focus of this study is at a pragmatic level focused on future scenarios and the capabilities needed by strategy-level leaders in the Australian Quarrying Industry for each scenario developed.

Inayatullah (2013 p. 60) developed seven simple questions to examine the future. These questions guide this study.

- What is the history of the issue? Which events and trends have created the present?
- What are your projections of the future? If current trends continue, what will the future look like?
- What are the hidden assumptions of your predicted future? If you change some of your assumptions, what alternatives emerge?
- What is your preferred future?
- How will you get there? What steps will you take to realise the present?
- What is the supportive narrative that will provide cognitive and emotive support for realising the desired future?

Voros (2003) provides a more detailed form of a generic foresight methodology in Table 2.2 which outlines the Foresight Process and the Phases of Research for this study.

Table 2.2: Foresight Process (Voros 2003)

Foresight Process	Phases of Research for this Study
Inputs	Phase 1: Delphi
Analysis Interpretation Prospection	Phase 2: PESTEEL and Online Survey
Outputs	Phase 3: Scenario Development

2.4 Strategic Leadership Theory

> *"The subject of leadership is vast, amorphous, slippery, and, above all desperately important" (Bennis 2007, p.2).*

It is argued that while there are many passing references to strategy-level leadership, much of the actual activity has in fact been devoted to leadership and its attempted development at lower levels (Storey 2005). Zaccaro (2007) noted that theories and models of leadership tend to assume that the processes of leadership are the same at higher and lower levels. Zaccaro (2007) assessment was that less than five percent of the leadership literature has focused on strategy-level leadership. The overwhelming focus on lower level leadership in various studies has also been confirmed by others (Day & Schoemaker 2008). Despite the relative neglect of senior level leaders there have been some previous attempts to explore leadership at this level. One significant strand of work has focused on Chief Executive Officers (Waldman et al. 2004).

For the purpose of this study, strategy-level leaders are defined as,

> *"The strategic leaders of an organisation including those who exert a moderate to high influence on the strategy formulation and formation of the organisation" (van der Laan & Yap, 2016 p. 78).*

Several studies have also been conducted since the introduction of upper echelons theory by Hambrick (2007). Upper echelons theory evolved into strategic leadership theory (Finkelstein & Hambrick 1996). Strategic leadership theory acknowledges that strategies can emerge from lower echelons in an organization but asserts that due to their unique position in the organization they are unable to exert the most influence on the organization's strategy. Strategic leadership theory postulates both a theory and a methodological approach (Carpenter et al. 2004). As a theory it predicts that an organization will reflect the cognitions and values of its most influential leaders. The

leaders' cognitions and values are similarly recognized as affecting their field of vision and their interpretation of information (Cannella Jr & Monroe 1997). These themes have possible relevance to the futures of the Australian Quarrying Industry.

Governance imperatives support the assertion that organizational leaders at the senior level of an organization are responsible for strategy. These strategy-level leaders are expected to enable innovation and creativity in the organization to explore and to discover new strategic directions and solutions to current strategic impasses (Amabile 1998; Storey 2005). Amabile (1998) asserts that this can be achieved by developing strategic thinking capacity, developing expertise through accumulated experience and through creating motivational environments.

Storey (2005, p. 102) suggests that future research activity for strategic leadership should address the following themes:

- Power and spheres of influence at top levels. The way in which leaders are embedded within webs of influence, constraints, alliances and politics requires much more study than so far been undertaken.
- Leadership as a means of handling the conflictual nature of organisational life. This theme should examine leaders' discourse, more especially the way leaders derive their influence from drawing on appropriate wide set of regimes of truth.
- What are the valued functions of the senior group? What, at minimum, do their different stakeholders judge should be the contributions which they are expected to make? How does the bounded, relational nature of leaders of organisations roles shape the exercise of those roles and crucially, to what extent, and how can some players break free of, or at least stretch, these boundaries?
- Comparative interpretations and sense making. How do those in senior leadership positions interpret their roles? What do they think people in their positions should be doing? What range of beliefs and assumptions do members of the senior group have?
- What capabilities are required in order to discharge the expected strategic leadership functions effectively?

This study follows up on theme 5 (What capabilities are required in order to discharge the expected strategic leadership function effectively?) by expanding strategic leadership theory to include capabilities as predictors and provides a methodological

contribution to futures studies by complementing the environmental scanning approach.

2.5 Capability definitions

Developing competency is a minimum standard for dealing with rational, linear systems and clearly defines work tasks (Nooteboom 2000). However, industries need capable people to deal with the unpredictable nature of complex environments (Hase & Davis 1999) and how to develop work environments that enable capable people to exercise their capabilities (Tiwari 2015). The issue of enabling capability is important and confronts the issues of power and control that populate the dominant theories of organizations no matter what their espoused position (Argyris & Schön 1997). Managers and supervisors in organizations need to be capable themselves in order to facilitate the development of capability of others (Lester 2014). Highly directive managerial styles usually reflect high levels of anxiety or the need for power on the part of the manager. A study of a number of Australian organizations has shown (Hase et al. 1998) that a most important characteristic of a capable organization is the capacity for managers to empower others, to share information, and develop capability. These are not new concepts and are endorsed by many contemporary management writers (Hamel 2009; Drucker 2012; Peters et al. 2012).

There is a heavy emphasis in management schools and in organizations on the technical aspects of management and work which is expressed through an emphasis on the attainment of competence (Hamel 2009). Similarly, the plethora of short management training programs attest to the simplistic approaches taken to developing people despite there being little evidence to demonstrate behaviour really changes as a consequence (Griffiths & Boisot 2006). It can be argued that more innovative approaches to fully enable people to express their capability (and further develop it by doing so) are needed, such as those applied in a major mining and construction company and in other Australian commercial and government organizations (Tiwari 2015).

Capability can be seen in terms of key clusters of good management competencies (Dora 2015). Kushwaha and Rao (2015) see capabilities as the skills, knowledge, experience, attributes and behaviours that individuals need to have to perform a job effectively. Winter (2003) suggests that capability comprises of many activities that

enable outputs that clearly matter to the organization's survival and prosperity. Hoskisson et al. (2004) refer to capabilities as results a capable person can achieve at a high standard and in an integrated way. According to Remidez and Fodness (2015) capable people have confidence in their ability to take effective and appropriate action, explain what they are about, live and work effectively with others, and continue to learn from their experiences, both as individuals and in association with others, in a diverse and changing society.

Capability is also referred to as being a future-oriented capacity to respond to the future change (Gratton 2000). This suggests that capabilities are closely associated with the cognitive ability of foresight. Brown, Sally and Glasner, Angela (2003) also view capability as being future-oriented. In their view, capability is concerned with future potential performance tasks and decision making, not in the present or even in past demonstration. (Lester 2017) states that capability is the application of management and management development. It has two broad meanings: one, as the potential needed for the acquisition of skills and knowledge; and the other as the content an individual has learned to do.

As an extension of foresight capability, Montgomery (2008b) suggests that leaders are organisational stewards that define what a firm is and what is will become. In order to achieve this, leaders allow themselves to think in this way and learn from it. She suggests that through an organic cognitive process that is adaptive, holistic and open-ended, leaders can create value. For this to occur the leader needs to have the capabilities to view time as continuous and open-ended i.e. see the future as a continuous extension of the past. Further, Montgomery (2008a) argues that the concept of strategic thinking captures the capabilities that typify the fit-for-future capabilities of modern strategy-level leaders. Montgomery (2008b, p. 58) highlights that, "creativity and insight are key as is the ability to make judgements about a host of issues that can't be resolved through analysis alone". The concept of strategic thinking that encapsulates the capabilities to respond effectively to rapid change, high competition and the need to develop new value through innovation is supported by numerous studies (Hamel & Prahalad 1994; Liedtka 1998; Tavakoli & Lawton 2005; Van der Laan & Yap 2016).

Lester (2014) focuses on capability as a vision for innovation and sustainability. He states that capable people can build innovative, compelling, sustainable and engaging visions, to develop foresight to make sense of the future and to engage in strategic thinking to manage people toward future goals. A key premise of this study reflects Lester's assertion that the ability to anticipate, frame and plan are key indicators of success. Further, foresight and strategic thinking capabilities adequately capture a broader spectrum of key capabilities that are essential in strategy-level leadership and suggest that the cognitive abilities of the industry leaders reflect how that industry may evolve in the future. The key premise of this study is that the capabilities of strategy-level leaders can serve as proxies predicting the futures of an industry.

2.6 Capability of foresight

> *Ratcliffe (2000, p. 39) states, "Global changes are probably more profound than commonly understood, demanding a new mindset… this cultural transformation engenders a fresh set of challenges…. in tackling the inherent complexity, uncertainty and ambiguity which need a futures-orientated approach to comprehend and capitalize upon societal change….. this organisational metamorphosis will be best understood, planned and managed through a process of foresight or prospective."*

Contemplating the future is an imperative of meaningful strategy. The future is unknowable as it has not yet occurred. The future, as a dimension in time, is a "cognitive construction" of how individuals perceive, imagine and judge the future to unfold (Narayanan & Fahey 2004). Foresight has been identified as a critical capability in leaders and organizations (Hamel & Prahalad 1994; de Geus 1997). Definitions of foresight have varied (Amsteus 2008) but are all concerned with perceiving how the future could develop and implications of such change. "*Foresight is the product of deep insight and understanding*" requiring a sustained and deliberate deconstruction of cognitions that dominate our habits of thought (Chia, 2004, p. 21). Chia states that foresight is a "*highly valued human capacity*" that is manifested in human cognition and evokes a "*generative field of potentiality*" (Chia, 2004, p. 22). Chia asserts that foresight can be cultivated by systematically developing 'peripheral' rather than 'frontal' vision. Foresight is a "cognitive temporal perspective that leaders

use to anticipate, clarify, and structure the future, so as to guide their organization in the present based on future opportunities" (Gary, 2008, p. 4). This study asserts that foresight is a critical capability which precedes making strategic decisions (van der Laan 2010).

Many strategy authors concur that foresight is a critical strategic leadership capability (Table 2.3).

Table 2.3: Definitions of Foresight (van der Laan 2010)

Source	Definition
Reid and Zyglidopoulos (2004)	• Understanding and anticipation of the future.

Slaughter (2007)	• An emergent capacity of the brain-mind system.
	• Boundaries of perception are pushed forward by:
	  ○ Consequence assessment – assessment of implications of present actions.
	  ○ Early warnings and guidance – detecting and avoiding problems before they occur.
	  ○ Pro-active strategy formulation – considers present implications of possible future events.
	  ○ Normative visions – envisioning desired futures.

Voros (2003)	• 'Foresight opens up an expanded range of perceptions of the strategic options available so that strategy-making is potentially wiser' (2003, p.12)
Amsteus (2008)	• Degree of analyzing present contingencies and degree of moving analysis of present contingencies across time, and degree of analyzing a desired future state or degrees or states a degree ahead of time with regard to contingencies under control, as well as degree of analyzing courses of action a degree ahead in time to arrive at the future state.
Hayward (2005)	• The capacity to bring a consideration of the future into the present decision perspective (as opposed to foresight actions). • An attribute or competence. • Important element of in a person's foresight competence is their Future Time Perspective (FTP) – cognitive understanding of expectations of the future. • Detection and avoidance of hazards. • Assessment of consequences of actions. • Envisioning desired future states.
Tsoukas and Shepherd (2004)	• The engagement of memory and expectation that enlarges the consciousness of the present – know how is brought forward from the past and extrapolations to the future are made. • Act of looking forward.

	• Taking provident care. • Ability to anticipate beyond seemingly ambiguous and complex systems. • Understanding ways in which patterns of the future can emerge.
Cuhls (2003)	• Enlarge the choice of opportunities, assess impacts and chances. • Prospect for the impacts of current research. • Ascertain new needs, new demands and new possibilities. • Focus selectively on the environment / system. • Define desirable and undesirable futures. • Start and stimulate continuous discussion processes.

To practice foresight in organizations is "to be trained in futures concepts, to become more future orientated at the fundamental levels of values, beliefs and philosophies" (Nanus, 1997 p. 195). Individual foresight capability can be further developed by being exposed to discourse on foresight concepts, its methods and application (Alsan 2008). Leadership that links vision to action and organizational cultures that are responsive to futures contributes to having future orientated institutions (Nanus 1984).

This study concurs with van der Laan and Erwee (2012) who define foresight as an individual's cognitive capability to creatively envision possible, probable and desired futures, understand the complexity and ambiguity of systems and provide input for the taking of provident care in detecting and avoiding hazards while envisioning desired futures. Foresight capability is therefore regarded as the ability to act accordingly and 'provide input' to the task of strategic thinking as a precursor of effective strategic decision-making.

This study places a strong emphasis on the role of individuals as strategy-level leaders in strategic decision-making. As modes of work have increasingly become more knowledge orientated, the understanding of how knowledge relates to action is regarded as an important research focal area (Sandberg & Pinnington 2009). Strategy, particularly in terms of the resource-based view of the firm is largely based on knowledge as a source of competitive advantage. The concept of foresight as a cognitive capability is fundamentally, 'knowledge work', and thus constitutes an important perspective in terms of how knowledge is connected to action.

This study seeks to describe foresight in strategy-level leaders in terms of their capability to do so. Foresight is innate to human beings yet differs from individual to

individual depending on several elements, primary of which is the temporal orientation. Their capability to exercise foresight is related to the cognitive ability to envision possible futures of the Australian Quarrying Industry and serves as a strategic leadership proxy reflecting the industry's strategic direction.

In addition to the Foresight Styles (Dian 2009) of the individual, the construct of foresight capability in terms of orientation to time is described by mental time travel (Suddendorf & Corballis 2007) as incorporated in the Theory of MindTime (Fortunato & Furey 2009). According to the Theory of MindTime, three distinct patterns of thinking – Past thinking, Present thinking, and Future thinking – evolved with the ability of humans to engage in mental time travel (Fortunato & Furey, 2009; Furey, 1994; Furey & Stevens, 2004; Suddendorf & Corballis, 1997). This study examines the construct validity of scores on a three-dimensional measure of thinking perspective using the TimeStyle Inventory (Fortunato & Furey 2010). The characteristics described by these orientations and styles are linked to the definition of foresight capability listed above. Figure 2.1 illustrates how the study's construct of foresight capabilities are operationalised. Of importance is that not only does this construct describes the foresight propensities of individuals acknowledging the variance according to context, but the use of both measures allow for triangulation in the analysis.

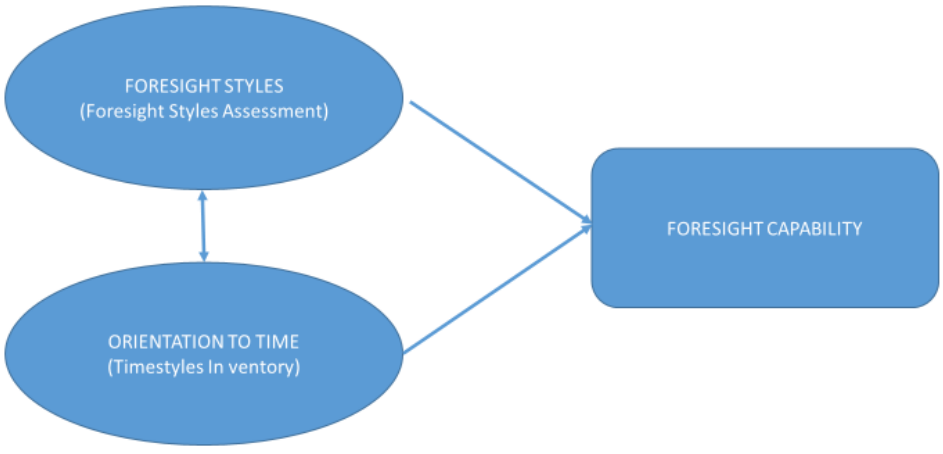

Figure 2.1: Foresight Capabilities Operationalised (van der Laan 2010)

Dian (2009) proposes that Foresight Styles reflect the style with which individuals cognitively respond to change and their envisioned prospects of the future. Foresight is embedded in the roles and tasks of strategy-level leaders. Foresight Styles explain how foresight cognitions differ from individual to individual within the context of their internal disposition in understanding the future. Gary (2008) notes that these cognitive dispositions emerge from an individual's innate innovativeness and time orientation. These differ according to their propensities to tolerate risk, creativity, tolerate ambiguity, their value orientations, in addition to their predominant focus on the past, present and future.

Dian (2009) typology measured by the Foresight Styles Assessment (FSA) suggest that there are six distinct styles: Futurist, Activist, Opportunist, Flexist, Equilibrist and Reactionist. Measurement of these dispositions is not directed at identifying a superior style in isolation but rather determines the values of each as differentiated across the spectrum of dispositions. As such the typology is recognised to describe the cognitive tendencies, differing from individual to individual, that interact with their temporal orientation and environmental change. Dian describes the styles as "distinct, yet co-occurring, relatively stable aspects of a person's time perspective" (Gary 2008 p. 5).

The Foresight Styles Assessment instrument has undergone further tests for validity and research by Gary (2008) indicating that a reduced four factor version had a greater factor loading and fit. Gary (2008 p. 76), in his study to empirically test the Foresight Styles Assessment, concludes that the refined four factor Foresight Styles Assessment "is valid and reliable with minimum construct validity for exploratory research". The four factors and attendant characteristics are listed in Table 2.4.

Table 2.4: Foresight Styles (van der Laan, 2010)

Foresight style	Characteristics
Framer	Interrogates the future Future time orientated Interested in the long-term issues that define the future Envisions 'bigger picture' futures
Adapter	Adjusts to new situations as future demands Balances multiples challenges and choices Helps others adapt / Is flexible / Activates action Flexible leadership / Change Orientated Influencer
Tester	Adopts new trends / Confirms diffusion of innovation theory Experiments with new trends when they arise Opportunistic / Not cognitive trend analysis
Reactor	Preserves own position Mitigates and resists change

An assumption may prevail that to be capable in foresight one would need a dominant style described as Framer by the Foresight Styles Assessment. While this is certainly related to the characteristics of an effective strategy-level leader, it is the ability to switch between styles according to the circumstances that may describe foresight capability better (Gary 2008). Certainly, the Adapter's ability to adjust to new situations as the future demands may contribute to foresight competence. One would expect however, that individual's that have a propensity to be Framers, would rely on Tester and Adapter styles depending on the situation but reject the Reactor style. The Foresight Styles Assessment was further tested and found to be a valid and reliable instrument by van der Laan and Erwee (2012).

2.6.1 Strategy-level leaders' foresight capability

Although numerous prominent leadership and strategy studies refer to the cognitive ability of foresight, attempts to conceptualise and operationalise it are scarce. Only a handful of studies have previously investigated foresight using psychological measures (Hayward 2005) or conceptualised it in terms of foresight styles (Dian 2009; Gary 2008). The relationship between orientation to time and leadership have been conducted (Thoms 2004, Thoms & Greeberger 1995) and provide support for the assertion that orientation to time presents a significant contribution to the construct of foresight.

While the construct of foresight remains elusive, it is this study's assertion that Gary's refinement of Dian's foresight styles (2008) and Fortunato and Furey's MindTime dimensions (2009) meaningfully represent an individual's foresight capability. They have been assessed as having construct validity (Fortunato & Furey 2009; Gary 2008). Psychological constructs, whether measuring personal differences, cognitive abilities or time perspectives are acknowledged as contributing to foresight research and decision making (Gary 2008).

Despite the support for the development of a construct of foresight capability based on psychological measures, this study supports Gary's (2008, p.7) assertion that such measures remain limited in comprehensively describing the meaning of foresight and are "less than the eloquent concept of foresight". However, it is contested that measuring foresight capability as a cognitive ability is meaningfully reflected in validated psychological measures that clearly describe the elements of such ability. Figures 2.2 and 2.3 illustrate the proposed dominant linkages between the psychological measures and the elements of foresight competence as adopted by this study.

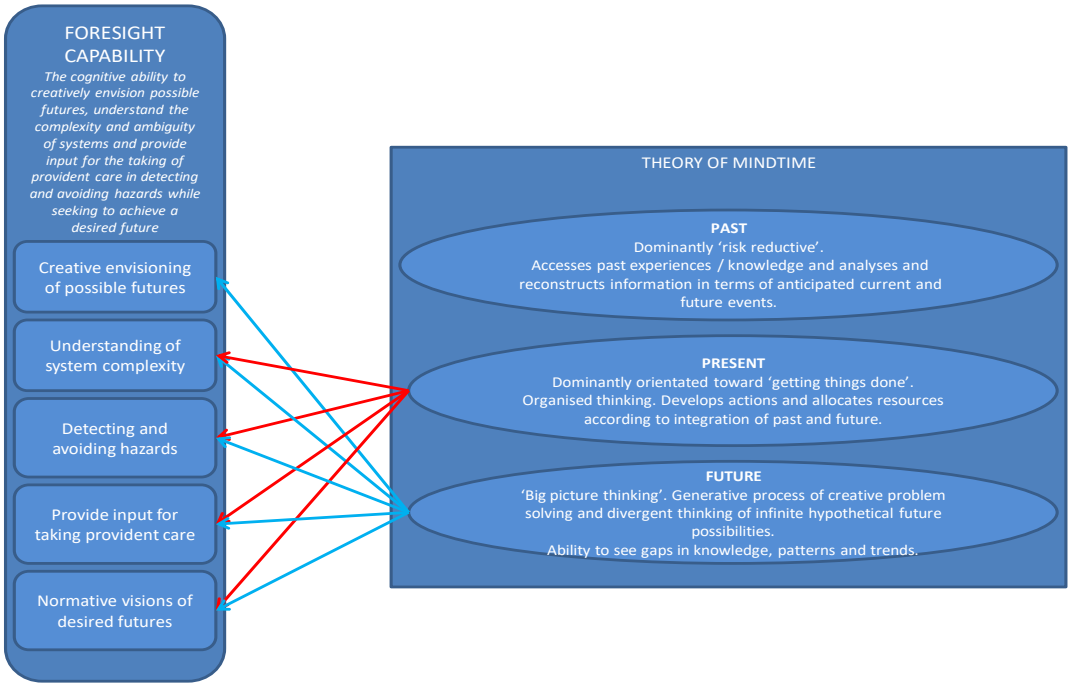

Figure 2.2: Foresight Capability and the Theory of MindTime (adapted from van der Laan 2010)

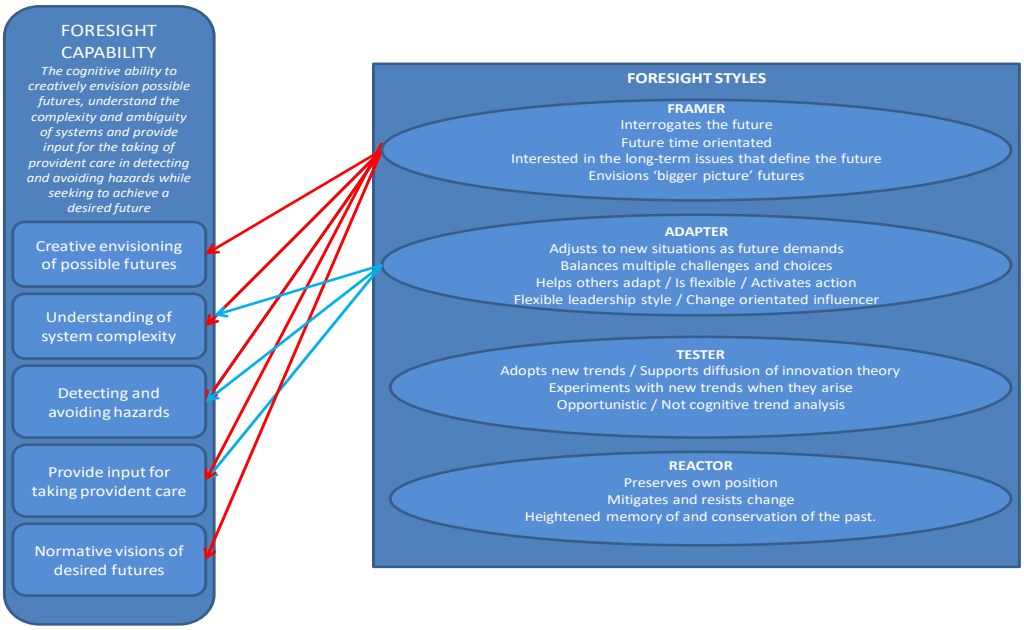

Figure 2.3: Foresight Capability and Foresight Styles (adapted from van der Laan 2010)

Figures 2.3 and 2.4 demonstrate the operationalisation of foresight competence as measured by two psychological constructs. Van der Laan (2010) and the literature validates the associations illustrated in the tables between the psychological measures and the elements of foresight competence. This study further confirms the validity and reliability of the construct and measurement.

2.7 Capability of strategic thinking

Strategy is not driven solely by anticipating the future but finds impetus in the gap between the present reality and the intent for the future (Stacey 1992; Hamel & Prahalad 1994). This is an important observation illustrating the distinction between foresight and strategic thinking. Foresight is driven by understanding and anticipating alternative future possibilities. Strategic thinking, however, is concerned with deriving intent as to the future of the organisation and combining generative and rational thought processes in terms of crafting the strategic architecture to bridge the gap between the status quo and the intention.

The literature is indecisive about what strategic thinking is (Heracleous 1998; Bonn 2001; Goldman 2007) and faces the possibility of being used so broadly and

generically that it faces the risk of being "almost meaningless" (Liedtka, 1998, p.121). In a review of strategic thinking research, O'Shannassy (2004, p.14) deduces that strategic thinking as "a particular way of solving strategic problems and (opening up) opportunities at the individual and institutional level combining generative and rational thought processes". Mintzberg (1994) describes strategic thinking as a synthesis involving intuition and creativity. Strategic thinking is seen as both analytical and creative (Raimond 1996). Table 2.4 illustrates leading definitions of strategic thinking in the literature.

Allio (2006) defines strategic thinking as the "systematic analysis of the organisation and the formulation of its longer-term direction". From these definitions, strategic thinking is regarded as analytical and involves a level of creativity in terms of choosing a future direction. Allio's definition seeks to balance this choice of direction between the longer-term (implying beyond short-term as opposed to long-term) and the realistic anticipation of long-term ambiguity and disruption. It also implies making a choice from alternative future options and makes provision for possible emergent strategies that will contribute to realised strategies. This is a significant observation that focuses the leader's thought processes to the evaluation of strategic choices based on a mixture of analysis and creative prospects. The outputs of foresight competence then, contribute to this evaluation of options by providing representations of possible futures. Table 2.5 provides a variety of strategic thinking definitions.

Table 2.5: Definitions of Strategic Thinking (Developed for this study from Allio 2006, Mintzbery 1994, Hamel & Prahalad 2005, Bonn 2001, Liedtka 1998, Travakoli & Lawton 2005)

Allio (2006)	The systematic analysis of the organisation and the formulation of its longer-term direction.
Mintzberg (1994)	A way of thinking that synthesises intuition and creativity whose outcome is an integrated perspective of the enterprise. Strategic thinking is not strategic planning.
(Hamel & Prahalad 2005)	Crafting strategic architecture emphasising creativity, exploration and understanding discontinuities.
Bonn (2001)	Strategic thinking at an individual level comprises of a) a holistic understanding of the organisation and the environment, b) creativity and c) a vision for the future of the organisation.

Liedtka (1998)	A particular way of thinking that includes five elements a) a systems perspective b) intent-focused b) thinking in time. b) Hypothesis-driven and e) intelligent opportunism
Tavakoli and Lawton (2005)	A cognitive capability. The cognitive process that precedes strategic planning or action whereby an individual contemplates the future development of the organisation whilst considering its attributes, its past and present and the external realities within which it operates.

Of importance in terms of conceptualising strategic thinking is agreeing on what it is not. Mintzberg states that "strategic planning is not strategic thinking" (1994a p.107). This distinction is a common theme in strategic thinking literature as it separates the purposes of each in terms of outputs. The output of strategic planning is a plan which has been analytically programmed according to already determined strategies. The output of strategic thinking on the other hand is "an integrated perspective of the enterprise" (Mintzberg 1994a p.107) aiding strategy formulation and decision making. The difference between the iterative processes of strategic thinking and strategic planning and their outputs is illustrated in Figure 2.4 and are separated by the actions of making strategic decisions and evaluating strategy after planning.

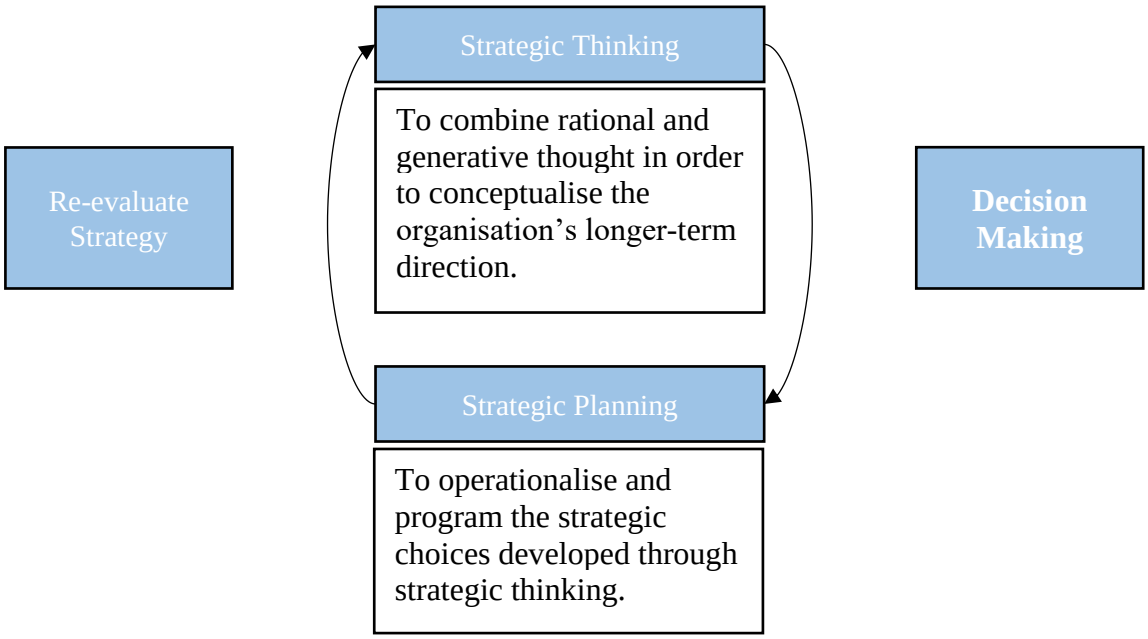

Figure 2.4: The Iterative Process of and Differences between Strategic Thinking and Strategic Planning (adapted from van der Laan 2010)

Stacey (1992), whose work predates those critical of the rational approach to strategy

such as Hamel and Prahalad, and Mintzberg, is also critical but from a different perspective - that of complexity theory. Stacey (1992) asserts that strategic thinking is not a determination of the likelihood of what will happen as determined by pre-programming. Rather, it is about learning and creating new ideas using qualitative similarities and analogies. "New strategic directions emerge spontaneously from the chaos of challenge and contradictions through a process of real time learning and political interaction" (Stacey 1992 p. 15).

Strategy-level leaders need to invent, discover and create their long-term intentions as they proceed not seek to repeat or imitate successes of the past (Stacey 1992). Stacey therefore agrees with the contemporary view that strategic thinking is a synthesis of creativity and rational thinking based on learning through interactive strategic considerations. This corresponds to Allio's (2006) perspective in that 'longer-term' direction setting of strategic thinking is dynamic and changeable.

Stacey is critical of attempting to pre-determine the future as it is fundamentally unknowable. The creation of a long-term vision, therefore, constitutes what he refers to as a 'defence fantasy' that is formulated to disguise the inherent complexity of the environment and uncertainty of the future. Stacey argues that he is not suggesting the abandonment of long-term concerns and is not dismissive of interrogating the future of the firm and continues by stating that:

> *"*So, when this book claims that visions and long-term plans are merely fantasy defences against anxiety, it is not recommending that you shut your eyes to the long term. On the contrary it invites you to drop the fantasy defence and open your eyes to the only processes that are realistically available for dealing with the long term … Furthermore when you see the world through the new lenses, you will realise that you cannot reduce your risk by simply letting the long term take care of itself … for in complex systems, even doing nothing could have escalating consequences" (Stacey, 1992 p. 18).

The essence of Stacey's argument is that in the context of strategy one needs to handle current issues that will have long-term consequences in a more creative and innovative way, by not abandoning the long-term view but by realising that the future is unknowable but can be influenced by current decisions. This is the point of

departure of foresight. Its “processes … are realistically available for dealing with the long term” (Stacey 1992 p.18) and as such its outputs have high strategic value for the strategic decision-maker within the context of their task of strategic thinking.

Conceptually, strategic thinking is regarded as a synthesis of systematic analysis (rational) and creative (generative) thought processes that seek to determine the longer-term direction of the organisation. It is a dynamic capability integrating emergent strategy with intended strategy in order to achieve realised strategy. Strategic thinking implies flexibility and tolerance for ambiguity that is required as a result of environmental uncertainty. The ability to fulfil this task can be regarded as strategic thinking capability and is conceptually linked to decision making.

Bonn (2001) indicates that strategic thinking manifests at two levels; individual and organisational. This view of strategic thinking acknowledges the influence of individuals’ characteristics and mental models (Malan 2010) on strategy formulation but also allows to focus on the individual’s strategic thinking ability in relation to other concepts. By indicating that “good strategists are able to recognise good ideas that have been put forward by other people … to visualise the value of ideas put forward by others might be even more important than generating an original idea” Bonn (2001 p 51) not only echoes the participative importance of strategic thinking but also opens up the possibility of a construct whereby previously derived ideas such as those flowing from foresight competence serve as a valuable input to strategic considerations. This is also aligned with Stacey’s assertions.

Strategic thinking is a way of thinking encompassing certain characteristics (Mintzberg 1994). Liedtka (1998) indicates that strategic thinking connects the past, present and future and in this way uses both the institution’s memory and its broad historical context as critical inputs into the creation of the future. It is the oscillation between past, present and future that is essential for both strategy formulation and execution (Lawrence 1999).

The outputs of strategic thinking at the individual level are illustrated in terms of decisions related to the strategic thought processes that have occurred. The outputs then flow into the strategic planning process which programs and operationalises the vision and determines the action plans to achieve it (Liedtka 1998; O'Shannassy 2003). This process is not linear as traditionally defined in terms of the rational

perspective of strategy formulation but is an ongoing iterative process of interaction between thinking and planning (Heracleous 1998).

Tavakoli and Lawton (2005) illustrate that deficiencies of strategically relevant information and knowledge undermine the appropriateness and quality of strategic decisions. The combined effect of the elements suggested by O'Shannassy which builds on the Liedtka model, implies a capacity for strategic thinking that meets what Day (1994) refers to as the fundamental tests for strategic value. However, this capability depends on the quality and variety of information available to the strategy-level leader (Tavakoli & Lawton 2005). It is suggested that the elements of strategic thinking point to the nature of required relevant information part of which are carefully developed possible futures, the output of foresight.

Liedtka (1998) proposes a model of five elements for the capability of strategic thinking. These are systems perspective, intent focused, thinking in time, hypothesis-driven and intelligent opportunism.

- Systems Perspective: strategic thinkers need to have an end-to-end perspective of the value chain of activities in the organisation. They have to see the interconnectedness and interdependencies of the various components and functions in the organisation. This systems perspective also includes an understanding of the dynamics of the relationship between the internal and external environment. Developing systems perspective requires leaders to develop a bird's eye view of the organisation and get out of their functional focus.
- Intent Focused: Intent focused is about being driven by goals and having a sense of destiny. Such a drive provides leaders with a constancy of purpose in dealing with changes in the environment. It provides the long-term (future) orientation in that is anchored to the strategic intent of the organisation.
- Intelligent Opportunism: The constancy of purpose generated by strategic intent must be balanced with the flexibility to adapt to opportunities in the environment. This ensures that the organisation does not become too rigid in pursuing a course of action.
- Thinking in Time: Strategic thinking must be able to connect with the past, present and future. This requires strategic thinkers to understand the gap between

the present and the desired future. This understanding enables the strategy-level leaders to be mindful of what needs to be done and what can be done.

- Hypothesis-Driven: Strategic thinkers need to see and formulate future possibilities and plans as hypotheses. A hypothesis-driven approach to thinking about strategy enable strategy-level leaders to test their assumptions and beliefs and adapt their plan as they receive cues and feedback.

Moon (2013) conceptualized strategic thinking as: creative thinking, vision-driven thinking, systematic thinking, and market-oriented thinking. Moon's (2013) notion of systematic thinking overlaps with Liedtka's (1998) notion of systems perspective. Vision-driven thinking is like Liedtka's (1998) intent focused element. According to Moon (2013), creative thinking is a foundation of strategic thinking and can be developed by being hypothesis-driven and thinking in time. Market-oriented thinking is about thinking of alternative ways to attain sustainable competitive advantage (Moon 2013).

Decision styles reflect the cognitive differences of individuals' propensities to strategic decision-making. The cognitive nature of strategic thinking suggests that the evaluation of decision styles serves as an indicator of the strategic thinking propensity of strategy-level leaders. This study accepts that the elements of strategic thinking are associated with certain decision styles as validated by Van der Laan (2010). These associations are illustrated in Figure 2.5.

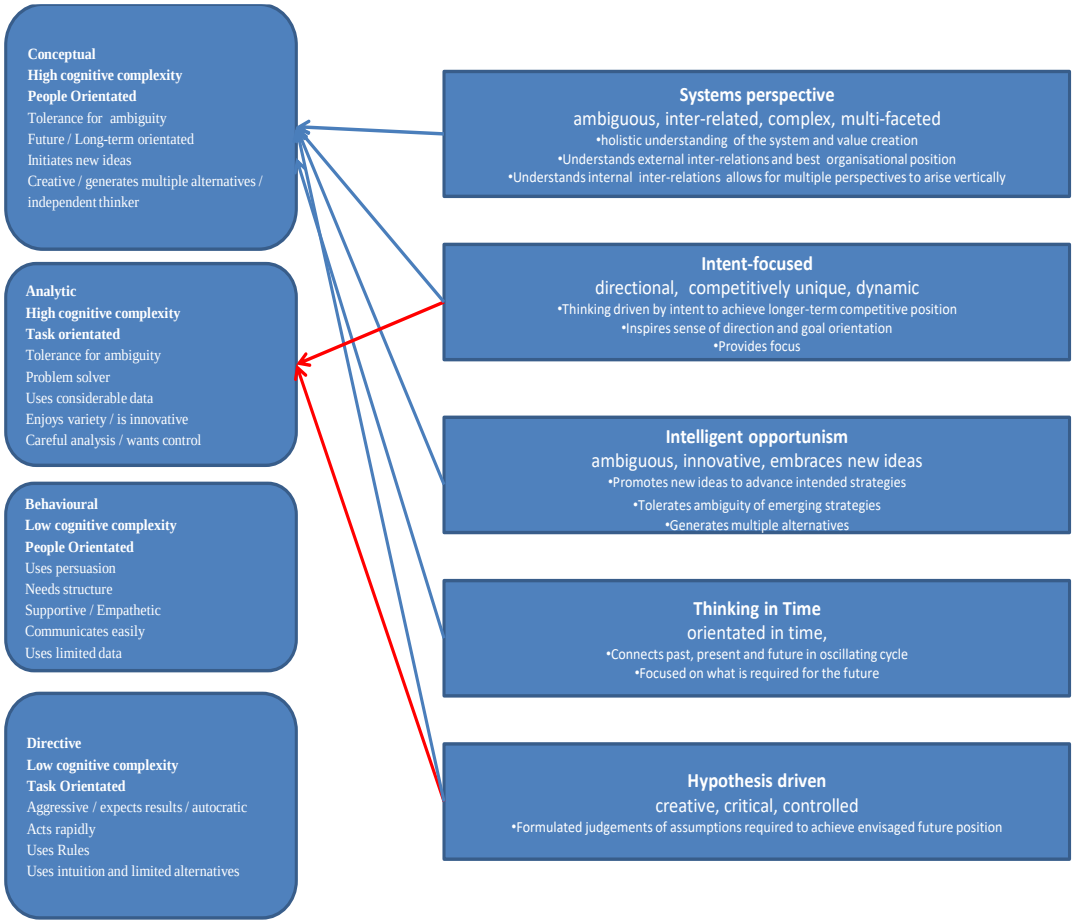

Figure 2.5: Strategic Thinking and Decision Styles (van der Laan 2010)

The elements of strategic thinking identified in systems perspective, intelligent opportunism and thinking in time correspond to the Conceptual Decision Style described in the Decision Style Inventory (Liedtka 1998). The elements of *intent focus* and *hypothesis driven* are clearly linked to both the Analytic and the more creative Conceptual Decision Styles. The study therefore assumes that propensities toward the Conceptual Decision Style as a dominant style with a back-up Analytic Style would reflect the propensity of an individual to be a strategic thinker. Goldman (2005) supports the assertion that strategic thinking is fundamentally one of conceptual style.. It is thus asserted that while the Analytic Decision Style reflects the analytical aspects of strategic thinking, the dominant style of decision-making propensity by strategic thinkers would be the more creative Conceptual Decision Style. Goldman agrees that the "natural place to look for understanding is cognitive science" (Goldman 2005, p.4) which includes decision-making research and thus supports the study's operationalisation of strategic thinking. Prior studies by Van der

Laan (2010, 2012, 2016) illustrate the validity and reliability of the construct and its measurement.

This study proposes that foresight competence and strategic thinkingare positively related. A lack of foresight competence is noted to limit strategic thinking and is a form of bounded rationality or myopia (Dickson et al. 2001). Conversely, greater foresight competence, or indeed a competency in individuals, is asserted to be positively related to greater strategic thinking ability. In terms of the conceptual framework of the study, individuals displaying higher levels of the psychological dimensions linked to foresight competence will display greater propensities toward the decision-styles linked to strategic thinking.

2.8 Foresight and strategic thinking capabilities

The capabilities of foresight and strategic thinking are prospective and seek to develop representations of the future. Both acknowledge the predictive value of the past, action values of the present and possible departure from the past of the future. They include cognitive iterative cycles of connecting the past, future and present in developing images of the future.

The timeframes typically considered by each capability are generally described as ‘long-term’. However, the difference between organisational long-term prospects is starkly dependent on the nature and context of industries in addition to the external market forces faced by the organisation. ‘Long-term’ in organisational strategy is generally regarded as timeframes extending beyond three years and is therefore rather termed ‘longer term’ in this study implying a time horizon that exceeds the short-to medium-term planning horizons commonly employed. However, in terms of foresight programs, long-term is regarded as implying timeframes exceeding 10 years, with a number of studies considering timeframes extending beyond 15 years (Blind et al. 1999; Héraud & Cuhls 1999). As such, this study asserts that foresight and strategic thinking differ in terms of the time horizons envisaged.

The distinction between a preferred future as the result of exercising a choice as opposed to desired futures illustrating a range of normatively determined possible futures is significant in the distinction between foresight and strategic thinking. Foresight does not predict the occurrence of a single future. Strategic foresight,

however, implies the selection out of several options, of a preferred future state. Strategic thinking considers available choices related to the selection of a long-term, single preferred future (vision) for the organisation. The purpose of foresight is however, to seek to expand the range of alternative futures that are possible and desirable. Foresight does not predict a single future. Rather, depending on present action, many futures are possible (multi-finality), but only one of them will happen (Grupp & Linstone 1999). In contrast, strategic-thinking is action-focused based on the iterative resolution of intent. The intent is manifested in the choices made by decision-makers and based on a single longer-term preferred direction and future state of the organisation based on the control and understanding of how maximum value is created in the organisation's system. Foresight includes a normative evaluation of what may constitute desired futures according to broader criteria than that of an organisation's ideals. The normative criteria arise from the values and subjective cognitions of the individual and include such considerations as the human well-being and the curatorship of the environment. Desired futures as expounded by foresight may therefore not correlate with the preferable future as expounded by the strategic thinking choices of an organisation.

A company cannot be everything to everyone; resources are limited and therefore choices on how to use them must be made (Eisenhardt & Sull 2001; Hammonds 2001). It is the task of strategic leaders to do so and thereby, *"...*enable the organization to concentrate its resources and exploit its opportunities and its own existing skills and knowledge to the very fullest" (Mintzberg 1987 p. 30).

2.9 Conceptual framework

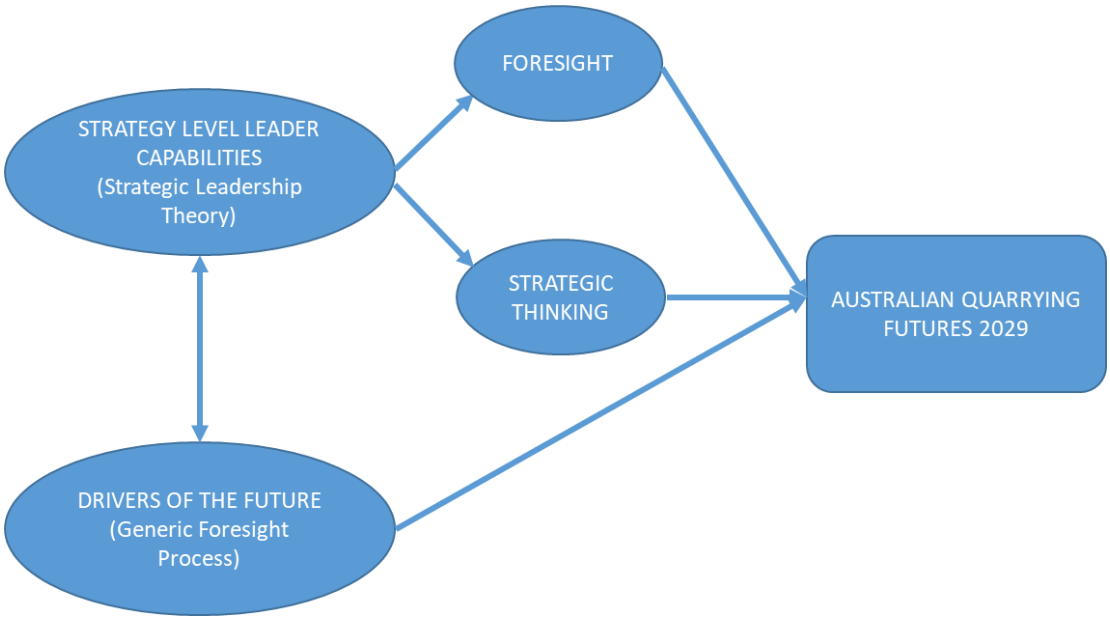

Figure 2.6: Conceptual Framework

The conceptual framework as described in Figure 2.6 outlines the following:

- Foresight and Strategy Thinking capabilities can be used as proxies to predict possible futures as suggested by Strategic Leadership Theory. It is acknowledged that other capabilities and characteristics may also serve as proxies but are not included in the study.
- Drivers of the future can inform Foresight and Strategic Thinking capabilities to determine the futures of the Australian Quarrying Industry.

It is proposed:

- Based on Strategic Leadership Theory, the strategy-level leader capabilities of Foresight and Strategic Thinking are reflective of the future of the Australian Quarrying Industry.
- The drivers of the future as identified in a generic foresight process can reflect on the future of the Australian Quarrying Industry.

Chapter 3 METHODOLOGY

3.1 Introduction

Chapter 2 provided an overview of the literature aligned to the study and a conceptual framework upon which the research is based. Chapter 3 describes the research methodology adopted for the study, its purpose and how it was designed and implemented.

3.2 The research questions

The overall purpose of the research was to answer the following question:

- Research Question 1: What are the possible futures of the Australian Quarrying Industry by 2029?

To answer the overarching question, two sub-questions were addressed:

- Sub-Research Question 1.1: What are the foresight and strategic thinking capabilities of current strategy-level leaders in the Australian Quarrying Industry and how may that reflect the possible futures of the industry?
- Sub-Research Question 1.2: What are the drivers of the future that are associated with the futures of the Australian Quarrying Industry?

3.3 Strategy of enquiry

Creswell (2009) supports the idea that a researcher should identify the framework that will be used for their study. The researcher should have the ability to provide an explanation for how they approach their research and design it. The explanation would include what kind of methods they employ during the research. Figure 3.1 illustrates the strategy of inquiry adopted by the study. It illustrates the interactive nature of the elements of the approaches to research beginning with the paradigm adopted by the study.

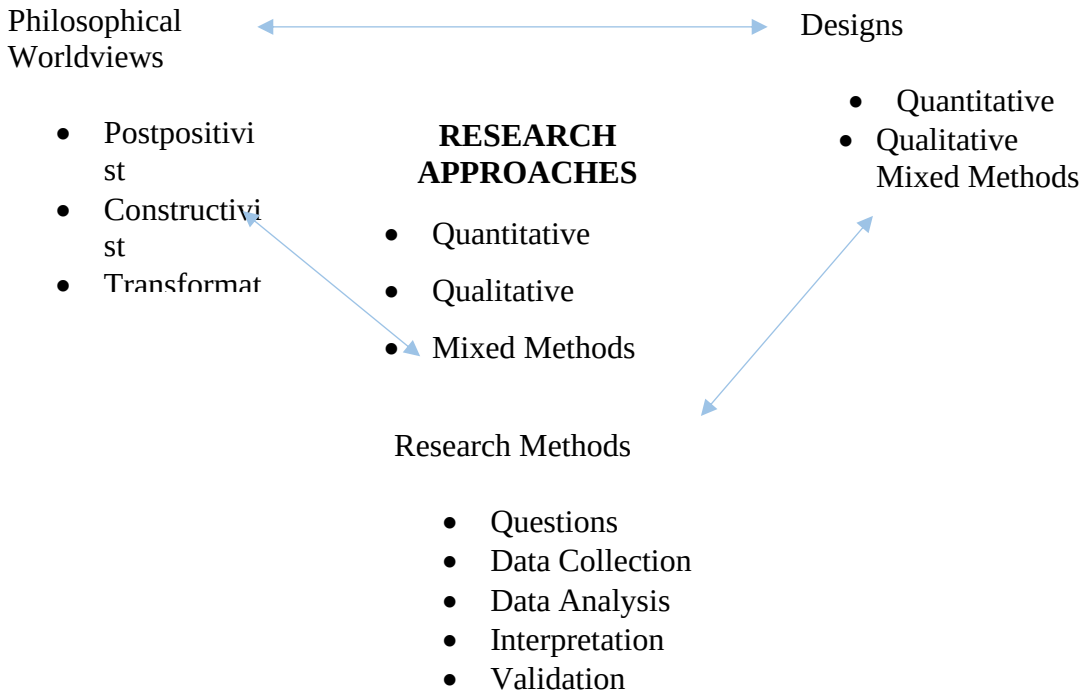

Figure 3.1 A Framework for Thesis Research

3.4 Insider Researcher

As a work-based research study, the location of the practitioner researcher is of critical importance. The researcher, as the Chief Executive Officer of the peak industry body, was positioned to be the 'subject matter expert' on the Australian Quarrying Industry as an 'insider researcher' (Fleming 2018) and was thus well placed to conduct and describe the environmental scan.

Insider research studies are common in work-based learning and research (Fleming 2018). Insider researchers are often well placed to gain an in-depth understanding of a research study within an industry where they are actively involved (Trowler 2011). Insider research carries many benefits yet confronts the researcher with many challenges (Fleming 2018). Fleming (2018) identified several challenges faced by an insider researcher. Each of the challenges faced by this study's insider researcher are listed below.

- Challenge 1: To minimise the potential for implicit coercion of participants.
- Challenge 2: To ensure privacy and confidentiality.
- Challenge 3: To identify potential biases and ensure trustworthiness, transparency and vigor.
- To acknowledge preconceived ideas and the desire for positive outcomes.

- To ensure tacit patterns and regularities were not taken for granted and examined more closely.
- Being aware of the potential of professional conflicts in the dual roles of being an employee and researcher within the same context.

This study deployed the following strategies to mitigate the challenges outlined above:

- Located primary sources that identified/validated key drivers and their effects.
- Engaged a 'critical friend' who interrogated and challenged the insider researcher's assumptions throughout each stage of the study.
- Minimised the challenges through the critique and feedback as part of the study's supervision process.
- Engaged an administrator to ensure privacy and confidentiality and minimised the potential for implicit coercion of participants in the study.
- Opened transparent communication with Delphi expert panel throughout each stage of the Delphi method.

3.5 Research design

The design and enquiry strategies are of great importance in order for a study to meet its aims and they should be clearly identified beforehand (Gorard 2013). The study is exploratory and adopted a sequential mixed methods design. The investigative strategy and the design of the research are vitally important to demonstrate how the goals and objectives of the research is fulfilled. The present study was designed into three phases. The first phase involved a Delphi Study which focused on possible futures of the Australian Quarrying Industry. The second phase consisted of a PESTEEL environmental scan and an online survey to establish leadership profiles. The third phase of the study was a work-based project called SMART QUARRYING which focused identifying the futures of Australian Quarrying Industry and developing future scenarios of the industry.

3.5.1 Research paradigm

Creswell and Poth (2018) believe that researchers should clarify the approach suggested by any research and justify this in terms of its 'fit' in answering the research questions. Creswell and Poth (2018) mention four pervasive worldviews

which are post positivism, constructivism, transformative, and pragmatism. The study area and experiences gained from previous studies play a significant role in terms of selecting the appropriate worldview for a study.

Creswell and Poth (2018) revealed that post positivism is more related to the conventional way of conducting scientific studies as it makes use of the quantitative enquiry methods which prioritize exploring cause and effect relationships. Unlike post positivism which is more about antecedent conditions and hence, an empirical answer, the pragmatic paradigm focuses on situations, actions as well as consequences and benefits as discovered from the use of pluralistic methods which can generate the best applications and solutions (Creswell & Poth 2018). Pragmatism necessarily suggests that the pluralism offered by combining both the qualitative and quantitative methods allows the researcher to gain both greater depth of understanding and breadth of application.

The pragmatist paradigm is in line with the notion that there is not one absolute truth (Creswell & Poth 2018) and hence, the perception of reality shifts over time. Pragmatic approaches have an impact on enabling human problem solving and cope with issues as they occur (Creswell & Poth 2018). Taking this into account, it is safe to assume that pragmatists do not commit to one mere research paradigm, system, or reality (De Vaus 2001). Instead, they are in favour of using various methods whose strengths lead to the most benefit and insight.

This study applied the pragmatic paradigm since precursor conditions were not necessarily the focal point of this research and it "did not have any commitment to any system of philosophy or reality" (Creswell 2009 p. 4). The focus of the study was on knowledge claims stemming from consequences and action orientation to figure out solutions (Creswell 2009). Research reveals that there are two principal requirements for a pragmatic approach to be employed in a research study (De Vaus 2001). Firstly, the research problem itself must be held central and secondly, the ability to give insight to the research question must be the main factor when selecting data collection and analysis approaches. Specifying the research problem as the most crucial component enabled the introduction of various methods to comprehend the problem. The approval, capability of resolving real world issues and the ability to adapt to different applications were the primary factors based on which the

methodology was selected (Rowe & Wright 2011). The primary objective of this study was to find answers to real-world industry problems (the possible futures of an industry) without getting caught up in certain worldviews that may limit the answers. This is why the pragmatic paradigm was the best choice for this particular research. When a researcher makes their choice in favour of pragmatism, this choice includes a built-in acceptance of making use of a design made up of mixed methods. Creswell and Poth (2018) inspire researchers to use mixed method design and generously draw on the strengths of both qualitative and quantitative assumptions in responding meaningfully to real world problems.

3.5.2 Qualitative, quantitative, and mixed methods research approaches

The research approach is of great importance in terms of specifying the best procedures so as to gather, analyse and interpret data (Creswell & Poth 2018). The mixed methods approach used in the pragmatic framework was understood to be highly appropriate to this study. The study was exploratory suggesting a qualitative first phase followed by a quantitative phase.

3.5.3 Qualitative research

The principal goal of qualitative research is to ‘construct’ social reality and meaning and it is backed by the constructivist worldview (Creswell 2009). Qualitative research, in work-based learning, employs various designs containing action research methods as well as case studies in order to conduct a thorough exploration of complex phenomena and describe it (Creswell & Poth 2018). By taking advantage of interpretation and content-based analyses, qualitative research can provide a better and deeper understanding of the nature of a phenomenon (Creswell & Poth 2018). Unlike quantitative approaches, qualitative approaches are usually inclined towards smaller sample sizes which are targeted and selected for a particular goal. Taking this into account, it is obvious that there is a limitation that the findings are difficult to validate and be generalised. However, qualitative methods are very well suited in exploring and ‘constructing’ unprecedented phenomena. In other words, when there has been no precedent or predictive fact, qualitative methods can ‘build’ a valid representation of a new phenomenon as such including qualitative enquiry is a fundamentally important approach to futures studies.

3.5.4 Quantitative research

The most suitable methods to study the identification of the inherent relationships among variables are quantitative methods. Creswell and Poth (2018) also note that quantitative approaches are in line with the knowledge paradigms coming from the scientific and post-positivist worldview and they are used for the purpose of explaining and defining the relationships among variables. These are mostly conducted with the purpose of prediction based on past fact. The well-known enquiry strategies using statistical analysis are devised by utilizing survey or experimental methods (Creswell & Poth 2018). In contrast to qualitative research, quantitative research uses larger samples representing a specific population. Making predictions for human behaviour is considered the principal objective of the quantitative approach and is a compelling empirical basis upon which to achieve broader validity, reliability, and generalisations of findings. Understanding and developing a baseline profile of leader capabilities for predictive purposes were therefore well suited to this aspect of the study.

3.5.5 Mixed methods

Satisfying the goals of this study and providing beneficial insight are the two objectives that quantitative and qualitative approaches have in common. Nevertheless, taking both approaches and uniting them into one mixed method design appears to be the best solution where the weaknesses in one approach are somewhat compensated by the strengths in the other approach. A mixed methods design is capable of delivering the best solutions for the research problem as they contribute with greater depth of insight and broader applicability. Creswell and Poth (2018) state that mixed methods are becoming more popular in terms of comprehending complex practice-based research problems. This is explained by the fact that they provide deeper meaning and a broader empirical basis for all potential claims. Creswell and Poth (2018) define ‘mixed methods’ as a unique technique for research design which enables researchers to combine both qualitative and quantitative methods to obtain data from different perspectives and include triangulated analysis.

The pragmatic paradigm stipulates that the research approach is related to the aim of the study and has the ability to provide precise answers for research questions. This study constructed a baseline profile for the Australian Quarrying Industry with respect

to strategy level leaders' foresight and strategic thinking capabilities as a valid predictor of the industry's strategic direction as assumed by strategic leadership theory (Hambrick and Finkelstein 1996). The methods of enquiry selected for this research were a thorough review of the current literature, an online survey and the Delphi method (Burch & Heinrich 2016). Figure 3.3 illustrates how the conceptual model of the study is aligned with the research questions.

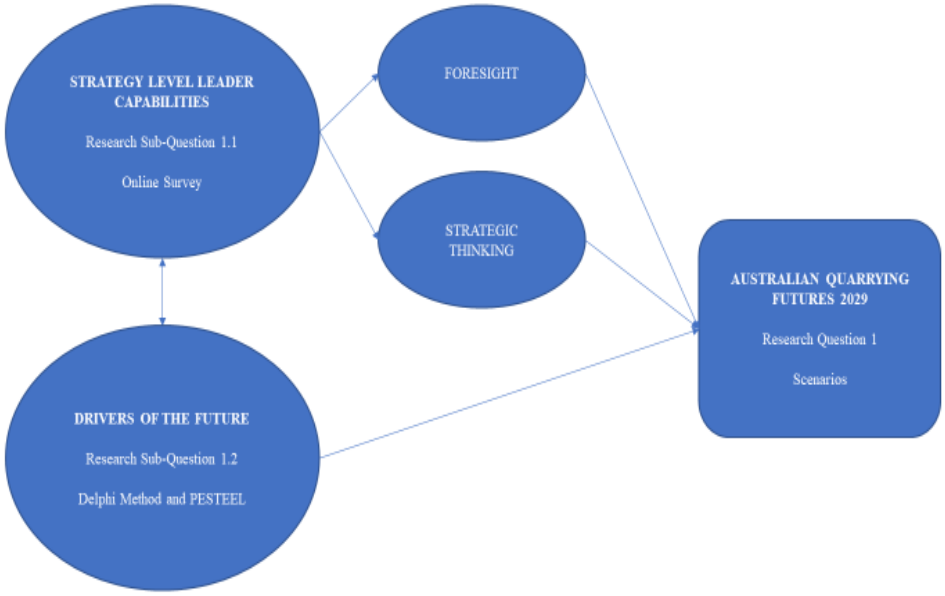

Figure 3.3: Research Questions and Research Phases alignment to Conceptual Model

3.5.6 Phases of this study

In addressing the research aims and questions an exploratory sequential design was considered appropriate. It began with a Delphi Method (Section 3.5), progressing to the PESTEEL (Section 3.6.1) and online survey (Section 3.6.2) and finally scenario development (Section 3.7) as listed in Table 3.1.

Table 3.1 Phases of this Study

Phase	Method	Qualitative/Quantitative	Purpose
Phase 1	Delphi Method (panel of experts)	Qualitative and Quantitative (Primary data)	Identify drivers/uncertainties of the future
Phase 2 (1)	PESTEEL (environmental scan)	Qualitative (Secondary data)	Analysis of Delphi results and desktop sources to complete environmental scan
Phase 2 (2)	Online Survey	Quantitative (Primary data)	Establishment of baseline profiles (foresight and strategic thinking) of strategy-level leaders
Phase 3	Scenario Development	Qualitative (Secondary data)	Development of a set of possible future narratives

3.6 Phase 1 - The Delphi study

Considering the worldview used for this research, the Delphi method was regarded as being more suitable for pragmatic research in that it is primarily exploratory.

Pragmatism makes up the philosophical basis for the Delphi method (Morgan 2014). Brady (2015) explained the following ways in which the pragmatic paradigm supports the Delphi method. Firstly, the pragmatic paradigm has good flexibility and therefore, is capable of using both qualitative and quantitative data enquiries. Secondly, it is an affordable method and can be distributed via email with high efficiency and convenience. Thirdly, there is no need for generalization as it focuses on individual participants having specific expertise. Fourthly, the Delphi method is able to provide for anonymity and provide an equal voice to experts' opinion.

The Delphi method has a structure that can produce outcomes for both qualitative and quantitative approaches. The original Delphi method was modified by studies carried out later, hence, leading to the distinction between Modified Delphi methods and Classical Delphi methods (Landeta 2006). The Modified Delphi method is typified by the removal of the component of conducting interviews and including a variety of ways ranging from open-ended question/s to pre-determined and constructed items to begin the process (Landeta 2006). Technological advancement, including online survey tools and emails have enabled more efficient and flexible ways to communicate (Landeta 2006).

A Delphi study represents an iterative process (see Figure 3.2) focusing on gathering anonymous views from subject matter experts while making efforts to unearth novel insight and achieve consensus (Landeta 2006). The published works and different fields where the Delphi method was used as the primary research technique illustrates its multi-disciplinary application and methodological rigor.

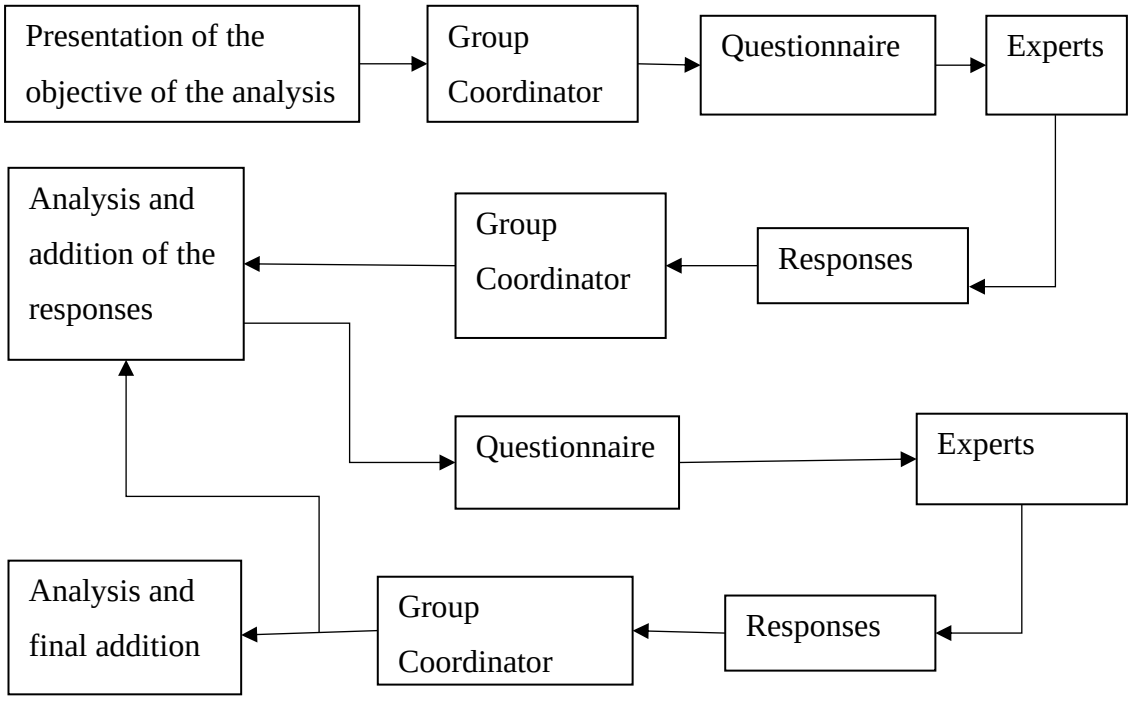

Figure 3.2: The Delphi Process (Landeta 2006)

For this study, the modification of the Delphi method was considered relevant as an appropriate means of collecting expert views with the help of email questionnaires presented to a panel of experts on an individual basis. In particular, the Delphi method

complimented the environmental scanning conducted in Phase 2 as part of the study's foresight process to develop a range of possible futures for the industry.

Utilizing expert views in specifying drivers and disruptors of the future is a well-known method (Feilzer 2010; Greitzer et al. 2013; Creswell & Creswell 2018). This method promotes advantages such as the ability to explore complicated issues where the experts are not required to meet up. This flexible design enabled follow-ups, solicitation of information and ranking of the different outcomes in terms of how important they were according to the experts. Meanwhile, it also served as an enabler to form a group opinion which is usually more valid in comparison with individual views (Rowe & Wright 2011). The Delphi study provided the most appropriate and significant insights in identifying drivers of the future that had a considerable influence on the Australian Quarrying Industry.

3.6.1 Choosing Delphi participants

For a Delphi process to be successful, making the right decision in terms of Delphi participants is probably the most vital component (Creswell & Creswell 2018). If the goal is to produce credible contribution based on expert opinion, participants should be selected carefully and any randomized selection process in that regard cannot be accepted (Derbyshire & Wright 2017). Shariff (2015) fully supported the same notion by proposing that only purposive, non-random samples must be employed while using the Delphi method.

The literature presents different viewpoints when it comes to selecting the participants that are supposed to be involved in a Delphi study. There are a number of disagreements in that sense and even the definition of the term 'expert' is disputed. Trevelyan and Robinson (2015) state that the definition of the term 'expert' should be clearly specified prior to designing a Delphi study because a simple assumption of experience and knowledge cannot be accepted. They are of the opinion that not every participant should be labelled as an 'expert' and researchers should have detailed information on the expertise level of different participants. This study made use of the term 'expert' while defining the participants of the panel and their expertise level.

Adler and Ziglio (1996) suggest that the four principal requirements to determine the expertise of the participants of the Delphi study are:

- Experience and knowledge related to issues that are being investigated.
- Capability and willingness for participation.
- Adequate amount of participation time.
- Effective communication skills.

Gutierrez (1989) defined an expert as a specialist who has comprehensive knowledge and wisdom regarding the investigated subject, actively partakes in the subject area and is committed to be involved to further develop the insight and understanding of the area. Campbell et al. (2004) argue that defining an expert is dependent upon the subject under investigation and thus, it is obligatory to have a clear representation of how the members of the panel are selected.

It is recommended to encourage researchers to clarify the basis in use while selecting panel members as it provides a level of transparency and validity (Rowe & Wright 2011). This study included panel members from senior management roles within the Australian Quarrying Industry that met the following criteria:

- Executive level leaders in the Australian Quarrying Industry, Industry Regulators and Industry Suppliers.
- Minimum of 10 years management experience related to the Australian Quarrying Industry.
- Graduate qualification.

3.6.2 Anonymity

Keeney et al. (2010) proposed that there is no way to guarantee the anonymity of a Delphi process. This opinion was backed by the idea that at least the primary researcher knows the identity of the experts. This is also the case for the current study where only the principal researcher was aware of this information. This is considered to be a useful method to exclude the issues concerning identity and enable the participants to respond in a more honest and genuine manner.

Delphi method provided an environment where experts did not have direct interaction, which resulted in their opinions being independent and this in turn, ensured that groupthink were avoided and identities of the individuals were protected (Janis 1972). Anonymity leds to objectivity in terms of responses and outcomes (Lilja et al. 2011).

Itallowed the study participants to adapt their responses based on the objective assessment of the responses of others.

3.6.3 Participant details

The required size of an expert panel for the Delphi method and no specific advice on the number of experts ensuring a representative sample, are the two popular arguments in the literature (Keeney et al. 2010; Shariff 2015). There are sharp fluctuations in Delphi panel sizes which are heavily impacted by several factors such as resourcing, the extent of problem complexity, and the characteristics of the sample in terms of being homogenous or heterogeneous (Trevelyan & Robinson 2015). Skulmoski et al. (2007) are of the opinion that ten to fifteen experts are adequate for a homogenous sample to produce sufficient quality results. In these cases, individuals are fully involved in contributing to the process owing to the importance of a high level of panel expertise and the small number of participants (Ludwig 1997).

Reliability plays a significant role in the Delphi method. Lilja et al. (2011) suggested that the most crucial component of reliability is based on the representativeness of the sample where the bias involved is lessened with the help of iterative Delphi process and anonymous respondents. The size of the sample is not necessarily crucial as its representativeness. In representing the chosen population, the Delphi process does not make use of random samples (Keeney et al. 2010). Experts with senior management roles in the Australian Quarrying Industry were purposefully selected for this study.

Keeping the suggestion of Skulmoski et al. (2007) in mind, the researcher recruited ten to fifteen participants within the frame of the study. The turnaround time required for the Delphi rounds was an issue and therefore, the means of distribution was chosen to be emails which were easy to use, and decreased the turnaround time (Okoli & Pawlowski 2004). Thirty experts were identified after meeting the panel member criteria. Each identified expert was delivered an email invitation which involved consent forms. The goal of the research, the description and definition of the Delphi process and participant requirements (potential risks, benefits, commitment, anonymity etc.) were specified and explained in the invitations (Wee Yong et al. 1989).

Eighteen (60%) of the thirty invited experts rejected to partake in the research, whereas twelve (40%) of them agreed to participate (Table 3.2). There was no further

attrition among the rounds of the Delphi which lead to 100% (n=12) of panel experts remaining in the Delphi processes through all stages without any exceptions.

Table 3.2: Panel of Experts – Position and State/Territory

Position	State/Territory
General Manager (Quarrying)	New South Wales
Chief Mines Inspector	Victoria
International General Manager (Industry Supplier)	Queensland
Chief Executive Officer (Quarrying)	New South Wales
Chief Executive Officer (Quarrying)	Queensland
International General Manager (Industry Supplier)	Victoria
Executive General Manager (Quarrying)	New South Wales
General Manager (Quarrying)	Western Australia
Regional Manager (Quarrying)	South Australia
Regional Mines Inspector	Tasmania
General Manager (Quarrying)	Northern Territory
General Manager (Quarrying)	Queensland

3.6.4 Delphi analysis

According to Hasson et al. (2000), the Delphi literature does not offer any universal guidelines which would be helpful for researchers in terms of analysing the collected data. Brady (2015) pointed out that there are no uniform techniques offered within the context of the Delphi method to perform data analytics. The method of data analysis was selected based on the type of data gathered and the objective and design of the study. Because the Delphi study has an iterative nature, data analysis was performed perpetually, throughout the study. The analysis done in the previous rounds played a significant role in informing the next rounds of the Delphi process (Brady 2015). The same data analysis method was used to inform all the three rounds of Delphi.

3.6.4.1 Quantitative analysis

Mostly quantitative data were used in a question and answer format employing a 5-point Likert scale. All data was cleaned, and screen checked for normality and missing values. Thereafter, a frequency analysis was employed.

3.6.4.2 Qualitative analysis

The Delphi method encourages the use of thematic analysis; however, the literature does not provide enough directions to guide researchers in conducting this task (Brady 2015). Qualitative data analysis is performed but the instructions to conduct the analysis are not necessarily mentioned in all cases. This research adopted a classical

content analysis of qualitative data in order to discover emerging themes in all three of the rounds of the Delphi method. Identifying the concepts in the text responses provided by experts was also part of the whole process. Computer packages can be used for the Delphi method or it can be processed manually (Shariff 2015). This study analysed the data manually.

In the first stage of Delphi the data collected was prepared for analysis and to achieve that, the text responses gathered in different Delphi rounds were transcribed verbatim into an excel database. In line with the Thematic Matrix proposed by Kuckartz (2014), the columns of the Excel database represented the survey questions, while the rows were labelled with experts' participants. At the next stage, each cell containing information was analysed to identify patterns, new information, and other elements. The information given in the literature and consultation with the participants also specified the study details and follow-up avenues. The participants were fed back with the quantitative and qualitative outcomes resulting from the analysis (Hasson et al. 2000) in addition to using further open-ended questions.

3.6.5 Delphi round 1

The first round of the Delphi study identified drivers and disruptors of the future of the Australian Quarrying Industry (APPENDIX 3). It has been discussed that pre-existing information usage might result in bias or it may confine the contribution made by experts (Hasson et al. 2000). To exclude such bias, textboxes and qualitative questions were added as options for providing extra comments.

A Likert scale, which is frequently used to design Delphi questionnaires was employed which allowed for interpreting data through consensus and agreement levels (Keeney et al. 2010). Using four to seven Likert scale categories generates the best results for a Delphi research (Trevelyan & Robinson 2015).

Taking this advice, a five-point Likert scale was selected for the research. In addition to Likert scale responses to questions, the experts were also given the freedom of raising issues and opinions which were not mentioned in the original questionnaire by free text responses. The round one of the Delphi started in 29 April 2016 and ended in 29 May 2016.

After all the responses provided by 12 experts were submitted, the compilation and analysis of the outcomes commenced. Consistent with the underlying pragmatic approach to the research, the results of the first round were analysed by using both qualitative (content analysis) and quantitative (frequency analysis) methods.

3.6.6 Delphi round 2

The outcomes gained from the Delphi round 1 analysis were used as a basis to develop the second-round questionnaire (APPENDIX 4). Several targeted questions based on the viewpoints of the participants were included from round one of the Delphi (Skulmoski et al. 2007). The second round of the Delphi process was held between 05 July 2016 and 05 August 2016 and it contained feedback based on primary Delphi questionnaire and offered a greater number of open-ended/narrative questions which were predicated on insights collected in the first round. It was an iterative process offering the experts an opportunity to confirm or reject the insights given in the primary Delphi questionnaire (Catrantzos 2012).

3.6.7 Delphi round 3

The third and last round of the Delphi process started in 20 September 2016 and ended in 20 October 2016 (APPENDIX 5). In this round, the researcher used the opportunity to give the participants the overall findings obtained from the two previous rounds. The members of the panel were asked to provide their level of consent on the results. Being much more qualitative was a feature of this round, where the level of consent with respect to the findings was requested. In case the respondents wished to provide additional explanation, free text responses were made available. Free text responses as well as the Likert's scale were employed for the purpose of presenting the extra questions emerging from the second round of the Delphi.

Consistent with the suggestions of Skulmoski et al. (2007), the Delphi was conducted through only three rounds and that was adequate in reaching saturation for Research Question 1 through accomplishing consensus, high level information exchange and the appropriate guidance on constructs. Moreover, conducting the process in three rounds is deemed to be the optimal decision to make sure that outcomes are relevant and still have room to avoid participant fatigue as well as possibility of attrition (Trevelyan & Robinson 2015).

3.6.8 Delphi summary

Following the completion of the Delphi process, Delphi experts were provided with an overview of the Delphi findings. This process verified and validated the findings as well as provided the opportunity to thank participants for their participation.

3.6.9 Assessing the reliability and validity of the Delphi method

Face validity considers to what extent the questionnaire appears to be addressing the main constructs regarding presentation and relevance. Within the context of the current study, making sure and demonstrating that all rounds of the Delphi study were certain and clear was of great importance (Shariff 2015). The members of the expert panel did not raise any issue or confusion all along the Delphi process. The level of agreement over the items was rather high indicating that potential futures of the Australian Quarrying Industry were properly addressed by the questions offered in the Delphi process.

The reliability of the content was ensured by the use of iterative rounds with expert participants both of which are important parts of a Delphi method (Shariff 2015). The term content validity refers to the evaluation in terms of whether a measure is capable of representing all aspects of the conceptual definition regarding a construct (Neuman 2011). The content validity was improved by the panel experts who made valuable contributions to include dimensions, the published literature, and carefully performed analysis in each round of the Delphi process all of which make the Delphi surveys more comprehensive. Additionally, members of the expert panel were presented the opportunity of reviewing the outcomes for the confirmation of the content through all rounds and were given access to the final summary paper.

Lastly, because of its recurrent nature Delphi process played a big role in terms of addressing the concurrent validity. The concurrent validity was improved with help of target concepts regarding potential futures resulting from the use of successive rounds (Hasson et al. 2000).

Using quality indicators in Delphi , including participant criteria , a specified number of rounds and well-clarified criteria for consensus, study was further improved in fittingness, credibility, confirmability and auditability Diamond et al. 2014; Hasson et al. 2000).

Another advantage of the Delphi method is the ability to decrease or completely remove factors such as group think or bias and the impact of powerful group influencers - all of which possessing the potential of affecting reliability (Keeney et al. 2010). The reliability of the Delphi study was further increased by factors such as unbiased expert selection criteria, keeping the respondent's anonymous and making sure that both private and public sectors were represented during the research (Hasson et al. 2000; Lilja et al. 2011).

Administrative and organizational abilities of the researcher significantly increase the level of success of the Delphi method (Hasson et al. 2000). To keep track of the Delphi process was considered a significant component enhancing the reliability of the research. It included details with respect to all panel experts, the expertise represented and the three stages of the Delphi process which started with sending emails, then continued with the questionnaires in the second round and ended with email reminders.

The researcher maintained a reflective journal throughout the research to present a better demonstration of the rigor of the whole research and the Delphi method in particular (Brady 2015). In addition to other duties, this journal was utilized to carry out the documentation of the supervision sessions as well as crucial decisions taken throughout the study. The journal laid out the details of opinions and decisions taken over the course of the study and included actions such as identifying challenges and vindicating decisions thereby, increasing the reliability of the research.

3.7 Phase 2 – PESTEEL (1) and Online Survey (2)

3.7.1 PESTEEL

'PESTLE' as it was originally termed, is an environmental scanning framework. Aguilar (1967) was the first to present the procedures and tools which are utilized with the intention of environmental scanning. According to his definition, environmental scanning is a process of seeking information related to the interactions and events in the external environment surrounding an entity. The knowledge based on this information is used to develop charts to demonstrate the future actions to be taken by the organisation. Hoskisson et al. (2004) classified the external environment into two categories – the general environment and the task environment. Bennis

(2007) stated that a PESTLE analysis could be very helpful in terms of analysing the outside environment. Since it is where the operative actions of an industry take place, the external environment carries credibility. PESTEEL analysis helps to comprehend the 'big picture' of the environment where an industry operates. This is helpful in identifying the systemic inter-relations of the operational environment in order to determine ways in which the environment can evolve and what the main 'drivers' of the future are.

The elements included in a PESTEEL are Political, Technological, Social, Economic, Legal and Environmental (Rapidbi 2007). One goal of PESTEEL analysis is to specify the forces in the macro-environment which have a significant impact on the industry and are probable to keep on affecting the industry in the future (Haberberg & Rieple 2008). While PESTEEL has been widely used, it fails to capture the increasingly critical dimension of ethics. Since the global financial crisis in 2008, the question of ethics in decision making has become an important environmental scanning consideration (Cowton et al. 2019). Therefore, for this study, a PESTEEL (Political, Economic, Social, Technological, Environmental, Ethical and Legal) analysis was conducted.

3.7.1.1 Political

PESTEEL examines the political landscape of the world which is currently characterised by a rise in populist movements by showing the power of mass by driver in an ordinarily, stale system (Graber 2017). The way an industry is regulated is heavily impacted by the existing political environment. Government departments, laws and lobby groups are all part of this environment and they influence and put limitation over an industry (Haberberg & Rieple 2008). The study critically analysed information about political drivers. The level of influence that a government can have over a specific industry or the economy of a country was mostly determined.

3.7.1.2 Economic

The Economic in PESTEEL includes the economy's performance as an economic driver for change to examine its direct impact on business (Bush 2016). The effects may vary but are often long-term in nature and can cause disruption to normal business processes with consumers or society ultimately bearing the final costs of any negative trends. This study also included the economic drivers for change, such as the

inflation rate, taxation, interest rates and economic growth patterns to examine their impact on industry (Rapidbi 2007).

3.7.1.3 Social

Societal drivers of change in PESTEEL address trends and uncertainties in population dynamics as well as social stability and human survival, driving a further understanding of the determinants of cultural trends, demographics and various population analytics (Bush 2016). The risks associated with such drivers, can place in question the stability of a civilisation and the associated well-being of that population. The drivers such as population dynamics, global warming, cultural expectations etc. have a social can impact on the community and the market (Haberberg & Rieple 2008). The importance of the social driver is particularly felt in terms of the products and services provided by an industry.

3.7.1.4 Technological

Technological drivers in PESTEEL pertain to the innovations in technology that may affect the operations of an industry (Bush 2016), especially in the present times of digital revolution. These developments include research and development, automation of processes and the extent to which technological changes occur in the processes conducted in an industry (Montani et al. 2019). All events that directly or indirectly impact technology were considered within the scope of technological drivers in this study.

3.7.1.5 Legal

PESTEEL analysis includes legal drivers of change from two different perspectives – the external legal environment as well as the internal legal structures that govern business activities. Laws can affect the business environment in difference ways, depending on jurisdictions, while companies also often put policies in place that they adhere to in order to drive appropriate behaviour (Bush 2016). The term ‘governance’ is commonly used to describe the way in which countries, companies and societies are governed in terms of legislation or policy (Adendorff 2013). It is often associated with providing quality service to the society or community, where the decision-making process is transparent, participative and accountable and under legal and societal scrutiny at all times (Adendorff 2013). Legal drivers for change take into account various aspects of the legal environment to chart appropriate strategies in light of this

legislation (Bush 2016). These drivers also take the legal environment into consideration which stipulates the way an industry operates. The standards set by law through legislation are considered while conducting operation in an industry. Industries need to be aware of the risks involved in the legal dimension (Wylie 2005).

3.7.1.6 Environmental

Environmental drivers in PESTEEL include global environmental risks to the physical environment. Environmental factors include variables such as consumer health, climate change, the availability of energy, the human-made destruction of a natural environment, or any direct consequences of these factors (Bush 2016). Every industry needs to pay close attention to what kind of influences they have on the natural environment (Bourassa et al. 2007). The increasing awareness about the environment and environmentally conscious campaigns of the public support this concept. If environmental risks are not considered when driving innovation and building regulation, the risks have the potential to destabilise both economies and societies and thereby potentially triggering geopolitical conflict and causing long-lasting damage to vital resources and individuals (Bush 2016).

3.7.1.7 Ethical

PESTEEL analysis looks at ethical concerns and concept of Corporate Social Responsibility and involves duties, morality, integrity, and behaviour, what is good and bad for the industry and its people as well as society (Nicolaides 2017). Companies can enhance their governance and develop efficient and effective ethics programs to enable them to operate more responsibly in the societies in which they operate. Ethical analysis in PESTEEL can define what it is precisely that Corporate Social Responsibility should encompass and how corporate ethics can be enhanced to proactively thwart unethical behaviours which may arise in both the micro and macro environments.

3.7.2 Online survey

The online survey method was chosen as a strategy (APPENDIX 6) to provide a quantitative description of the relationship connecting different variables (Creswell 2009).

The popularity of surveys stems from their ability to possess multiple central characteristics which also include temporal perspectives (Denscombe 2003). Within

the scope of this study, ‘survey research’ is perceived to be the strategy that enables data acquisition describing populations of individuals or a group of people (Leedy & Ormrod 2005).

The survey research allowed access to industry groups from a geographical perspective, data collection in an unobtrusive manner, and a lesser degree of bias (Denscombe 2003; Neuman 2006; Sapsford 2007). In particular, the survey was deemed to be the most productive for standardized responses from a geographically diversified population, straightforward questions and ensured anonymity. (). Online survey questionnaire development and administration.

The quantitative approach process can be divided into three parts. Firstly, it begins with an abstract idea, then the idea is followed and supported by a measurement procedure and collecting empirical data in line with the research ideas marks the culmination point (Neuman 2006). This section covers the stages of formalizing a questionnaire in order to gather accurate and comprehensive information within the format of empirical data which represents the problem that the research is based on. Creswell (2009) stated survey questionnaires are pervasively viewed as a suitable tool to gather information from various respondents representing the target population so as to put forward claims regarding the population. This is why survey questionnaires must be designed carefully to achieve validity and reliability in data collection within a cross-sectional research design (Denscombe 2003).

The questionnaire used in the study contained three existing scales. The draft version of the survey was distributed to the researcher’s professional colleagues. The Delphi method panel of experts was asked to evaluate the survey questionnaire, the conceptual model, hypotheses of the study and instrumentation in use. The rationale, preferred instruments and the support for the research were generally accepted and approved without amendment. The Future TimeStyle one-factor congeneric model, as operationalised by van der Laan (2010), had a Cronbach alpha reliability score of 0.855. The Cronbach alpha reliability score for the Foresight Styles Assessment, as operationalised by van der Laan (2010), was 0.820. The Conceptual Decision Style one-factor congeneric model’s Cronbach alpha reliability score, as operationalised by van der Laan (2010) was 0.793. These scales served to measure the foresight and strategic thinking capabilities of leaders (van der Laan 2016) as indicators of the

future state of the industry as per the strategic leadership theory (Hambrick and Finkelstein 1996).

Since online surveys have the advantages of being considerably cheaper and faster and the ability to generate plausible responses without containing researcher bias (Neuman 2006), the survey was conducted online. Gosling et al. (2004) discussed that surveys conducted on the internet produce much better response rates in comparison with those utilizing land mail and deliver better data quality than conventional interviews deliver. When it comes to response rates, they tend to be greater, in proportion to the level of education and interest that the population has towards the subject topic of the study (Neuman 2006). Online surveys also have the benefit of higher diversity in the sampling in terms of geographic, socio-economic and gender standpoints Gosling et al. (2004).

In regard to investigating the dominant coalitions or higher echelons of organizations, the main source of information seems to be their executives, referred to as strategy level leaders, which played a significant role in this study. Even though the upper echelon executives tend to have significantly lower response rates (Cycyota & Harrison 2006), adopting more specific strategies enabled the researcher to attain a sufficient representative response rate from the leading executives of the Australian Quarrying Industry.

The researcher made use of the approach of sending email invitations to individuals on industry public lists. The email outlined a brief description of the study and invited the recipient to click on a link to head to the online survey where the researcher's contact details were available. The same page indicated that participation was voluntary, and the anonymity of the participants would be guaranteed. University of Southern Queensland consent forms and information sheets were emailed to all who agreed to partake in the study (APPENDICES 7 and 8). Participation in the online survey could not begin until the researcher received a completed consent form. As soon as they completed the survey, the participant was thanked and introduced to a unique response ID referring to the response code stored in the database. Those participating in the study were offered the opportunity of requesting the outcomes of the research if they choose to do so.

The online survey service named *Questionpro*, a database and software survey administrator online was used to conduct the study survey. The service offered a variety of operations such as autonomous coding of responses, data storage, export service and descriptive reports on surveys viewed, dropouts and completions. The researcher preferred an entry level service package that came with a few restrictions on data services.

As a result of their reviews on the surveying executives and on the response rates in particular, Cycyota and Harrison (2006) concluded that conventional methods of raising data-collection responses in the study survey had a lesser degree of success when it came to executives. Cycyota and Harrison (2006) further expanded by pointing out that costly methods of data collection from executives did not have any remarkable impact on the response rates. Cycyota and Harrison (2006) reported that the researcher being endorsed by an industry partner or supported by existing social networks such as professional groups, industry, contacts from university or personal life are real factors that lead to greater response rates. In this study, the aforementioned support was provided by The Institute of Quarrying Australia as it endorsed the research and gave the researcher access to a membership list to use.

The purpose of the online survey was to:

a) validate the drivers of the future of the Australian Quarrying Industry; and
b) establish the baseline profiles of foresight and strategic thinking as operationalised by van der Laan (2010).

3.7.2.1 Sample size

The online survey was used to profile senior executive leaders with 10+ years' experience in the Australian Quarrying Industry and affiliated with the Institute of Quarrying Australia to assess their current foresight and strategic leadership capabilities. Sixty leaders, who met the criteria, were invited to complete the online survey. A total of forty-one completed responses were received from the sixty invitations issued.

3.7.2.2 Data analysis strategy

Analysing the gathered data was part of the study and the statistical analysis software; SPSS was employed for this task.

The data collected was made available for downloading as SPSS files which eliminated any extra efforts for data manipulation. After downloading the SPSS files, the analysis process commenced in accordance with the suggestion made by Hair et al. (2010) and Creswell (2009). The first stage was to check for any inconsistencies or missing data. The defaults setting of preferred software which is responsible for reminding the respondent of the fields they missed out on considerably decreased the amount of time required for the checking process. Any incomplete response located were coded as missing results and then reported.

The data was analysed using the scoring and profiling approach as operationalised by van der Laan (2010). In addition, it used frequency analysis in validating the Delphi findings. Correlation analysis was also conducted testing whether there were any statistically significant relationships between the drivers.

3.8 Phase 3 – Scenario development

The modern era features rapid change, innovations and a lot of uncertainty which explains why there is a shift of focus on the utilization of scenario planning methods due to its helpfulness when there is complexity and uncertainty (Schoemaker 1991). As stated by Peikola et al. (2009), scenarios are viewed as useful tools in assisting organizations for preparation against potential eventualities inevitably bringing flexibility and innovativeness to the organization.

Herman Kahn is known as one of the founders of studies covering futures and is considered father of scenario planning which he refers to a set of hypothetical events set in the future designed to provide clarification over a potential chain of casual events as well as their decision points (Aguilar 1967). Godet (2000b) defines scenarios as descriptions for future situations and events that enables one to envision possible futures from the real situation. A different definition was given by Fontela and Hingel (1993) who defended that scenarios were alternative futures based on a combination consisting of policies and trends. Managers often make use of scenario planning techniques to explain their mental models regarding the future so as to take better decisions (Martelli 2001).

The level of uncertainty in Australian Quarrying Industry is increasing which resulted in a greater level of importance in terms of specifying future trends and estimated

business landscape. Some of the potential future alternatives which allow a holistic way of future planning and substantially can increase the capability of identifying the best futures of the Australian Quarrying Industry by 2029, representing a 10-year horizon, were discussed within this research.

Possible futures can be demonstrated by developing multiple possible scenarios and this can shed light on the interactions going on among several trends, the events engaged with the future and leadership abilities required for the management of the favoured future. All complex components of scenario planning were systematically included in this study in a comprehensive, coherent and rational way.

3.9 Ethical considerations

Researchers are concerned about potential ethical issues over the course of their research (Creswell & Creswell 2018). In order to maintain the integrity of the researcher, the research itself and those who take part in the research, ethical standards must be set (Neuman 2011). As a result of the efforts towards ensuring the maintenance of the standards of ethical research, a number of institutional and academically prescribed precautionary actions were taken.

It is mandatory for any research to be approved in terms of ethics prior to being conducted. This study was approved 06 April 2018 (H18REA070) and this approval was valid until the expiry date of 06 April 2021 (APPENDIX 1). It is the responsibility of researchers to adhere to the standards as set out in the regulations as well as in policies and to make sure that the rights and interests of those who partake are not put in jeopardy by their conduct. Upon the completion of the research, a report should be sent to the participants.

Ethical considerations in regard to reporting accuracy, anonymity, confidentiality and voluntary participation (Zikmund 2003) were tabled by the researcher before the research began and then continued over the course of the entire study. The contact details of the researcher for all means of communication were indicated and there was no concern brought up during the entire study.

Necessary measures were taken while collecting, managing and presenting the data to ensure the protection, confidentiality and privacy of the participants in accordance with the ethical guidelines (Neuman 2006). The participants who responded to the

questions were given the assurance that their anonymity would be maintained. They were also assured that the findings of the study will be used for academic knowledge and advancement (Neuman 2006). In addition, the results of the study were made available for the participants so that they could have a copy of it if they wished.

3.10 Conclusion

Chapter three provided an overview of the research design, paradigm, strategy and ethical considerations for the study. Through detailing the research methodology, data collection, and methods of analysis the rigour of the research was clarified. It enabled the research questions and research phases to align with the conceptual model (Figure 3.3). The next chapter presents the findings of the data collected.

Chapter 4 DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

Chapter 3 outlined the research design, strategy and methods chosen by this study to collect data and to answer the research questions. Chapter 4 analyses and presents the findings of the data collected from the Delphi Method and the Online Survey.

4.2 Delphi method

4.2.1 Introduction

The purpose of the work-based project was to develop a fit-for-future Australian Quarrying Industry strategy to ensure that the industry is informed by a futures-orientated understanding of key drivers and shifts in its operating environment. Note that the study was practice-based and located within the context of a work-based project, SMART QUARRYING (Chapter 6).

A panel of experts (n=14) was formed to provide direction to the SMART QUARRYING research and development project. The members of the SMART QUARRYNG research and development project panel were chosen by emailing an invitation to the Institute of Quarrying Australia members who met the selection criteria. Those who received invitations had a minimum of 10+ years working in or for the Australian Quarrying Industry, a genuine interest in exploring the future of the Australian Quarrying Industry and the time to commit to the research and development project. Fourteen Institute of Quarrying Australia members volunteered, and all were accepted as members of the SMART QUARRYING research and development project.

The Delphi Method was used to gather expert opinion from the members of the SMART QUARRYING research and development project's panel of experts to determine factors that were relevant to SMART QUARRYING. This information was then used to develop an online survey, which was piloted and validated among a group of strategy-level leaders from the Australian Quarrying Industry.

4.2.2 What is SMART QUARRYING?

In its first meeting, the expert panel (n=14) was asked to define SMART QUARRYING. The panel agreed on the following definition.

> *SMART QUARRYING was described by the panel as primarily being future- and people- orientated in order to develop a sustainable industry for the future while maintaining good stewardship of natural resources. It was noted that collaboration with customers and other stakeholders would develop new value previously untapped by the industry. The ways in which this is to be achieved was described as primarily being strategically focused, ambidextrous (short-term, strategic exploitation; long-term strategic exploration), highly innovative and focused on developing and retaining talent that over time transforms the industry culture and perceptions of the industry. It was noted as important to exceed customer expectations and embrace change.*

In round two, the panel was asked to indicate any words that should be removed or added to the definition developed in round one. No words were removed but the panel did add '…… *and embrace change as well as explore the 'bench strength' for succession planning*' to the round one definition.

After round two, the description of SMART QUARRYING read:

> *SMART QUARRYING was described by the panel as primarily being future- and people- orientated in order to lead a sustainable industry for the future while maintaining good stewardship of natural resources. It was noted that collaboration with customers and other stakeholders would develop new value previously untapped by the industry. The ways in which this is to be achieved was described as primarily being strategically focused, ambidextrous (short-term, strategic exploitation; long-term strategic exploration), highly innovative and focused on developing and retaining talent that over time transforms the industry culture and perceptions of the industry. It was noted as important to exceed customer expectations and embrace change as well as explore the 'bench strength' for succession planning.*

After round three, the description of SMART QUARRYING remained the same as it did after round two.

4.2.3 Key Drivers that define SMART QUARRYING

In round one, the panel was asked to list the top five key drivers that define SMART QUARRYING. The panel listed *leadership, people, innovation, culture,* and *long-term strategy* as their top five key drives that defined SMART QUARRYING.

In round two, the panel was asked to rank the top five key drivers that were identified in round one from highest (1) to lowest (5). This ranking is listed in Table 4.1.

Table 4.1 Round two results for ranking the top five key drivers that define SMART QUARRYING

Round Two Panel Rankings	Key Drivers that Define SMART QUARRYING
1	People
2	Long-term strategy
3	Leadership
4	Innovation
5	Culture

After round three, the key drivers that defined SMART QUARRYING remained in the same ranked order as they did after round two. It is significant to note that '*people*' was ranked as the number one key driver that defined SMART QUARRYING.

4.2.4 Ways in which SMART QUARRYING can be achieved

In round one, the panel was asked to list the ways how SMART QUARRYING can be achieved. The panel listed *innovation, talent recruitment and retention, formal learning, leadership, capabilities, and strategies* as the ways how SMART QUARRYING can be achieved.

In round two, the panel was asked to rank the ways on how SMART QUARRYING can be achieved as identified in round one from highest (1) to lowest (6). This ranking is listed in Table 4.2.

Table 4.2: Round two results for how SMART QUARRYING can be achieved

Round Two Panel Rankings	How SMART QUARRYING can be achieved
1	Capabilities
2	Leadership
3	Strategy
4	Talent recruitment and retention
5	Formal learning
6	Innovation

After round three, the ways on how SMART QUARRYING can be achieved remained the same as they did after round two (Table 4.2). It is significant to note that '*capabilities*' was ranked as the number one way on how SMART QUARRYING can be achieved.

4.2.5 Enablers of SMART QUARRYING

In round one, the panel was asked what factors they considered increase the likelihood of SMART QUARRYING success (ENABLERS).

Members of the panel suggested that *reducing margins, decreasing talent availability, negative perception of industry in the community, and increased pressure to adopt new/advanced technologies* all contribute to the need for the SMART QUARRYING initiative.

In round one, the panel was asked to identify additional factors that would increase the likelihood of SMART QUARRYING in the industry. In response, the panel listed the following additional factors that would increase the likelihood of the success of the SMART QUARRYING initiative (ENABLERS).

The additional enablers identified by the panel were:

- *Innovation.*
- *Institute of Quarrying Australia leadership.*
- *Enhanced career profile.*
- *Whole of life quarrying.*
- *Functional experts.*
- *Consistent education.*
- *Global connectivity.*
- *Collaboration.*

- *Improved Occupational Health and Safety statistics.*

Further, in round two, the panel was asked if they disagreed with any of the above additional enablers and to add to the list of enablers. Ninety percent of the panel agreed that *Improved Occupational Health & Safety statistics* was not an enabler.

Additional enablers introduced by the panel in round two included:

- *Whole of industry talent bench strength.*
- *Mentoring programs for leaders.*
- *Functional experts.*
- *Adopting externally developed expertise.*

Table 4.3: Enablers of SMART QUARRYING

Enablers of SMART QUARRYING
Innovation
Institute of Quarrying Leadership
Enhanced career profile
Whole of life quarrying
Functional experts
Consistent education
Collaboration
Global connectivity
Whole of industry talent bench strength
Mentoring programs for leaders
Functional experts
Adopting externally developed expertise

After round three, the factors that would increase the likelihood of SMART QUARRYING success remained the same as they did after round two (Table 4.3).

4.2.6 Obstacles to SMART QUARRYING

In round one, the panel was asked what factors they considered DECREASE the likelihood of SMART QUARRYING (OBSTACLES). In response, the panel listed the following factors that would decrease the likelihood of the success of the SMART QUARRYING initiative (OBSTACLES).

The obstacles identified by the panel were:

- *Economic recession.*
- *Government over regulation.*

- *Skills shortage.*
- *Lack of company support.*
- *Lack of industry leadership.*
- *Poor in-house talent development.*

In Round 2, the panel was asked if they disagreed with any of the above obstacles and to add to the list of obstacles. One hundred percent of the panel agreed with the obstacles listed above.

Additional obstacles introduced by the panel included:

- *Lack of support/endorsement from regulators/industry bodies*
- *International competition*
- *Poor personal professional development*

Table 4.4: Obstacles of SMART QUARRYING

Obstacles of SMART QUARRYING
Economic recession
Government overregulation
Skills shortage
Lack of company support
Lack of industry leadership
Poor inhouse talent development
Lack of support/endorsement from regulators/industry bodies
International competition
Poor personal professional development

After round three, the factors that would decrease the likelihood of SMART QUARRYING success remained the same as they did after round two (Table 4.4).

4.2.7 Professional efficacy of SMART QUARRYING

In round one, the panel was asked what approaches contribute to Professional Efficacy of SMART QUARRYING. The six approaches tabled included *effective and safe professionals, professional credentialing, confident and resilient professionals, effective and safe professionals, professional capabilities,* and *mentoring and coaching*.

In round two the panel was asked to rank from highest (1) to lowest (6) the approaches that contributed to professional efficacy. Round 2 results for professional efficacy are listed in Table 4.5.

Table 4.5: Round two results for approaches that contribute to professional efficacy

Round two Panel Rankings	Approaches that contribute to professional efficacy
1	Professional Capabilities
2	Mentoring and Coaching
3	Effective and Safe Professionals
4	Insightful and Trusted Professionals
5	Confident and Resilient Professionals
6	Professional Credentialing

After round three, the factors that would contribute to professional efficacy remained the same as they did after round two (Table 4.5). It is significant to note that '*professional capabilities*' was considered the number one approach that will contribute to professional efficacy.

4.2.8 Education and SMART QUARRYING

The panel was asked to rate to what extent they agreed or disagreed that the following types of education may increase the likelihood of Professional Efficacy: *formal education, informal education,* and *non-formal education.*

Table 4.6 Types of Education

Types of Education	Panel Results
Formal Education Formal learning refers to what takes place in the education and training system of a country. It is official, structured, organised by public organisations or recognised private institutions and results with formal certification and formal level of qualification which is recognised by relevant national educational authorities (Palumbo 2019).	**70%** of the panel agreed that formal education may increase the likelihood of Professional Efficacy. **20%** of the panel neither agreed nor disagreed that formal education may increase the likelihood of Professional Efficacy. **10%** of the panel disagreed that formal education may increase the likelihood of Professional Efficacy.
Informal Education Informal learning is developed whether or not there is a deliberate choice and is realised in the performance, by any person, of activities in everyday situations and interactions that take place in them, within the context of work, family and leisure, i.e. it is without external support and is not institutionalised (Palumbo 2019).	**50%** of the panel strongly agreed that informal education may increase the likelihood of Professional Efficacy. **40%** of the panel agreed that informal education may increase the likelihood of Professional Efficacy. **10%** of the panel neither agreed nor disagreed that informal education may

	increase the likelihood of Professional Efficacy.
Non-Formal Education Non-formal education is any type of structured and organised learning which is institutionalised, intentional and planned by an educational provider, but which does not lead to formal level of qualification recognised by the relevant national education authorities (Palumbo 2019).	**30%** of the panel strongly agreed that non formal education may increase the likelihood of Professional Efficacy. **40%** of the panel agreed that non formal education may increase the likelihood of Professional Efficacy. **30%** of the panel neither agreed nor disagreed that non formal education may increase the likelihood of Professional Efficacy.

Round one results for the types of education that may increase the likelihood of Professional Efficacy are listed in Table 4.6. The types of education rating did not change during rounds two and three. It is significant to note that the panel of experts rated *'formal learning'* at 70% to increase the likelihood of professional efficacy.

4.2.9 The future and SMART QUARRYING

In round one, the panel was asked what drivers in the future would shape the Australian Quarrying Industry.

These drivers included:

- *New talent/talent.*
- *Industry responsibility to invest in talent development.*
- *Community/external perception.*
- *Foresight.*
- *Regulations (Workplace Health and Safety and environment).*
- *Whole of life quarrying.*
- *Supply and demand.*
- *Professional credentialing.*
- *Automation.*
- *Technology.*
- *Economy.*
- *Mergers and acquisitions.*
- *Collaboration.*
- *Multinationals.*

In round two, the panel was asked to rank the panel-identified drivers that would shape the Australian Quarrying Industry from highest (1) to lowest (14).

Round two results for ranking the drivers that would shape the Australian Quarrying Industry are listed in Table 4.7.

Table 4.7: Round 2 results for drivers that will shape the Australian Quarrying Industry

Round two Panel Rankings	**Drivers that will shape the Australian Quarrying Industry**
1	New talent/talent
2	Industry responsibility to invest in talent development
3	Community/external perception
4	Foresight
5	Regulations (WH&S and environmental)
6	Whole of life quarrying
7	Supply and demand
8	Professional credentialing
9	Automation
10	Technology
11	Economy
12	Mergers and acquisitions
13	Collaboration
14	Multinationals

After round three, the drivers that will shape the Australian Quarrying Industry remained the same as they did after round two (Table 4.7). It is significant to note that *'new talent/talent'* was the driver ranked as number one to shape the Australian Quarrying Industry.

4.2.10 The present and SMART QUARRYING

In round one, the panel was asked what in the Australian Quarrying Industry's present would continue into the future.

These elements perceived were:

- *Perception of product limitation.*
- *Incremental innovation.*
- *Consistent demand from engineering and construction.*
- *Legislation and Regulation.*

In round two, the panel was asked to rank the panel-identified present elements that would continue into the future (Table 4.8).

Table 4.8: Round two results for present elements that would continue into the future

Present elements that will continue into the future	**Round two Panel Rankings**
Legislation and Regulation	1
Incremental innovation	2
Perception of product limitation	3
Consistent demand from engineering and construction	4

After round three, the elements that would continue into the future remained the same as they did after round two (Table 4.8). It is significant to note that *'legislation and regulation'* ranked number one as present element that will continue into the future.

4.2.11 The past and SMART QUARRYING

In round one, the panel was asked what in the past would shape the future or hold back the Australian Quarrying Industry. The identified elements are listed in Table 4.9.

Table 4.9 Past elements that will shape or hold back the future

Shape the Future of the Australian Quarrying Industry	Hold Back the Future of the Australian Quarrying Industry
• New talent • Industry Profile • Heritage and nostalgia	• Poor Workplace Health and Safety standards • Regulator perceptions • Owners/managers resistance to change • Poor end of life closures

In round two, the panel was asked to rank the panel-identified past elements that would shape the future or hold back the Australian Quarrying Industry. The elements are ranked in Table 4.10.

Table 4.10: Round two results of the past elements that would shape the future or hold back the Australia Quarrying Industry

Round two Panel Rankings	**Elements that would shape the future or hold back the Australian Quarrying Industry**
1	Shape: New talent
2	Hold back: Poor WH&S standards
3	Hold back: Regulator perceptions
4	Hold back: Owners/managers resistance to change
5	Hold back: Poor end of life closures
6	Shape: Industry profile
7	Shape: Heritage and nostalgia

After round three, the elements that would shape the future or hold back the Australian Quarrying Industry remained the same as they did after round two (Table 4.8). It is significant to note that *'new talent'* was ranked number one to shape the future of the Australian Quarrying Industry and that *'poor workplace health and safety standards'* was ranked number one to hold back the Australian Quarrying Industry.

4.2.12 Varying degrees of control and SMART QUARRYING

In round one, the panel was asked to select the elements that the Australian Quarrying Industry has varying degrees of control over. In round two, the panel was asked to review their round one selection to determine if there was agreement. Some elements were removed by the panel in round two. After round three, the elements remained the same as they were listed in round two. The elements from the three rounds are listed in Table 4.11. It is significant to note that the panel of experts believed that the Australian Quarrying Industry had full control of the *'ethical'* and *'environmental'* elements and more control over the elements of *'social'* and *'technological'*. It is also significant to note that the elements of *'political'* and *'legal'* were regarded by the panel of experts as the Australian Quarrying Industry having less or no control.

Table 4.11 Varying degrees of control

Round	Elements: Full Control	Elements: More Control	Elements: Less Control	Elements: No Control
One	Economic Technological Environmental Ethical	Environmental Technological Social Ethical Legal	Legal Political Social Environmental	Political Legal Social
Two	Ethical Environmental	Social Technological	Political	Legal
Three	Ethical Environmental	Social Technological	Political	Legal

4.2.13 Summary: Delphi Method

The Delphi Method suggested that:

- the foresight and strategic thinking capabilities of strategy-level leaders were the most significant leader characteristics that would determine the future of the industry. As such, with the context of strategic leadership theory, an

indication of the current foresight and strategic thinking capabilities of strategy-level leaders would serve as a valid indicator of the future of the industry within the 10-year horizon; and

- what the drivers, certainties and uncertainties of the future were for the Australian Quarrying Industry.

4.3 Online Survey

4.3.1 Introduction

Based on the Delphi findings, the online survey was conducted to:

- validate/reject the Delphi findings; and
- develop foresight and strategic thinking baseline profiles for strategy-level leaders in the Australian Quarrying Industry.

4.3.2 Data preparation

the gathered data needed processing and editing to transform into a format appropriate for answering the questions of the research (Zikmund 2003). The data was prepared to ensure that the data were suitable for further analysis in terms of correctly coding, downloading, cleaning and screening into the computer database (Zikmund 2003).

4.3.2.1 Response rates

The online survey was administered by email invitations, including a hyperlink to the online survey to sixty (60) individuals, purposefully targeting strategy-level leaders of the Australian Quarrying Industry who were associated with the peak professional body. Each individual was working in the Australian Quarrying Industry in a senior executive leader role and was a member of the peak professional body, the Institute of Quarrying Australia. Forty-one (41) individuals completed the online survey with no survey response received for the remaining nine (9) individuals.

Responses with more than 25% missing data were excluded (Sekaran 2002). It was assumed that in these cases, respondents had lost interest or were not serious in the first instance. It was also determined that with an average completion time of 23 minutes, the survey was not a great imposition from the point of view of the respondents' available time.

4.3.2.2 Data coding

Data was automatically coded upon submission online by the survey software, (*Questionpro)*. The survey consisted of pre-coded questions without any open-ended questions or answers. After collecting the answers, the raw data were edited. The editing worked as a quality screen to ensure that all information was precise and complete (Zikmund 2003).

The survey required respondents to identify their positions, their role in the organization's strategy and their perceived influence on the formulation of strategy. It further required respondents to indicate aspects related to strategy in their organization particularly in terms of participation. The questions related to participation not only served to triangulate the results related to the strategy making mode scale of the survey, but also illustrated a leaders' perception of their influence on strategy. As such, the editing of the response data not only ensured the quality and accuracy of the imputed data but also determined which cases qualified in terms of the population parameters.

4.3.2.3 Data screening

The method of cleaning and screening is to screen for the correct capturing of the raw data by identifying outliers, missing data and abnormal distribution (Creswell & Poth 2018). A benefit of online survey questionnaire administration is that mistakes in information input are mainly prevented (Creswell & Poth 2018). The responses of the respondents were allocated and registered automatically in the online survey software (*Questionpro*). The data was then downloaded from the online database into a Microsoft Excel file format. The Excel files containing all the primary data were then exported into an SPSS sav. file format for further processing.

Two categories of problems were considered: (a) case-related problems such as missing data; and (b) problems related to distribution such as outliers and normality. Data were checked for accuracy and to ensure that missing values were treated appropriately. In terms of problems related to distribution, descriptive statistics techniques and frequency distributions of each variable were used.

4.3.2.4 Missing data

The online survey included the feature of returning respondents to incorrectly or non-completed questions. SPSS data analysis software was used to check for missing

values. A missing values analysis was conducted revealing that 0% missing values were detected.

4.3.2.5 Outliers

SPSS data analysis software was used to identify any outliers in the data. Outliers are defined as observations that are distinctly different from other observations in the data set (Hair et al. 2010). The impact of outliers can be negative or have no effect and should be viewed within the context of the analysis. P-P plots were examined to detect outliers. The information they provide may be of benefit or are not representative of the population presenting the possibility of distorting the statistical analysis (Hair et al. 2010). No significant outliers were detected, and no cases were deleted.

4.3.2.6 Normality

Many inferential statistical techniques require an assumption of the normality of the data (Sulong et al. 2013). This was an important consideration as normality of the data is required especially for small sample sizes (Hair et al. 2010). Testing the data for normality was conducted and included consideration of P-P plots and statistical tests. Ory and Mokhtarian (2010) recommends examining and correcting for violations of univariate normality before screening for multivariate normality. The criteria for univariate normality utilized in this study were Skewness between -2.0 and 2.0 and Kurtosis between -7.0 and 7.0 (Ory & Mokhtarian 2010).

4.3.2.7 Summary: data preparation

The process of data cleaning ensured that the data were accurately represented in terms of the observations. It further applied the population parameters to ensure that the data retained was reflective of the population being studied. Data screening addressed aspects of missing data, outliers and non-normality to the data.

4.3.3 Strategy-level leadership demographics

The online survey data about the demographic characteristics of the respondents included information related to their gender, age, level of education, occupation and level of influence on the strategy in an organization. The strategy-level leadership demographics are given in Table 4.12.

Table 4.12: Strategy-level leadership demographics

Profile characteristics	**Frequency Total:**
Gender: Male Female	n=41 85.37% 14.63%
Age: 20-24 25-34 35-44 44-59 60+	n=41 2.44% 24.39% 19.51% 39.02% 14.63%
Position within organization: Quarry Owner CEO of Quarry Operation Senior Manager Quarry Manager Regulator Industry Supplier Other	n=41 2.44% 4.88% 36.59% 9.76% 4.88% 14.63% 26.83%
Level of education: Primary Secondary Vocational Education and Training Undergraduate Postgraduate	n=41 0% 4.88% 31.71% 48.78% 14.63%
Level of influence on the strategy: High level of influence Medium level of influence Low level of influence No level of influence	n=41 31.71% 46.34% 19.51% 2.44%
Level of influence on developing new ideas/solutions: Very high High Average A little None	n=41 26.83% 36.59% 31.71% 4.88% 0%
Innovation in my organization is mostly done by: Senior Managers Managers Consultants Everyone Nobody	n=41 26.83% 19.51% 4.88% 46.34% 2.44%
How innovative is your organization? The leading innovator in the industry	n=41 4.88% 19.51% 58.54%

Very innovative Innovative A little innovative Not innovative	12.2% 4.88%

Gender and Age. The sampling unit of analysis was the strategy-level of leaders in the Australian Quarrying Industry. In summary, the sample consisted of 41 qualifying respondents. There were 85.37% males and 14.63% females. The study did not purposefully target gender and was random. This may support the observation that there is gender inequality at the strategic level of organizations in the Australian Quarrying Industry. Many of the respondents (39.02%) were between the ages 44-59 years with those aged between 25-34 years were 24.39% and those aged between 35-44 years were 19.51%. The sample was therefore predominately (82.92%) in the middle to advanced stages of their careers.

Education. Respondents with undergraduate qualifications accounted for most of the sample (48.78%). The sample primarily consisted of persons with tertiary level degrees (63.41%) followed by 31.71% with a Vocational Education and Training qualification. With 4.88% of respondents having secondary school level education. The sample can be regarded as predominantly having a tertiary level education followed closely with a VET level education.

Organizational Strategy Formulation. The survey collected information related to the respondents' perception of who formulates strategy within their organization. Responses confirm that the strategy is predominately formulated by everyone in the organisation (46.34%) with 78.05% suggesting that they have medium to high level of influence on strategy and 63.59% having a high to very high influence on developing new ideas/solution. The survey suggests that 58.54% of organizations were innovative. Only 4.88% identified that their organization was a leading innovator in the industry.

4.3.3.1 Summary strategy level leader demographics

The profile and responses of the respondents provide meaningful insights as to the main actors involved in strategy as represented by this sample. These insights reflect the key demographics of the Australian Quarrying Industry as recorded in the Institute of Quarrying Australia's membership in 2017:

- 89% male.
- 47% aged between 44-59 years of age.
- 64% with a vocational education and training qualification.
- 71% in a quarry manager or senior manager role.

4.3.4 Industry drivers of the future

During the Delphi method, the panel of experts identified a selection of drivers that would impact on the future of the Australian Quarrying Industry. These drivers were listed in the online survey with participants asked to rate each driver ranging from having no influence through to having very strong influence of the Australian Quarrying Industry future.

Table 4.13: Industry Drivers of the Future

Driver	**% No influence**	**% Limited influence**	**% Some influence**	**% Strong influence**	**% Very strong influence**
Changes in government	7.32	7.32	34.15	36.59	14.63
Regulation	0	0	17.07	48.78	34.15
Economic growth	0	2.44	7.32	51.22	39.02
Environmental politics	0	7.32	14.63	51.22	26.83
Rehabilitation	0	17.07	31.71	39.02	12.2
Automation	0	9.76	31.71	46.34	12.2
Community perceptions	0	4.88	17.07	46.34	31.71
New products	0	7.32	56.1	31.71	4.88
Culture of the industry	0	2.44	36.59	39.02	21.95
Professional development and training	0	0	29.27	63.41	7.32
Compulsory professional certification of quarry managers	0	7.32	29.27	46.34	17.07
Leadership: foresight and strategic thinking	0	0	12.2	48.78	39.02
Corporate greed	0	14.63	36.59	26.83	21.95
New technologies	0	2.44	29.27	48.78	19.51

Availability of quarry products near market	0	4.88	19.51	51.22	24.39
Ethical practice	0	17.07	39.02	36.59	7.32
Unethical practice	0	21.95	39.02	26.83	12.2
Workforce health and safety	0	0	14.63	51.22	34.15
Infrastructure spend	0	4.88	17.07	31.71	46.34
Resistance to change	0	17.07	36.59	36.59	9.76

Key:

	65% + Strong to Very Strong Influence
	60-64% Strong to Very Strong Influence
	50-59% Strong to Very Strong Influence

4.3.4.1 Summary

The online survey results validate the data that were collected in the Delphi Method with *regulation, economic growth, environmental politics, community perceptions, professional development and training, new technologies, availability of quarry products near market, leadership (foresight and strategic thinking), workplace health & safety, and infrastructure* scoring 65+% + as drivers having a strong to very strong influence on the future of the Australian Quarrying Industry. The online survey's results also justify the SMART QUARRYING Research and Development Project to develop a capability framework to address the key drivers that will shape the future of the Australian Quarrying Industry.

4.3.5 Baseline leadership profiles

4.3.5.1 TimeStyle Inventory (TSI)

The dominant style of strategy-level leaders' foresight capability was measured by the TimeStyle Inventory (Fortunato & Furey 2009). The TimeStyle Inventory measures an individual's orientation to time. It is a twelve-item modified scale measuring three factorial structures – future, present, past – of the latent variable, an individual's orientation to time.

Table 4.14: TimeStyle Inventory (van der Laan 2010)

	Abilities	Characteristics
Past thinking	Retrieval of past experience and knowledge by reflection To reconstruct, analyse and critical evaluate information in order to reduce risks associated with current events	Dominantly risk reductive. Contemplative thinking. Accesses past experiences and knowledge.
Present thinking	Organised thinking based on current observations that integrate Past and Future perspectives in order to develop actions, allocate resources and efficiently apply them.	Dominantly orientated toward 'getting things done' Organised thinking. Mentally 'stepping out of time'.
Future thinking	Creative imagineering / Infinite future possibilities Foresees environmental changes. Generative process of creative problem solving and divergent thinking in order to detect gaps in knowledge, patterns and trends.	'Big picture thinking' Imaginative thinking. Ability to see gaps in knowledge, patterns and trends that diverge.

To unlock innovation and organizational creative thought processes the idealized profile for an individuals' orientation to time would include equal orientation to the past and present and a slightly increased orientation to the future. Table 4.14 describes the characteristics of the three styles.

4.3.5.2 Orientation to Time

Time orientation is theorized as an unconscious yet fundamental cognitive process that people use for organizing personal experiences relevant to certain temporal dimensions in order to assign coherent meaning to those experiences (Kluckhohn & Strodtbeck 1961). Although many models have advocated time orientation and human behaviours (Graham 1981; Hofstede 2011), this study focused on the model by (González & Zimbardo 1985) that advocates temporal focus given to the categories of future, present and past orientations. Under this model, time is viewed as a continuum ranging from a category of past to present and to future (Shipp et al. 2009).

The sample average illustrates a significant orientation to the present, followed by a high orientation to the future and a lower orientation to the past (Table 4.1).

Individuals were primarily focused to the present and extracted from the continuum of time which breaks links to the past and future.

Present-oriented individuals see the past as passed and the future as uncertain. In other words, what is done is done and tomorrow may never come so we had better be focused on today. They consequently prefer short-term benefits and immediate results (Shipp et al. 2009). They are more concerned about what is happening now, what needs to be done, and what resources do we currently have. As leaders, they often ensure that things are being done the right way. Part of the reason that present-oriented leaders can spend so much of their time on present-oriented activities is because they are spending little time thinking about events that occurred in the past or planning for the future (Thoms 2004). They are not looking to the future when choosing what to do.

A focus on the present suggests following implications for the future of the Australian Quarrying Industry:

- Present-oriented leaders in the Australian Quarrying Industry run the risk of spending little time thinking about the future and how drivers will impact on their roles and industry. The end result could see these leaders not being prepared for the impact of the industry drivers e.g. the impact that automation of machinery and vehicles will have on operations and talent management.
- Improvements that they make will have short-term rather than long-term implications. They may continue to fix a broken piece of quarry machinery quickly to keep production moving but fail to invest in new equipment that would have a long-term positive impact financially and the amount of down time for that piece of equipment.

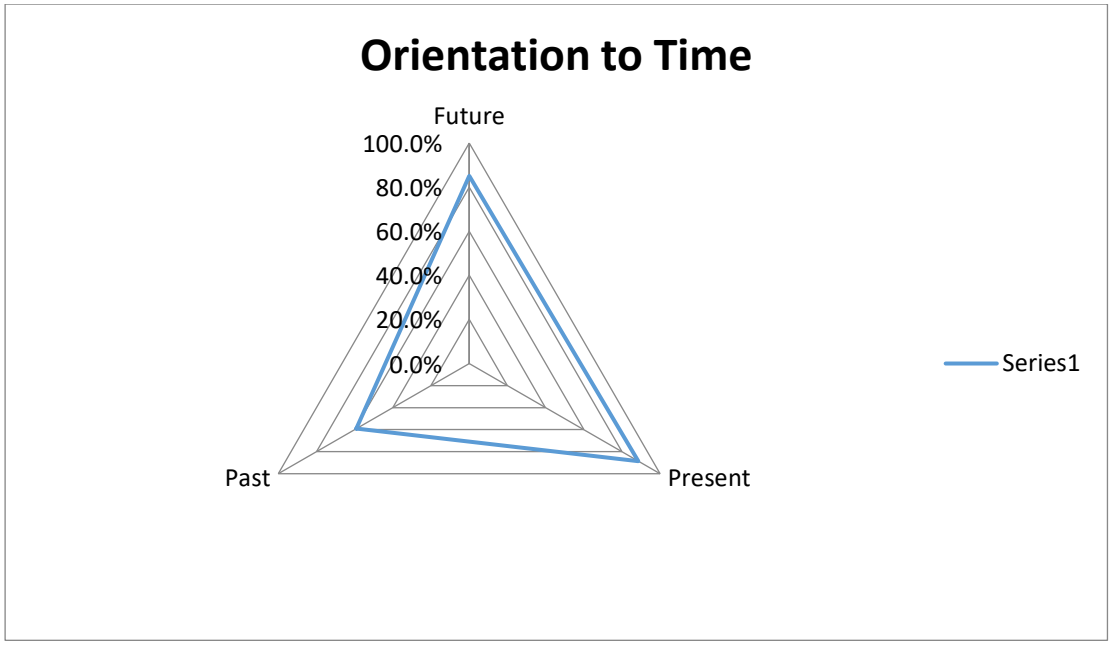

Figure 4.1: Orientation to Time of strategy-level quarrying industry leaders

4.3.5.3 Foresight Styles Assessment (FSA)

A strategy level leader's dominant and back-up styles of engaging with matters related to anticipating the future can be measured by the Foresight Styles Assessment (Gary 2008, Dian 2009; van der Laan 2010). To unlock innovation and organizational creative thought processes the idealized profile for individuals' foresight orientation is that they display strong tendencies toward the Tester and Framer dimensions.

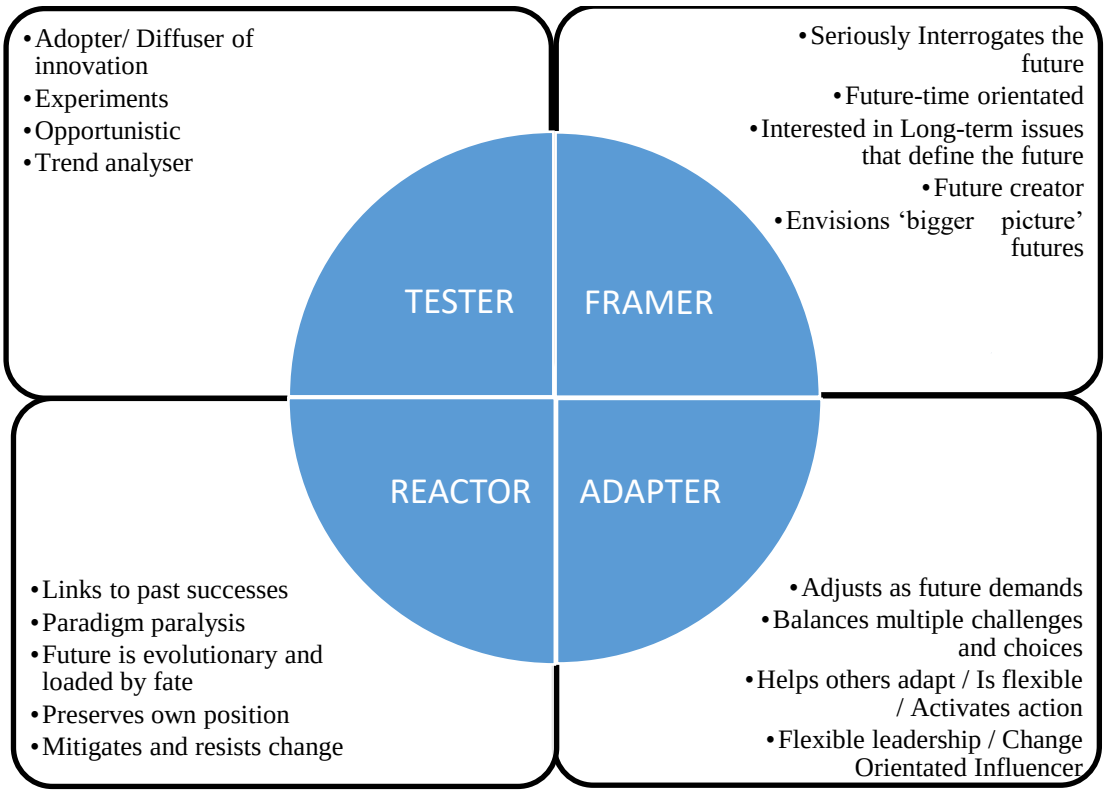

Figure 4.2: Foresight Styles and Characteristics (van der Laan 2010)

Online survey foresight style findings are captured in Figure 4.3. The dominant style of the sample was that of Adapter. An Adapter is someone who adjusts to new situations when they see that the future demands it (Yukl & Lepsinger 2004). Once they realize this, they help others adapt to change in the present moment (Simpson & French 2006). This finding complements the Orientation to Time orientation on the present with leaders not looking to the future when choosing what to do. The sample also showed a strong back-up style of Framer (Figure 4.3). A Framer is someone who asks the larger questions about the future. It derives from Dian's (2003) concept of Futurist but appears more specifically operationalized. Conceptually, it draws upon future time orientation (Kluckhohn & Strodtbeck 1961).

Having a dominant adaptor foresight style suggests the following implications for the future of the Australian Quarrying Industry:

- If a quarrying strategy-level leader focuses on strategies that are more immediately relevant, tested and useful, it may lead to improvements in the current ideas, methods, practices, policy, and structure. This focus may not be

useful when addressing industry drivers such a new technology, new legislation, ongoing community perceptions, and changes in the economic cycle with all requiring a new approach to current strategies e.g. accepting one opinion from one source on legislative changes may not be useful long-term as the opinion may not be true and accurate.

- Dominant adapter foresight style quarrying strategy-level leaders may want an early resolution of the problem, limited disruption and immediate increased efficiency but this is not always possible given the impact that some industry drivers will have on the Australian Quarrying Industry's futures e.g. leaving it to the very last minute to apply for a new stage in operations to meet increased demand will be met with failure as such approvals can take months if not years.
- A quarrying strategy-level leader with a dominant adaptor foresight style are more likely to try to improve a failing system when what is needed is something new e.g. industry drivers will demand a more innovative approach when considering improvements to site operations such as meeting the ever-changing health and safety regulations.

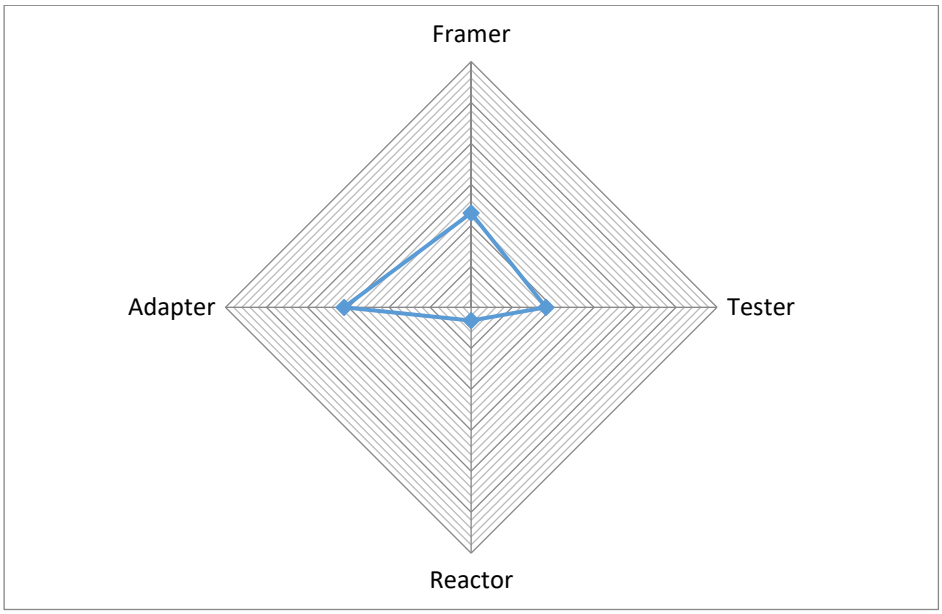

Figure 4.3: Foresight styles of strategy-level quarrying industry leaders

4.3.5.4 Strategic thinking in decision making

Effective strategic thinking is typified by a balance of conceptual and analytical cognitions when tasked with thinking about an industry's future. The idealized strategic thinking profile would illustrate a balance between the conceptual and analytical dimensions with a tendency to favour participation. Participation is recognized as essential in enabling the generative processes and emergence of new ideas associated with innovative and strategically astute industries.

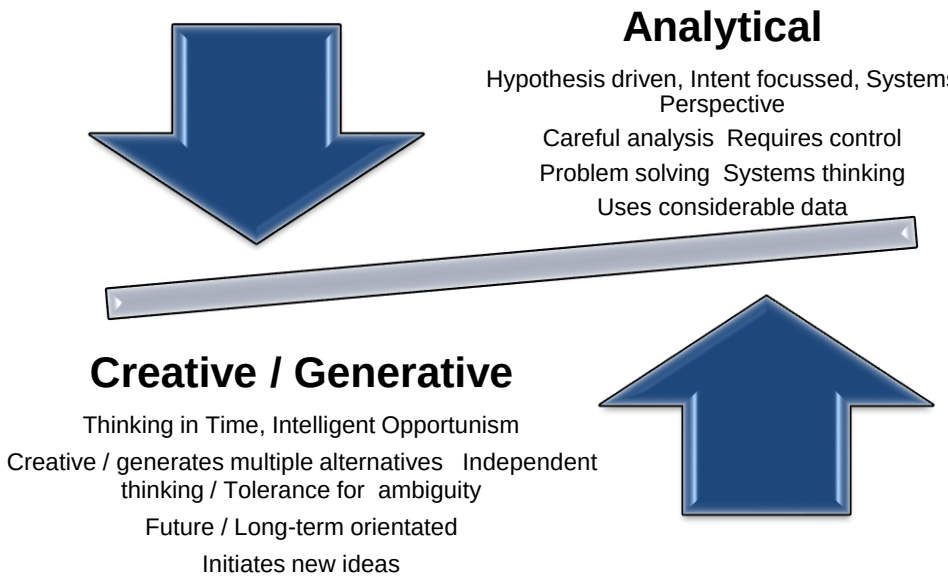

Figure 4.4: Strategic Thinking Dimensions and Characteristics (van der Laan 2010)

The findings in Figure 4.5 suggest that quarrying strategy-level leaders are focused on behavioural approaches to their thinking, slightly more than adopting a directive approach. If this approach does not work, they revert to a directive approach. They recognize the importance of teams given the operational size of many quarries but will be directive as a back-up. The sample also suggests that there is a strong tendency to favour an analytical thinking approach associated with strategy.

Having a blend of behavioural, directive and analytical decision-making styles suggests the following implications for the future of the Australian Quarrying Industry:

- Having the ability to make others feel included and important, getting buy-in from others and communicating their decisions will be a strength for strategy-level leaders when exploring the potential impact of industry drivers e.g. managing changes to legislation that will impact on areas of site operation.

- Behavioural style decision-makers may lose themselves in the advice and opinions of others. Conflict may also prove to be detrimental to the decision-making process as strategy-level leaders may choose to avoid conflict and make a unilateral decision e.g. the interpretation of legislation changes can be confusing when decision-makers are taking advice from others not directly associated with the legislation.
- Reverting to a directive approach would indicate lower engagement and a more managerial industry. When considering the impact of the industry drivers, strategy-level leaders may need more than a rational and autocratic style as decision-making is focused on the short-term e.g. managing community expectations will require more than an autocratic style as no outside information and/or opinions have been considered before decisions are made.
- A strategy-level leader adopting an analytical approach to decision making may explore creative solutions and willing to give more prospects an opportunity before making the final decision. This approach will be very useful when considering the impact industry drivers may have on the future of the Australian Quarrying Industry. A concern would be making timely decisions and communicating with others during the decision-making process e.g. during periods of economic downturn and making decisions regarding staff retention and redundancy and the impact these decisions would have on the site's culture and employee morale.

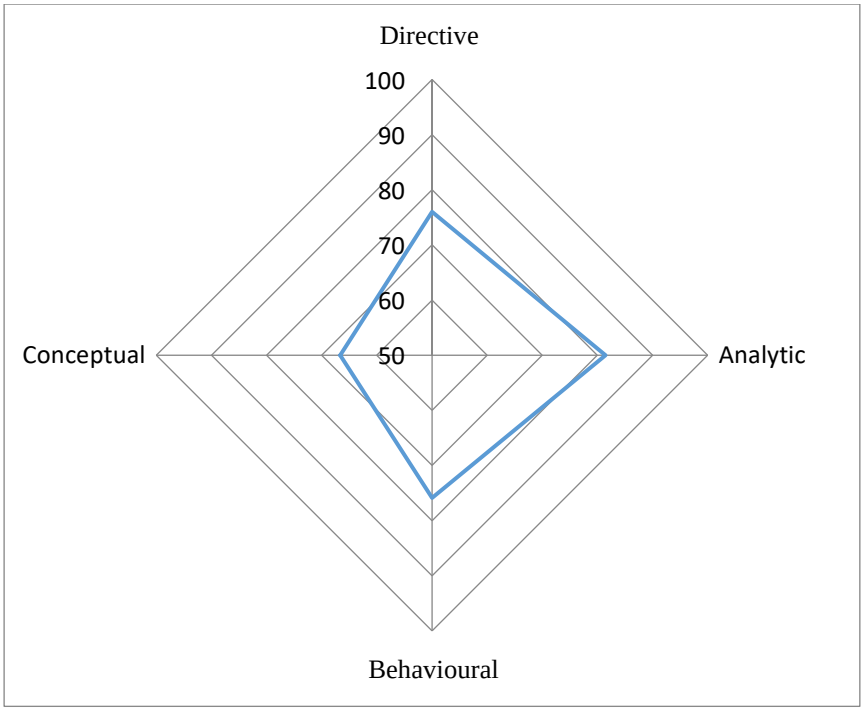

Figure 4.5 Decision Style Inventory of strategy-level quarrying industry leaders

4.3.6 Summary: Baseline leadership profiles

In summary, the baseline leadership of strategy-level leaders in the Australian Quarrying Industry as suggested by the online survey are profiled as:

- Present-orientated with a focus on ‘getting things done’.
- Adapters who adjust as the future demands.
- Analytical but with a behavioural approach to their thinking and reverting to a directive approach when a behavioural approach does not work.

4.3.7 Correlations

4.3.7.1 Introduction

A correlation analysis was conducted of the sample (n=41) using SPSS statistical data analysis software. The analysis used Pearson’s correlation and flagged statistically significant correlations at the 0.95 (*) and 0.99 (**) levels. Correlations are used to illustrate whether and how strongly pairs of variables are related. The Pearson correlation coefficient is a measure of the strength of a linear association between two variables. The correlation analysis was used to develop the scenarios (Chapter 7).

4.3.7.2 Results and discussion

Result 1: Level of influence leadership has on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence leadership has on the future of the Australian Quarrying Industry and the influence of resistance to change, industry foresight and industry strategic thinking have on the future of the Australian Quarrying Industry (Table 4.15).

Table 4.15: Result 1 Correlations – Leadership Influence

	What level of influence does leadership have on the future of the Australian Quarrying Industry?
What influence does resistance to change have on the future of the Australian Quarrying Industry?	.447**
What influence does industry foresight have on the future of the Australian Quarrying Industry?	.381*
What influence does industry strategic thinking have on the future of the Australian Quarrying Industry?	.422**

Discussion 1

There was a statistically significant positive correlation between leadership and resistance to change. Leadership is statistically positively correlated with industry foresight and industry strategic thinking. Leadership is indicated to be a key driver to prepare the Australian Quarrying Industry for the future. Strategic thinking and foresight capabilities are going to be guiding attributes for effective strategy-level leadership. Strategy level leaders will need to mitigate resistance to change for the industry to survive and prosper as it moves into the future e.g. quoting that an individual has 25 years' experience in the industry will only be useful to an extent when considering industry developments if this individual is not open to new ideas.

Result 2: Level of influence culture of the industry will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the

relationship between what level of influence the culture of the industry has on the future of the Australian Quarrying Industry and the influence of resistance to change, industry foresight and industry strategic thinking have on the future of the Australian Quarrying Industry (Table 4.16).

Table 4.16: Result 2 Correlations – Industry Culture Influence

	What level of influence will the culture of the industry have on the future of the Australian Quarrying Industry?
What influence does resistance to change have on the future of the Australian Quarrying Industry?	.384*
What influence does industry foresight have on the future of the Australian Quarrying Industry?	.421**
What influence does industry strategic thinking have on the future of the Australian Quarrying Industry?	.362*

Discussion 2

The culture of the industry is statistically positively correlated to resistance to change, industry foresight and to industry strategic thinking. Resistance to change has a statistically significant impact on the culture of the Australian Quarrying Industry. The culture of the industry will need to positively change its culture in order to manage future challenges. Foresight and strategic thinking capabilities will support strategy-level leaders to assist with the change management processes and any resistance experienced. In the researcher's experience, the Australian Quarrying Industry has a reputation of resisting change with change only eventuating when it is mandated by legislation.

Result 3: Level of influence education will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of education the respondents have and its influence on ethical and unethical practice (Table 4.17).

Table 4.17 Result 3 Correlations – Level of Education Influence

	What is your level of education?
What influence does ethical practice have on the future of the Australian Quarrying Industry?	-.349*
What influence does unethical practice have on the future of the Australian Quarrying Industry?	-.398*

Discussion 3

Ethics is statistically negatively correlated to the level of education. This negative correlation supports the argument that an increased level of education will decrease the level of unethical behaviour. In the researcher's experience, strategy-level leaders in the Australian Quarrying Industry must receive professional development and ongoing training in ethics to ensure future actions are not deemed to be unethical and so doing undermine the future of the industry.

Result 4: Level of influence resistance to change will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence will resistance to change on the future of the Australian Quarrying Industry and the influence of automation have on the future of the Australian Quarrying Industry (Table 4.18).

Table 4.18 Result 4 Correlations – Level of Resistance to Change Influence

	What level of influence will resistance to change have on the future of the Australian Quarrying Industry?
What influence will automation have on the future of the Australian Quarrying Industry?	.412**

Discussion 4

There is a statistically positive correlation between resistance to change and automation. This correlation suggests that with the introduction of automation into the industry there is a corresponding increase resistance to change. This is problematic for the Australian Quarrying Industry as automation within the industry will continue to grow and industry will need to accept and adopt automation as standard practice. Strategy-level leaders will need to ensure they manage change as they continue to introduce automation into the industry e.g. in the researcher's experience, many operational employees are resisting the introduction of automation as they fear for job

security. Employers will need to sensitively manage the introduction of automation by ensuring opportunities are provided to reskill and retrain employees to manage and operate automated practices.

Result 5: Level of influence of unethical practice will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence will unethical practice have on the future of the Australian Quarrying Industry and the influence availability of quarry products have on the future of the Australian Quarrying Industry (Table 4.19).

Table 4.19: Result 5 Correlations – Levels of Unethical Practice Influence

	What level of influence will unethical practice have on the future of the Australian Quarrying Industry?
What influence will availability of quarry products have on the future of the Australian Quarrying Industry?	.344*

Discussion 5

There is a statistically positive correlation between unethical practice and availability of quarry products. Strategy level leaders will need to manage the issues related to the availability of quarry products to service current and future projects and not resort to unethical practices. In the researchers' experience, there will be competition between quarrying organisation to secure quarry products in some areas of Australia e.g. Sydney no longer has quarry products close to market given the increase in urban sprawl. In some cases, strategy-level leaders have resorted to unethical practices to secure quarry products to meet the market demand.

Result 6: Level of influence resistance to change will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence resistance to change will have on the future of the Australian Quarrying Industry and the influence leadership will have on the future of the Australian Quarrying Industry (Table 4.20).

Table 4.20: Result 6 Correlations – Levels of Resistance to Change Influence

	What level of influence will resistance to change have on the future of the Australian Quarrying Industry?
What influence will leadership have on the future of the Australian Quarrying Industry?	.447**

Discussion 6

There is a statistically positive correlation between resistance to change and leadership. Strategy level leaders will need to ensure that leadership styles mitigate team member resistance to change. In the researcher's experience, strategy-level leaders will need to choose a behavioural style to introduce and manage change. Failure to do so will impact negatively on the sites culture and employee morale making change difficult and slow.

Result 7: Level of influence workplace health and safety and infrastructure spend will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence availability of quarry products will have on the future of the Australian Quarrying Industry and the influence workplace health and safety and infrastructure spend will have on the future of the Australian Quarrying Industry (Table 4.21).

Table 4.21: Result 7 Correlations – Levels of Workplace Health & Safety and Infrastructure Spend Influence

	What level of influence will workplace health and safety have on the future of the Australian Quarrying Industry?	What level of influence will infrastructure spend have on the future of the Australian Quarrying Industry?
What influence will availability of quarry products have on the future of the Australian Quarrying Industry?	.338*	.324*

Discussion 7

There is a statistically positive correlation between the influence of the availability of quarry products on the future and the influence of workplace health and safety as well as infrastructure spend. Strategy level leaders will need to ensure health and safety practices are managed on a daily basis, rather than just when an incident occurs, given

the pressures of ensuring the availability of quarry products close to current and future projects and the variations to infrastructure spend. Strategy-level leaders will also need to be mindful that health and safety standards and procedures do not diminish given the pressures placed on the business to have availability to quarry products to meet infrastructure demands e.g. there could be potential for strategy-level leaders to take their focus off workplace health and safety in favour of committing time and effort to meet the demands of an increased infrastructure spend resulting in an increase in workplace accidents.

Result 8: Level of influence of corporate greed, environmental politics and rehabilitation will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence corporate greed will have on the future of the Australian Quarrying Industry and the influence of environmental politics and rehabilitation will have on the future of the Australian Quarrying Industry (Table 4.22).

Table 4.22: Result 8 Correlations - Levels of Corporate Greed, Environmental Politics and Rehabilitation Influence

	What level of influence will environmental politics have on the future of the Australian Quarrying Industry?	What level of influence will rehabilitation have on the future of the Australian Quarrying Industry?
What influence will corporate greed have on the future of the Australian Quarrying Industry?	.398*	.333*

Discussion 8

There is a statistically positive correlation between corporate greed and environmental politics as well as rehabilitation. As the pressures associated with environmental politics and rehabilitation requirements build, strategy level leaders will need to ensure that corporate greed does not become an issue. Corporate greed can become an issue when a quarrying business does not follow effective governance during times when the business is under pressure. In the researcher's experience, there is a concern

that the larger quarrying businesses will ‘take over’ over the smaller quarrying businesses as the smaller operations may not have sufficient resources to meet legislative changes that have occurred in response to environmental politics.

Result 9: Level of influence of community perceptions will have on the future of the Australian Quarrying Industry

A Pearson product moment correlation coefficient was computed to assess the relationship between what level of influence community perceptions will have on professional development. A correlation coefficient was also computed to assess the relationship between community perceptions and leadership.

Table 4.23: Result 9 Correlations – Levels of Community Perceptions

	What level of influence will community perceptions have on the future of the Australian Quarrying Industry?
What influence will professional development have on the future of the Australian Quarrying Industry?	.390*
What influence will leadership have on the future of the Australian Quarrying Industry?	.511**

Discussion 9

There is a statistically positive correlation between community perceptions and professional development and a moderate positive correlation between community perceptions and leadership. Strategy-level leaders need to ensure that they continue undertake continuing professional development to keep abreast of the latest innovative practices in managing community perceptions. Failure to do so has the potential of witnessing communities having a dominance over quarrying practice which could lead to declines in profitability and productivity. Leadership that continues to learn, develop and innovate will have a strong influence on the future of the Australian Quarrying Industry.

4.3.7.3 Summary: correlations

There are strong correlations between:

- Leadership, culture and resistance to change.
- Industry foresight and the future of the Australian Quarrying Industry.
- Industry strategic thinking and the future of the Australian Quarrying Industry.

- Ethics and the level of education.
- Introduction of automation and resistance to change.
- Availability of quarry products and unethical practice, workplace health & safety and infrastructure spend.
- Leadership and resistance to change.

4.4 Conclusion

Chapter four outlined the research design, strategy and methods chosen by this study to collect data to answer the research questions. This chapter also analysed the data received from the Delphi rounds and the Online Strategy-Level Leadership Survey. The next chapter explores the key drivers that will have an impact on the Australian Quarrying Futures using the PESTEEL analytical tool for environmental scanning.

Chapter 5 **PESTEEL**

5.1 Introduction

Chapter 4 provided an analysis of the data derived from the Delphi Method and the Online Strategy-Level Leader Survey. This chapter will explore the key drivers of the future of the Australian Quarrying Industry. This chapter further presents an environmental scan across the political, economic, social, technological, natural environment, ethical and legislative (PESTEEL) dimensions of the Australian Quarrying Industry's operating environment. his chapter provides a PESTEEL analysis to inform the development of scenarios of the Australian Quarrying Industry and its possible futures.

5.2 PESTEEL

PESTLE is an analysis tool for environmental scanning (Shtal et al 2018). While the PESTLE has been widely used, it fails to capture the increasingly critical dimension of ethics. Since the global financial crisis in 2008, the question of ethics in decision making has become an important environmental scanning consideration (Cowton et al. 2019). For this study, a PESTEEL (Political, Economic, Social, Technological, Environmental, Ethical and Legal) analysis was conducted in order to inform the development of scenarios of the Australian Quarrying Industry and its possible futures.

5.2.1 Political dimension

The following political dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to shaping the future of the Australian Quarrying Industry:

- Political perceptions.
- Changes in government.
- Community perceptions.

Each key driver is discussed below.

Political Perceptions: The experts anticipated that all levels of government in Australia will have an increasing impact on the Australian Quarrying Industry. This

anticipated impact is of critical importance as it can influence infrastructure spend, new developments and changes to legislation (Banks 2011). Changes in government, regulation and community perceptions, all products of political systems and discourse, are the main drivers of change in the political environment (Wang et al. 2019). As an example, the controversial Adani Australia's Carmichael coal mine project in Queensland continued to be a significant fault line in the 2019 Australian Federal Government election campaign. The Australian Labor Party's unexpected loss in the 2019 federal election has been attributed to its anti-mining policies evident in regional Australians' eroding support for the party (Zhou 2019). The party admitted the unexpected loss is very much aligned to its stance on Adani Australia's Carmichael coal mine in Queensland and the coal industry in general (Zhou 2019). The National Liberal Party Coalition was successful throughout the campaign in using the future of the coal industry as a campaign rallying point fully supported by local media in central Queensland amplifying the government's message (Murphy 2019). The National Liberal Party Coalition leader, Scott Morrison, lobbied to approve an environmental approval for the Adani project throughout his campaign which won him support in Queensland and provided the commonwealth seat majority to form government in Australia (Murphy 2019). This illustrates how political perceptions, especially as they relate to the attitudes of the electorates can influence an industry's future.

The convergence between the nature of the quarrying business, the environment, public sentiment and a generally greater emphasis on corporate social responsibility has changed the nature of political perceptions of the industry. These perceptions are increasingly unpredictable and less supportive thus placing the industry leaders under pressure to adopt more expensive and onerous development and more costly business plans. Strategy-level leaders are engaging external consultants to meet the increasing demand to improve the political perceptions of the industry as quarry managers do not have the knowledge, skills and experience to manage this task to a satisfactory level.

Changes in Government: Political parties are prone to being subject to public sentiment (Dür 2019). Where they are perceived to be supportive of quarrying activity it is increasingly likely that it will have a negative effect on voting numbers. An example of this scenario is the Queensland government's ongoing management of the Acland Mine Stage Three application in 2018-19 (Gleeson 2018). The Queensland

Labor Government refused to sign off on the Acland Mine Stage Three application citing lack of appropriate environmental management reports. It is anticipated that public sentiment will continue to influence the Queensland government of the day through to the October 2020 Queensland election.

Changes of government in Australia are occurring well before the three-year term (Dewhurst et al. 2018). With every change of government, there are outcomes which are having a profound impact on the Australian Quarrying Industry. These outcomes are occurring without first properly consulting with the industry or allowing sufficient time for businesses within the industry to adapt to the new expectations. The Australian Quarrying Industry is being affected by these changes and this uncertainty is having a destabilizing effect on productivity levels within the industry given the ongoing change in government policies and regulations.

Community Perceptions: Pressure from community groups is also mounting and will continue to increase into the future (Iskandar et al. 2019). Community perceptions are an integral part of informing political behaviour and policies. Engagement with communities is critical, with 80 percent of Australians indicating it is important that government considers the views of the community when planning or investing using taxpayer dollars (JWS Research 2018). Community expectations can no longer be met with lump sum cash payments that quarries used to connect with local communities, a community event or donations to community causes. Each year, communities are seeking more meaningful and measurable outcomes and are influencing consent decisions to start up or expand a quarrying operation. This is taking a financial toll on the quarrying industry as sites cannot start up or expand to meet customer demands without incurring additional costs which impacts on profitability and productivity levels.

Increasingly, activist groups work to sway public opinion through online communications such as social media and campaigns go viral. As activist groups become more vocal and more organized, they can exert greater pressure on both governments and communities considering quarrying project approvals and consequently impacting on the future of the Australian Quarrying Industry. An example of where public opinion is exerting greater pressures on both government

and communities are the Extinction Rebellion protests across the globe (Gunningham 2019).

Although some quarrying organisations rely on social media to engage with political stakeholders, they are not on the forefront of emerging trends. This places these quarrying organisations at a disadvantage to political stakeholders capable of mobilizing full-scale media campaigns to support their expectations and demands. The Australian Quarrying Industry is increasingly required to become more active and spend more to deliver its own messaging to engage directly and share targeted information with various political stakeholders (Harjunpää 2019). This has left the industry increasingly vulnerable to the perceptions of the electorate and therefore political response.

The political stakeholder landscape will become increasingly complex and the Australian Quarrying Industry will need to proactively engage political stakeholders to navigate the increasingly volatile political environment (Goodz 2016). Quarries that consistently engage with the political stakeholders can realize tangible advantages related to their expectations. The Australian Quarrying Industry must demonstrate a high level of commitment to responsible corporate behaviour by engaging their leaders to play key roles in political stakeholder engagement and solution identification as evidenced with other industries (Ballet et al. 2019).

Quarries interested in reclaiming their license to operate are coming to realize that a new form of political stakeholder engagement is needed; one that balances the demands of multiple groups (Quicke & McKenzie 2019). Rather than simply reporting the amount of money spent on meeting legislative requirements and community initiatives, quarries may increasingly need to consider tracking and reporting on the impact they are having on each stakeholder group. Quarries should be showing how their activities and investments contribute to GDP, economic transformation and job creation. If the Australian Quarrying Industry can start aligning their operations with the underlying and long-term needs of the political stakeholders and further explore the concept of shared value, they could earn not only their license to operate, but the license to grow.

Possible impact of drivers: The political dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Political perceptions.
- Changes in Government.
- Community Perceptions.

Responding proactively may result in the following outcomes toward 2029:

- Quarries do not fear a change of government as governments, communities and quarries are collaborating on regulations related to health and safety and land management.
- Automated government monitoring is providing information transparency to all stakeholders.
- Quarries are viewed by all stakeholders as ‘welcome guests’ due to a reputation of responsible usage and rehabilitation.
- Governments are actively investing in promoting equitable and climate resilient practices.
- Evidence of a highly compliant quarrying industry.

Failure to respond proactively may result in the following outcomes toward 2029:

- Unresponsive quarries are being taken over by those quarries who demonstrate proactive engagement; therefore, limiting market competitiveness.
- With limited competition in the quarrying market the price for quarry products is increasing which is having a large impact on the affordability of infrastructure projects.
- Quarries are viewed as ‘bad tenants’.
- Any proposed or actual change in government is providing uncertainty for ongoing and future quarry operations.
- An increased influence of community groups on local quarry operations is impacting on ongoing and future quarry operations.

5.2.2 Economic dimension

The following economic dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to economic factors influencing the future of the Australian Quarrying Industry:

- Economic growth.

- Availability of quarry products near market.
- Infrastructure spend.

Each key driver is discussed below.

Economic Growth: Australia seems to be in a "two-speed economy" again as it was a decade ago (Kramer 2016). The "two-speed economy" is creating unevenly distributed rates of growth in the quarrying industry across the Australian states and territories. The forecast is that Australia will climb two places on its world economic league table by 2026 from its 2017 ranking of 13 (Cebr 2017), and if Australia's population continues to grow, Australia's economy will rise from being the 13th largest in 2017 to 11th largest in 2026 (Cebr 2017).

In 2017-18 economic activity in Sydney and Melbourne together accounted for 52.8 percent of national growth (SGS Economics and Planning 2018). The quarrying industry in New South Wales and Victoria will remain very strong economically given the possibility of sustaining this high level of growth. As an example, the New South Wales and Victorian governments have committed a pipeline of transport infrastructure investment totalling over $78 billion in Sydney and Melbourne (Deloitte Access Economics 2019). Infrastructure investment of this size will increase activity in the quarrying industry in these states.

Western Australia has been at the bottom of the economic cycle but it is likely to improve given the recent Federal Government's decision to award Western Australia more GST-based revenues (Verender 2018). There are parts of the Western Australia's Metronet system and more road projects being approved due to an increase in commonwealth funding from GST-based revenues. The Western Australian quarrying industry is likely to start to improve given the level of infrastructure spend approved by its state government.

Queensland experienced the mining bust and hit the bottom of the economic cycle in 2011 (Gregory & Sheehan 2011). The quarrying industry in Queensland mirrored this experience of the mining industry during this time. It is only during the past two years that the quarrying industry in Queensland has been buoyed by the increase in non-residential building and engineering construction. Road development has been the dominant activity but with work starting on the cross-river rail and the Inland Rail

Project from 2020, the quarrying industry will experience a boom given the need for quarrying product to meet the expected demand of these projects (Ho 2019).

Population growth is a key indicator for a state government to increase or decrease infrastructure spending (Infrastructure Australia 2019). The level of infrastructure activity has a direct impact on the quarrying industry given the demand or lack of demand for quarry products. In the smaller states like South Australia and Tasmania, it is predicted there will be weaker levels of activity in the quarrying industry because the population growth in each of these states is slowing (Australian Bureau of Statistics 2018).

*Availability of Quarry Products Near Market***:** Humanity is becoming more urban, with most population growth projected to take place in cities and larger towns (United Nations 2018). Seventy-seven percent of population growth over the coming 30 years is projected to occur in Melbourne, Sydney and Brisbane (Australian Bureau of Statistics 2018). Infrastructure demand in these areas is anticipated to rise in the next decade dramatically requiring an increasing demand for quarry products.

A key challenge for the Australian Quarrying Industry is the availability of quarry products near the market. Costs are kept to a minimum where the quarry products are supplied close to the market. The further a quarry product needs to be transported, the greater the cost to the market. While the industry generally feels confident about being able to meet demand, it recognizes that if they try to do things too quickly, they will increase costs because they have to transport materials from further away and work out how to deliver them. Having a good plan and pipeline and industry certainty is important but the industry also needs to have supply in the right places. Construction work is expected to increase over the next ten years particularly in road, rail and non-residential building (Infrastructure Australia 2019). A lot of these construction sectors tend to be materials-heavy when it comes to quarry products, so the demand for these construction materials will not abate anytime soon.

To ensure the availability of quarry products are near the market demand, the Australian Quarrying Industry must engage appropriate strategies for the best access of these materials without increasing the cost of projects and ensuring a sustainable industry into the future. Higher capacity rail and road transport technology may offset

costs of delivery and allow the industry some increased distance from the quarrying source.

Another source of quarry product to meet the market demand is recycled material. Produced at quarry sites from wastes brought in from outside construction sites make it possible to optimise the availability of quarry products if a natural deposit is unavailable close to market demand. It is anticipated that recycled material will be a key feature of meeting market demand into the future.

Infrastructure Spend: Australian infrastructure spending has been through a period of transition with infrastructure investments and regulatory reforms and it will face significant challenges in the future (Infrastructure Australia 2019). The role that governments play in the long-term responses to these challenges will have a clear impact on national prosperity (Infrastructure Australia 2019). Australia's states and territories are projected to experience funding difficulties and will decrease budgets, making public funding of large infrastructure projects more difficult to access (Infrastructure Australia 2019).

The Australian Quarrying Industry realises that there is a need for steady investment over time that properly deals with our population and economic growth; not big waves of infrastructure build and catch-up spending (Infrastructure Australia 2019). Unfortunately, Australia's history on this point is not a good one because we have severely underestimated our population growth and have not put the appropriate funding mechanisms in place to build infrastructure at the right times. It means that Australia goes through periods of catch-up. Right now, Australia is trying to catch up on infrastructure spend to make up for decades of under-investment e.g. road networks in Sydney, Melbourne and Brisbane (Henderson 2019). If this issue is not addressed in the immediate future it is anticipated that the road network in the major Australian capital cities will not be able to service their growing populations (Infrastructure Australia 2019).

These periods of catch-up can be quite intensive and uncoordinated (Infrastructure Australia 2019). Australia is not getting the best quality outcomes because the quarrying industry is being stretched so hard all at once. This often drives prices up as a way of responding to supply and demand. In terms of overall coordination, governments must think inter-jurisdictionally. They must recognise they are

competing for the same resources when it comes to big, iconic infrastructure projects. Governments can do a lot more to co-ordinate their investment by just being aware of what is going on in the market.

Australia needs to concentrate on the construction pipeline needing a better funding system that promotes steady investment over time (Infrastructure Australia 2019). Australia needs to think about how it can sequence projects effectively so that it does not overstretch the construction industry and its supply chain; particularly, the quarrying industry. Many governments do not have a good knowledge of the supply/demand balance for construction materials within their jurisdiction (National Housing Supply Council 2009). If the lack of good knowledge continues during the next decade, governments may not know or have all the information they need to prepare appropriate plans for the timely development of new quarries to support long-term infrastructure projects. This is likely to impact on the roll out of infrastructure projects to meet the demand of a growing population.

Possible impacts of drivers: The economic dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Economic growth.
- Availability of quarry products near market.
- Infrastructure spend.

Responding proactively may result in the following outcomes:

- Quarry planning is aligned to commercial objectives with sustainable goals managing the economic cycle.
- Quarries are being opened in remote areas given cost savings associated with automation and new transport solutions allowing quarry products to be available to market demand.
- Increased confidence in the industry is permitting increased investment by government and private sectors in infrastructure spend.

Failure to respond proactively may result in the following outcomes:

- Quarries not ready to manage the growth period in the economic cycle is resulting in many quarrying operations unable to meet the demands of

economic growth negatively impacting on current and future infrastructure projects.

- Quarries not prepared to manage the decline period in the economic cycle are declaring bankruptcy which is negatively impacting on unemployment figures and the local economies.
- Not able to service the market with proximity to quarry products is increasing the time to complete infrastructure projects as well as their project budgets.
- Quarries not using recycled materials are not being deemed competitive and/or viable in the open market.
- The price of quarry products is increasing due to increased transport costs to get the product to market.
- Infrastructure spend is dictating the viability of quarrying businesses. During periods of low infrastructure spend, quarries are needing to look for other business opportunities to keep their doors open increasing competitiveness between quarrying businesses. This competitiveness is leading to unethical behaviour.
- During periods of high infrastructure spend, quarries are preparing to ensure they have ample quarry product supplies to meet market demand. This competitiveness is leading to unethical behaviour.

5.2.3 Social dimension

The following social dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL:

- Workforce health and safety.
- Resistance to change.

Each key driver is discussed below.

Workforce Health and Safety: The health and safety imperative on work sites is never far from the minds of strategy-level leaders in the Australian Quarrying Industry. The risks associated with quarrying remain real with fatalities, accidents and work-related health issues increasing across the industry (Safe Work Australia 2019). Considering these realities, the Australian Quarry Industry continues to refine their health and safety programs. In recent years, this has seen them turn to data analytics to pinpoint industry risks, organisational behaviours and internal cultures most likely to result in

severe health and safety events. As technology becomes more intuitive and less costly, it is enabling some quarries to implement health and safety programs focused on zero fatalities rather than zero harm (Mabika 2018).

Strategy-level leaders realise that health and safety is not only a function of process-driven policies (Health and Safety Authority 2019). It also requires the promotion of a culture of safety. Embedded in that notion is the idea that employees must be both physically and mentally healthy for a safe and productive environment to flourish. Failure to do so may result in an industry reputation of poor workplace health and safety practices which will impact on attracting and retaining industry talent. Poor workplace health and safety practices may also see a more vested interest by government regulators.

Two current health and safety issues impacting on the Australian Quarrying Industry are declining mental health and increasing silicosis related illnesses (UNPG 2016; Aberkane 2017). Declining mental health and the increasing threat of silicosis related illness are becoming more prevalent in the Australian Quarrying Industry and poses an emerging challenge to the industry, possibly to a greater extent than the more 'mechanical' nature of workplace health and safety issues in the past.

Ongoing challenges to corporate profitability, government regulations, community expectations and employee layoffs are heightening employee despondency. It is estimated that workplace stress affects around 32 percent of all Australians thus being a significant factor in workplace reform (Hayes 2019). Most quarries are taking steps to assess the mental health of their workers and provide counselling services to assist those in distress. With concerns around mental health rising (Hayes 2019), new strategies will need to be deployed, including enhanced professional development and training, revised work schedules and the fostering of a work culture focused on preventing the onset of mental health issues. By using analytics, it is anticipated there will be a strengthening of these efforts as well by helping companies uncover the risk factors that contribute to mental health problems.

Another health risk from working in the quarry industry is that of exposure to fine dust containing crystalline silica (quartz). Workers exposed to fine dust containing quartz are at risk of developing a chronic and possibly severely disabling lung disease known as 'silicosis' (Health and Safety Executive 2015). It usually takes several years

of regular daily exposure before there is a risk of developing silicosis but given the fact that quarry workers are significantly exposed to dust, the Australian Quarrying Industry must act now. Failure to act now, it is anticipated that there will be increasing number of workers presenting with silicosis symptoms. It is also expected that there will be an increase in compensation claims for those workers diagnosed with silicosis which will lead to an increased cost of insurance policies which will be passed on to the industry. There is also to be an expected increase in the number of certain operators not reporting workplace health and safety incidents for fear of regulatory investigations. Quarries who do respond proactively to mitigate exposure to silica dust are expected to experience an increase in costs for personal protective equipment for operational workers. For those quarries who do not provide a silicosis mitigation strategy, it is anticipated that they will struggle to find applicants to fill employment positions.

Resistance to Change: In today's fast pased environment, change is an inevitable part of business. While some businesses are able to deal with change easily, for others, it can be a more difficult process to deal with. Some employees may resist the process, and their resistance to the change process can have negative effects for the organisation. If these negative effects are not addressed in a timely manner, they can become widespread and detrimentally affect the business.

There is a resistance to change in the Australian Quarrying Industry given its traditions and culture. When employees resist a change taking place at work, they may feel less optimistic and hopeful about their professional future with the organisation (Burnes 2015). This is particularly so if there is a lack of communication regarding the change (Burnes 2015). Among other negative effects of resistance to change, low morale can spread throughout the entire staff, which can in turn lead to staff recruiting and retention issues (Rafferty & Jimmieson 2017). Another negative effect that results from employees spending time focusing on resisting the changes in the workplace is that they become less focused on performing the daily tasks required from their jobs (Rafferty & Jimmieson 2017). This can lead to a reduced level of efficiency and output among employees, which can be damaging to the organisation's bottom line (Rafferty & Jimmieson 2017). Whether based on real information or misguided preconceptions, it is essential that the Australian Quarrying Industry does

not underestimate the effort it will take to overcome this resistance, while clearly recognizing when it is worth the effort.

Possible impact of drivers: The social dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Workforce health and safety.
- Resistance to change.

Responding proactively may result in the following outcomes toward 2029:

- Decrease in instances of workplace accidents and deaths.
- Improved public perception of industry practice.
- Workforce is embracing change given the consultative approaches evident in quarry operations.

Failure to respond proactively may result in the following outcomes toward 2029:

- A poor workplace health and safety culture placing all workers at risk.
- Not being able to recruit and retain talent due to a poor workplace health and safety culture and negative public perception.
- An increased industry regulator interest in quarrying operations where workplace health and safety practices are below industry standard (over-regulation).
- A workplace culture where resistance to change is dictating the speed and adoption of innovative operations to ensure business viability.
- Unable to recruit and retain talent due to a poor workplace culture dominated by a resistance to change.

5.2.4 Technology dimension

The following technology dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to economic factors influencing the future of the Australian Quarrying Industry:

- Innovation.
- Automation.
- New technologies.
- New materials.

Each key driver is discussed below.

Innovation: One of the most important factors that will promote future Australian economic growth and competitiveness is strong leadership in innovation. In an increasingly interconnected and rapidly changing world, Australia risks being left behind if it fails to innovate and build innovation capacity. Australia needs to improve its innovation performance. As a percentage of GDP, Australia's expenditure on innovation sites below the OECD average (ACLA 2014). Further, in the 2015 Global Innovation Index, Australia ranked 72nd (out of 141 countries) in innovation efficiency (ACLA 2014). Innovation efficiency is the ratio of innovation output to innovation input. When compare against OECD peers, Australia's innovation efficiency rank is 30 out of 34 (ACLA 2014).

The Australian Quarrying Industry has also spent several years ruthlessly reducing costs restraining investment in research and development. The industry will need to continue to do so in order not to put returns of investment in peril and undermine capital budgets. This is forcing the Australian Quarrying Industry to consider how to both sustain their cost take-outs and drive ongoing productivity improvements. While there is no 'right' solution to this quandary, strategy-level leaders are tackling this issue in several ways. One strategy involves a continued investment in innovation which is leader enabled and a significant aspect of the future capabilities needed by the industry to retain competitive advantage. From automation, new transport solutions, new products and new technologies, quarries embracing innovation are able to improve quarrying intensity. However, this innovation is not occurring in all Australian quarries; in particular, the smaller quarrying operations. This is mainly due to cost and resistance to change. If innovation is not a priority for all quarrying operations it is anticipated that a number of quarries will not be able to compete with quarries who engage in innovative practice as part of their daily operations. The Australian Quarrying Industry has the potential to prosper in the future, but it must be achieved through new avenues, with innovation and early adoption of new technology playing a large role.

Automation: Over the next decade, the average Australian resource sector worker will spend two hours per week less on manual and routine tasks (Austmine 2018). It is predicted that automation will make Australian jobs safer, more satisfying and more

valuable (Austmine 2018). Jobs will become safer as machines will take over the most dangerous tasks at work; satisfying, as machines will take over the most routine tasks at work; and valuable, as machines will take over the least productive tasks in the economy (Taylor et al. 2019).

The move towards autonomous vehicles and automated technologies has already revolutionized some quarrying practices (Frank 2019). As the capability of these machines grows over the next decade, they will be able to perform increasingly complex tasks, including hazardous processing activities, reducing labour costs and enhancing productivity as a result. Quarries could ultimately operate fully autonomous sites, concentrating labour in centralized functional hubs (Ameen & Safawizadeh 2017). It is predicted that by 2029 there will be fully automated quarry sites operating in many countries reducing costs and work site accidents and permitting a 24-hour operation (Austmine 2018).

The application of robotic technology has far reaching potential for the quarrying industry during the next decade (Bogue 2018). Robotic devices powered by artificial intelligence can perform a range of quarrying tasks including drilling, blasting, loading and hauling. These new technologies will impact on the way quarries currently operate.

New Technologies: The Internet of Things (IOT) can potentially transform the mining industry by creating new ways of maintaining mine safety and productivity (Thibaud et al. 2018). This new technology involves connecting machines, fleet and people with unique identifiers based on radio frequency identification device and sensor technologies while allowing them to automatically transfer and receive data over a network without requiring human-to-human or human-to-computer interaction (Thibaud et al. 2018). This platform can not only improve traceability and visibility of the entire quarrying operation but also enable computers to observe, identify and understand different facets of quarrying operations without human intervention and to automate and improve the maintenance and operation of machines. It also enables machine learning and artificial intelligence capabilities to develop.

Many businesses are considering if wearable technology can deliver business benefits (Business Direct 2019). By incorporating computer and advanced electronic into personal protection equipment, quarry workers stand to realize a range of

unprecedented advantages e.g. devices can track operator fatigue to cut down on accidents that endanger worker safety. Wearable devices can even signal if their wearers are in physical distress, enabling rapid response to accidents or injuries.

Originally confined to custom prototyping, 3D printing has rapidly become a production-ready technology (Carrión 1997). For the Australian Quarrying Industry, the implications are significant, enabling operations in remote locations to custom manufacture critical parts on demand. Thus, reducing both delays for unplanned maintenance and the need to hold costly inventories. Another new technology that has emerged is 3D laser scanning, which helps to capture spatial data using laser light and enables geologists to build 3D geological maps combining the surface mapping data (Yoon et al. 2018). This new technology will assist quarries in identifying new product areas and site safety.

New materials: An increase in infrastructure construction has increased the rate at which high-quality aggregates are consumed (Fan et al. 2017). This situation, coupled with an unbalanced geographical distribution of deposits, has created a supply problem in many areas of Australia. New materials offer a possible alternative to importing natural aggregates from other areas. As the aggregate shortage becomes more widespread and the importing of natural aggregates becomes too extensive and costly to be a sound practice, new materials are providing a feasible solution to the problem. New materials such as fibre composites are now being used for infrastructure applications. Many years of research and development have resulted in the successful application of composite fibre technology to a number of applications including road bridges, electrical cross arms and pedestrian structures.

Possible impact of drivers: The technology dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Innovation.
- Automation.
- New technologies.
- New materials.

Responding proactively may result in the following outcomes toward 2029:

- Many quarrying processes are managed by robotic technology.

- Innovation is integral to daily practice and has improved resource efficiency, extended product lifelines and waste production.
- Fully automated quarry sites are operating in many locations across Australia.
- Innovations at the quarries are globally recognised and endorsed.
- Artificial intelligence is helping efficiency apportion the use of resources among competing priorities ensuring the conservation of critical resources.
- New technologies are allowing for more accurate exploration saving on time and cost.
- New jobs have been created to manage automated practices.

Failure to respond proactively may result in the following outcomes toward 2029:

- Quarries not evolving through innovative practice and are going out of business, while others are adapting, innovating, seizing opportunities and thriving by taking advantage of the new environment.
- Displaced workers, given advances in technology, are unemployable in the quarrying industry and are searching to be reskilled to be redeployed to new opportunities within the work environment.
- New technologies are being adopted at a slow pace with quarries not keeping up with demand.
- Quarries not embracing new technologies continue to use outdated operational practices which is resulting in declines in productivity, productivity, safety, and corporate social responsibility.
- New synthetic materials reduce demand of natural aggregates.

5.2.5 Environment dimension

The following environment dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to economic factors influencing the future of the Australian Quarrying Industry:

- Environmental politics
- Rehabilitation.

Each key driver is discussed below.

Environmental Politics: Governments around the world will continue their vigilance with their environmental green agenda (Tomaras 2019) . Governments continue to

legislate the quarrying industry with stringent environmental law and regulations which is deemed a political necessity as well as an ethical imperative. In the eyes of the public, quarrying is not an environmentally friendly operation because it produces vibration, noise and dust. This was certainly the case in the 1960s, 70s and 80s (Tomaras 2019). The perception of quarrying started to change quite significantly during the past 20 years particularly with rise of environmental politics. There have been major changes to quarry approvals and contracts. For all approvals and contracts, the principles of environmental politics are included with much focus and consideration placed on environmental aspects and the conservation of natural resources. The mandate for a quarrying project is simply to revert the site back to a natural-looking state or to turn a once bare-looking eyesore into an area covered with vegetation in harmony with the natural environment and suitable for future development. It is predicted that these stringent environmental laws and regulations will continue to influence the practice of quarrying (Cardno 2013).

Rehabilitation: A quarrying rehabilitation contract is usually long-term undertaking taking more than 10 years to complete. As a result, the quarry owner is now more willing to spend time and effort investigating and adopting innovative ways to reduce impacts on the environment and attending to matters affecting the environment and the community. Current practice recognises environmental impact assessments being carried out for quarry rehabilitation works before they commence with this practice expected to become more stringent during the next decade (Cardno 2013). Air quality, noise, water quality, waste disposal and blasting are assessed, and assessment criteria are established (Cardno 2013). Mitigation measures and monitoring and audit requirements are also specified. Once the works commence, regular environmental control, monitoring and auditing is conducted.

Environmental issues, such as the effects of the operations on any future development works near the site, are assessed and measures taken to mitigate the impacts on the environment in compliance with relevant Act and Regulations. Quarry rehabilitation works include re-contouring and extensive planting and the conservation of flora and fauna unique to a location. It is anticipated that the rehabilitation of quarries agenda will continue to evolve.

Possible impact of drivers: The environmental dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Environmental politics.
- Rehabilitation.

Responding proactively may result in the following outcomes toward 2029:

- First Australians have an increased level of political power in relation to land management and working collaboratively in partnership with quarries.
- Rehabilitation practices are evident throughout the lifecycle of a quarry.
- Governments, communities and quarries are working in partnership to manage the environment for a sustainable future.

Failure to respond proactively may result in the following outcomes:

- A quarry's licence to operate are being revoked thereby ceasing all production which is impacting on levels of unemployment and the local economy.
- Permits continue to be under scrutiny due to sub-standard practice.
- Poor community perceptions of the industry continues and, in some cases, placing increasing extra pressure on quarries.
- Government regulatory interventions continue and, in some cases, placing increasing extra pressure on quarries.
- The cost to rehabilitate a quarry site is increasing substantially as rehabilitative practices are not started during the initial stages of operation.

5.2.6 Ethical dimension

The following ethical dimension key drivers were identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to economic factors influencing the future of the Australian Quarrying Industry:

- Ethical and unethical practice.
- Corporate greed.

Each key driver is discussed below.

Ethical and Unethical Practice: The ethics of any business-related operation have never been more in focus and prone to scrutiny and the Australian Quarrying Industry

is no exception. Since the Global Financial Crisis, ethics and social responsibility have been playing an important role in the business world including in the quarrying industry. There is no doubt that overtly unethical behaviour in key sectors does impact on global share markets and hence on the whole economy. The focus on and transparency of ethical conduct is higher than ever with a prediction for this pressure to increase over the next decade (Boubakary 2016). Although the Australian Quarrying Industry's economic mission is acknowledged, it is now the industry's responsibility to address public concerns. The Australian Quarrying Industry is the subject of scrutiny and bad press related with ethics and corporate social responsibility concerns.

It is the widening list of unethical practice that industry stakeholders seek to distance themselves from the industry to date should particularly concern the Australian Quarrying Industry. Surface extraction in its broadest sense has always been beset with high risk, from the exploration stage onwards and an unknowability factor attached to the potential future prices for its products. Forecasting changes in demand, which can be cyclical or more fundamental and long-term in their nature, has proven to be even more perilous that getting budget deficits correct. This uncertainty can lead to short duration 'super profits' interspersed with very ordinary returns and sometimes ruinous losses. This profile is compounded by the capital-intensive nature of the industry. Punitive and multiple taxation of the profitable phases and limited write downs of capital and exploration outlays can be the deciding factors on whether an enterprise survives or fails.

The Australian Quarrying Industry must avoid given reason to those for whom any form of resource extraction has negative connotations. Recent findings into unethical practice by once respected organisations has highlighted the need for organisations not to engage in unethical practice e.g. the Red Hill quarry expansion in Western Australia that destroyed an extremely significant Indigenous site in 2014 and the destruction of Indigenous artefacts in central Queensland at the Bottletree quarry between 2013 and 2016 (Jenkins 2019).

The Australian Quarrying Industry has recognised that sustainable development principles and the triple bottom line approach to their businesses were reasonable and essential expectations of the local and broader communities, embracing environmental

and social wellbeing, as well as financial viability. The overall response has been mainly praiseworthy in terms of actual outcomes. In addition to mitigating harm, the industry has improved the lives of many in the regions in which they operate, including employment and infrastructure in remote areas for disadvantaged sectors of the community and for indigenous people. It will be vital that the Australian Quarrying Industry is not perceived to embrace any business practices that leave it open to 'unethical' labelling, which would seriously erode the many benefits of the sector and provide credibility for its detractors.

Corporate Greed: Corporate greed, by definition, is when a company chooses to prioritise increasing profits in a way that harms employees, consumers and the environment (Marta et al. 2019) . It occurs when making money becomes the only goal, and the other company's social responsibility is ignored (Marta et al. 2019). An industry that seeks to maximise corporate greed and interprets its ethical responsibilities narrowly will find it hard to resist narrow interpretation of its corporate responsibilities (Spinello 2019). The Global Financial Crisis (GFC) of 2008 is an excellent example of corporate greed with some of its findings mirroring current corporate climate in the Australian Quarrying Industry.

Many believe the GFC was a crisis brought on my economic factors caused by unethical lending practices. Lo (2008) believed that a human element was at play, most notably the emotions of greed and fear of the unknown. During extended periods of prosperity, market participants become complacent about the risk of loss; either through a systematic underestimation of those risks because of recent history, or a decline in their risk aversion due to increasing wealth, or both. The prolonged periods of economic growth and prosperity can induce a collective sense of euphoria and complacency in an industry. The seeds of crisis are created during a lengthy period of prosperity. During this period an industry can become more risk tolerant. This greed is spurred on by the profit motive. Profit motive is one of the current key drivers of the Australian Quarrying Industry.

There have been many examples from the Australian Quarrying Industry that have been in the headlines due to corporate greed aligned to profit motive. In March 2019, a construction company was fined more than $AUS400,000 for destroying a recognised sacred site while working on a quarry about 200 kilometres north of Roma

in central Queensland between 2013 and 2016 (Jenkins 2019). This culture of prioritising short-term gains and instant profits has brought about irresponsible decisions, people breaking the law and ignoring the lines that define acceptable conduct. It is anticipated during the next decade during times of high competition, the needs for quarrying products to be close to market, and lean profit margins that corporate greed will still occur in the quarrying industry.

Possible impact of drivers: The ethical dimension of the Australian Quarrying Industry's operational environment consists of the following key drivers:

- Ethical and unethical practice.
- Corporate greed.

Responding proactively may result in the following outcomes toward 2029:

- Quarry products are being ethically sourced and produced.
- Quarry acquisition are occurring where ethical organisations are taking over unethical organisations.
- Corporate greed has been minimised due to the adoption of ethical practices.

Failure to respond proactively may result in the following outcomes:

- Scrutiny into quarrying ethical practice continues due to government and community interest with the potential of revoking a quarry's licence to operate if unethical practice is proven.
- Overregulated quarries due to unethical practice and poor workplace health and safety records.
- Engagement in practices of corporate greed due to regulatory demands, the lack of quarry products near the marketplace, low profit margins, and high levels of competition.

5.2.7 Legal dimension

The following legal dimension key driver was identified by the Delphi panel of experts and validated by the PESTEEL analysis from secondary sources as they relate to economic factors influencing the future of the Australian Quarrying Industry:

- Regulations

This key drive is discussed below.

Regulations: Reconciling the ever-changing regulatory needs of governments while still delivering return on investment for quarrying businesses has been a concern in the quarrying industry for some time and is expected to continue during the next decade. Governments at all levels in Australia - local, state and commonwealth - have not softened their stances around resource management and associated regulatory mandates (Holley 2016). These are mostly in response to community sentiment and in response to seeking to gain the popular vote (Holley 2016). In most jurisdictions, quarrying organisation continue to struggle to obtain environmental and other approvals and adhere to a range of regulations. At the same time, the cost of bureaucracy required to exert regulatory control is also being passed on to the industry, thus taking a toll on corporate profits and their license to operate. It is anticipated that reconciling regulatory needs will not only continue in the future but become more robust during the next ten years.

Lengthy permit processes cause significant delays in getting new and expanding quarrying projects operational. The average time to get the permits needed for a new quarry in Australia is seven to ten years (Business Queensland 2018). Quarrying organisations are required to get approval from several levels of government before starting a new project or expanding an existing quarry site. Multiple governmental agencies may be involved at each of these levels. Community organisations, native title and land rights, and the general public are often involved in the processes as well. The process to approve new and expanding quarrying projects is expected to maintain its current standing until government policy at all levels is refined during this current period of regulatory reform. Quarrying organisations will need to remain patient during the reform process and continue to follow current regulations.

Quarrying organisations have welcomed the news that government policy at all levels is aiming to provide a relatively well-define system of laws and procedures govern the development and expansion of quarrying projects (Coppel & Mundy 2013). In August 2019, the Commonwealth government of Australia announced that it would carry out a year-long inquiry into regulation affecting the resources sector, with a view to streamlining approvals and reducing the regulatory burden on business in the sector (Canavan 2019). This inquiry is a response to industry concerns regarding the time required to obtain development approvals for quarrying projects and are aimed at supporting new quarrying development. The Australian Quarrying Industry has

welcomed the Australian Commonwealth government's efforts to reduce the regulatory burden in their sector and will continue to engage in law and policy reform efforts in environmental regulation.

Environmental assessments, approvals and compliance with regulatory requirements are mandatory for the commissioning and operation of all quarrying projects in Australia (Coppel & Mundy 2013). Quarrying organisations wishing to commission new or expanding operations must prepare an assessment of the anticipated environmental impact of their operation. The grant of environmental approval is generally subject to conditions that aim to minimise the overall environmental impact of the quarrying operation. For many quarries, preparing an environment assessment report is usually conducted by an external consultant which becomes an added operational cost. External consultants are contracted to complete this work because strategy-level leaders admit to not having the knowledge, skills and time to develop these reports. Given the ongoing complexity of these reports, it is anticipated that many quarries will continue to find the costs of external consultants to develop these reports throughout the next decade.

Australia appears to be following suit of mandatory continuing professional development for all quarry managers as regulated by WorkSafe New Zealand. New South Wales is currently the only state/territory with a mandatory requirement for ongoing professional development, with a competency maintenance scheme largely based on the New Zealand continuing professional development system (IQA 2019). It is anticipated that all other Australian states and territories will adopt these mandated continuing professional development regulations during the next ten years.

Possible impact of drivers: The legal dimension of the Australian Quarrying Industry's operational environment consists of the following key driver:

- Regulations.

Responding proactively may result in the following outcomes toward 2029:

- Certificates of Competency are embraced by the industry.
- Quarrying organisations are self-regulated given their history of compliance.
- Approval processes are streamlined and managed in partnership with governments, communities and quarries.

Failure to respond proactively may result in the following outcomes toward 2029:

- Negative regulator and community perceptions, including native title and land rights, are increasing creating a negative impact on the quarry organisation's licence to operate.
- The cost of increased regulator control and intervention continues due to regulations not being adhered to by quarry organisations placing pressure on operating budgets.
- The permit process is delaying the delivery of quarry products as current reforms were not successful stalling infrastructure projects.
- Quarries continue to engage external consultants to complete regulatory reports increasing operational costs.
- Limited evidence of continuing professional development having traction.
- Quarry managers are not having their Certificates of Competency renewed as they ignore the mandated continuing professional development requirements.

5.3 Conclusion

Chapter 5 explored the changes and the effects of key drivers from the external macro environment on the Australian Quarrying Industry futures. The analysis identified the possible impacts on the futures of the Australian Quarrying Industry.

In summary, the following key drivers were identified by the Delphi panel of experts and validated by the PESTEEL:

- Political perceptions.
- Changes in government.
- Community perceptions.
- Economic growth.
- Availability of quarry products near market.
- Infrastructure spend.
- Workforce health and safety.
- Resistance to change.
- Innovation.
- Automation.
- New technologies.

- Environmental politics.
- Rehabilitation.
- Ethical practice.
- Unethical practice.
- Corporate greed.
- Regulations.
- Unemployment.
- Community expectations.
- New materials.

Data was gathered using the PESTEEL's environmental scanning process by seeking and validating information related to key drivers that were identified by the Delphi's panel of experts. The scanning process provided an in-depth understanding of the key drivers alerting the Australian Quarrying Industry to potential impacts on the industry as well as opportunities for the industry to explore. The knowledge gained from the PESTEEL analysis was used to inform the development of scenarios. The PESTEEL analysis included the assimilation of the Delphi data with secondary data from sources and the insights of the researcher as located in the phenomenon.

Chapter 6 **SCENARIOS**

Chapter 5 explored the key drivers that will have an impact on the Australian Quarrying Futures toward 2029. These emerged based on the results of the Delphi study, the survey and the PESTEEL analysis of environmental factors that may shape the industry in the future. These key drivers do not provide a full description of Australian Quarrying Futures by 2029. Rather, it is proposed by the study that in terms of Strategic Leadership Theory, the leadership profiles derived from the survey may be combined with the PESTEEL analysis in informing three possible scenarios of the future of the industry.

The core assumption of the study is that leadership characteristics and decisions in the present are valid proxies for how the future may evolve. Further, that the capabilities of interest in the survey, namely foresight and strategic thinking profiles of leaders are directly linked to strategic decisions related to the future of the industry. Also, that as these profiles change, different industry futures emerge.

The study therefore expands traditional scenario development beyond environmental scanning and the identification of drivers of change and wildcards within a certainty / uncertainty spectrum. It is suggested that by combining the empirical evidence derived from the Delphi and PESTEEL analysis with the predictive value of Strategic Leadership Theory, the resultant scenarios will have greater depth, breadth, and empirical support.

In this chapter, three conceivable scenarios are formulated to expand the scope of possibility of the Australian Quarrying Industry by 2029. The scenarios are not developed to predict ‘a future’ of the industry but rather to present a broader view to the industry and within which more informed decision making can occur.

6.1 Scenarios

The scenario process is based on the premise that there are already key determinants or components of the future that exist in the present. The scenario method can be used as a methodology for future analysis to access and expose these futures. It is feasible to extrapolate from key drivers of change of the future and to use both qualitative and quantitative methods to explore them to be able to reflect wisely and discuss what

might occur in a more informed way (Fourie 2007). While it is argued that innovation should be crucial to the positive development of an industry and society generally (Lindgren & Bandhold 2003), it cannot take place outside of the context of including the identification of discontinuities, and trends and the so-called 'wildcard ' (Loveridge 2009).

Scenarios constitute the conducting of thinking experiments. They include developing narratives based on current empirical indicators that converge to describe alternative images of the future in a memorable way revealing possible occurrences which would otherwise be unknown. Schwartz (1991) agrees that scenarios do not involve the prediction, but rather present perceptions of the future and how it may evolve.

6.1.1 Scenario planning

Scenarios are a precious methodology that helps organizations prepare for potential events and makes them flexible and creative (Hiltunen 2009). Herman Kahn is one of the founders of future studies and a planning father. He describes scenarios as resulting from a series of future hypothetical occurrences built to explain potential changes in causal activities and their decision-making points (Kahn & Wiener 1967).

Scenarios can describe the future and course of occurrences that enable one to go from the current position in the present to a possible future (Godet 2000b). Scenarios can also be described as alternative futures arising from trends and policies that are discontinuous (Fontela & Hingel 1993). Leaders often use scenario planning methods to articulate their mental models and views of the future in order to make better choices in their decision making (Martelli 2001).

Developing numerous feasible future options based on scenarios contributes to holistic future planning (Jetter 2003). Scenarios also reduce uncertainty and the usefulness of the general decision-making method (Van der Heijden 1996). Planning based on scenarios enables us to prepare for the future and innovate the future (Martino 2003). Scenario planning allows stakeholders to ask key questions about the future (Barber 2009). Scenarios offer an overview of the setting and highlight the relationships between various future trends and occurrences (Joseph 2000). Furthermore, scenario planning introduces all complicated aspects coherently, systematically, fully and plausibly (Pillkahn 2008). Scenario planning is also a structured approach that enables the realization of preferable futures (Saliba 2009).

In the last decade, the use of scenario planning has increased considerably (Rigby & Bilodeau 2007). Research suggests that a correlation exists between scenario scheduling methods and insecurity, unpredictability, and instability of the general company setting (Malaska et al. 1984). The significance of defining future trends and anticipated industry landscapes has grown increasingly uncertain. Consequently, the use of scenarios has risen because the company climate is more complex and uncertain. Researchers also note a direct link between scenario planning and innovation (Sarpong & Maclean 2011).

Scenarios do not predict the future, but they explore several plausible future situations, with the aim of broadening the sphere of thought and scenario development participation (Godet 2000a). Scenarios differ from predictions because scenarios explore a variety of possible results arising from uncertainty, while predictions are aimed at identifying the most probable pathway and estimating uncertainties (Saliba 2009). Scenario planning therefore does not forecast the most likely future but generates several plausible futures (Wilkinson 2009).

6.1.2 Process of developing scenarios

In this study, the main purpose of using scenario building was to evaluate possible futures of the Australian Quarrying Industry. Three plausible possible exploratory futures of the Australian Quarrying Industry by 2029 were identified. Each situation has a title that will resonate with the target audience. The development of each scenario was done by using inputs derived from the Delphi study, the online strategy-level leaders survey, strategy level leader Profiling and a PESTEEL analysis.

In Chapter 4, an analysis and interpretation of data from the Delphi study and online survey was undertaken. Environmental politics, regulations and rehabilitation, automation and new technologies, community perceptions, infrastructure spend, workforce health and safety, and ethical and unethical practice were identified as key drivers in determining the futures of the Australian Quarrying Industry. A PESTEEL analysis was conducted confirming the key drivers identified in Chapter 4 while conducting a broad environmental scan.

This research uses the deductive strategy to scenario building. Scenarios offer a way to address uncertainties through the creation of room for ideas. Often several drivers can be recognized during the original stage which have an important effect on the

main topic, but which are difficult to predict. Therefore, the real effect of these drivers remains unsure (Lindgren & Bandhold 2003). The deductive strategy can help in complicated systems with changing characteristics to overcome the hazards inherent in those evolving characteristics.

The deductive strategy employed by the scenario development process in this study sought to combine empirical evidence in the present (validated identifications of trends, drivers of change and wildcards) with industry leaders' foresight and strategic thinking profiles to develop the scenarios using the traditional four quadrant approach (certainty / uncertainty and high control / low control matrix). The predictive utility of Strategic Leadership Theory is a unique feature of the deductive logic employed by this form of scenario development.

The empirical evidence was derived from the Delphi study of current industry experts who identified key drivers of change, trends and possible wildcards while identifying current leadership capabilities and inadequacies. The online survey sought to a) validate the Delphi findings amongst a broader representation of industry leaders and b) provide quantitative profiling data to establish current industry leaders' foresight and strategic thinking capabilities.

The PESTEEL analysis combined the Delphi findings with an environmental scan to finalise the drivers, trends and wildcards that would inform the scenario development together with the leader profiles.

6.1.3 Scenario validation

Bradfield et al. (2005) emphasize that coherence, plausibility, inner cohesion and logical support are the prevalent baseline criteria by which all scenarios should be validated, irrespective of scenario design methods. Burt (2007) explains how scenarios should describe the plausible future and how the future world unfolds internally. de Brabandere and Iny (2010) claim that scenarios must be appropriate, consistent, plausible, compelling, transparent, easy to recall and illustrative for choices to be taken. Schoemaker (1993) highlights the significance of coherence and plausibility in the construction of scenarios. Three scenarios are now described based on the research findings and scenario development method employed by the study.

6.2 “SAME FUTURE SAME INDUSTRY” scenario

By 2029 the Australian quarrying industry is typified by leaders that are predominantly orientated to the present and optimising day to day operations. They have a view of the future and know it is important but fail to action this orientation. They adopt a primarily adaptive style of viewing the future. This is dominated by a focus on optimising current productivity, profit margins and problem solving as the situation demands it. They try frame future strategies and solutions, but these are limited by their emphasis on adapting to rapidly changing operational environments. Shareholder expectations for short-term returns also limit their ability to plan longer term strategies. They promote but fail to realise innovation due to limited board-approved investment in research and development. As a result, they have low levels of enabling the testing of new ideas and solutions.

The quarrying leaders balance a directive style of management and encourage participation by employees when making strategic decisions. The strategic decisions are primarily based on analytical inputs associated with past performance and operating conditions. Parts of the industry incorporate conceptual approaches to increasing strategic opportunities in the future and these have paid off. Quarrying leaders predominantly believe that the future will not change dramatically, and that change will be linear. They do not envision an industry that will be very different.

There is evidence that industry leaders’ focus is on the preservation of their own leadership positions within the industry. Organisational change is guided by the traditional values of the organisation. Large-scale change is a gradual process. Despite these general characteristics there is evidence that industry leaders are becoming more proactive. The leaders are starting to be open to experimentation and risk-taking and are encouraging innovation among their employees.

Quarrying remains a conservative industry with practices basically the same as 20 years ago. They are typified by business-as-usual approaches driven by supply and demand and an old industry culture. “Same future, same industry” quarries are viewed as a ‘bad tenant’ rather than a ‘welcome guest’ because of environmental impacts. Social and environmental impacts continue to be a problem for securing and maintaining social licence. Environmental permitting procedures for quarrying still come under scrutiny due to sub-standard practices. Leaders fail to address these

ongoing environmental concerns and do not adequately change public and governmental perceptions.

Technologies for recycling, reuse and substitution are gradually being developed but at a slow pace not keeping up with innovation. Research and development exist in isolated pockets. Automation remains a topical subject but there remains a lack of significant investment by the Australian Quarrying Industry due to the high costs to test and adopt these technologies.

There is a constant turnover of talent with no industry stimulus to attract, develop, invest in and retain new talent. A combination of perceived conservative industry culture, traditional extractive industry techniques and a negative public perception detract from industry efforts to attract talent. Even though professional development and training have been an industry priority for a very long time there is limited evidence of any traction. Professional certification of quarry managers and supervisors is still talked about but a long way off from reality. There remains a high resistance to change resulting in a stagnant industry culture. Gender composition of the workforce is still predominantly male.

The national economic performance is stable suggesting that the “Same future, same industry” quarrying industry is sustainable but under pressure. Infrastructure spend remains consistent. The lack of future-orientation and strategic thinking capabilities exacerbate the situation by not providing a higher-level awareness about opportunities that may emerge out of charting new directions and driving investment into innovation, talent development and public image. There is also increased vulnerability to discontinuous changes in the operating environment.

The Australian quarrying industry remains overregulated due to instances of poor health and safety records and unethical practice. Unethical practice is not obvious but heavily speculated. The industry is generally not trusted. Increased community scrutiny continues to place old and new pressures on all levels of government to ensure all quarries are compliant with related Regulations and Acts, health and safety standards and social responsibility.

Due to increasing vulnerability to market conditions, small quarrying operators increasingly go into administration or are purchased at lower than market value by

large corporate operators. Large operators drive industry progress but not to its full potential.

The Australian quarrying industry in 2029 understands that it operates in a market characterised by: constant disruption, volatility, rising public demands, a widening talent gap, and dwindling access to key resources such as energy, water and quarry products close to markets. It prides itself on its resilience and ability to respond to market changes. There is an enhanced awareness that resilience in and of itself is not enough. There is an acceptance that surviving is no longer sufficient and to thrive the industry needs to re-envision their futures, strengthen their risk management and find better ways to engage with their communities and stakeholders, push the boundaries of their digital transformation, attract truly diverse workforces, and avoid the capital project mistakes of the past. It also requires these leaders to make technology, especially automation, a strategic priority by acknowledging its role as an enabler across every facet of their quarrying business.

6.3 “INVOLUNTARY ADMINISTRATION” scenario

By 2029 the Australian quarrying industry is typified by leaders that are predominantly orientated to the past. They rely on the successes of the past and generally believe that the same patterns of business cycles will repeat. They overwhelmingly focus on optimising day to day operations in the present. They adopt a primarily reactive style of viewing the future and back this approach up by aiming to adapt to conditions as they occur. This is dominated by a focus on optimising current productivity, profit margins and problem solving but find that they are unable to anticipate change. Their future orientation is limited by believing that the future cannot be anticipated due to rapid and discontinuous change. Stakeholder expectations for short-term returns further limit their orientation to the future. Their performance is incentivised by short-term targets and financial gains.

The quarrying leaders increasingly adopt a directive style of management and limit participation and input by employees when making strategic decisions. Even though they complete strategic thinking and planning exercises these have no traction and do not alter the direction of the industry. Their strategic decisions are primarily based on analytical projections of budget, supply, demand, and short-term profit targets based

on zero-based budgets and percentage growth ambitions. The lack of innovation and investment in research and development is driven by the inability to conceptualise and implement longer term strategies and investment. Quarrying leaders predominantly only adopt new technologies as developed and tested in the mining industry.

The quarrying industry of 2029 remains conservative and somewhat isolated from other related industries. It is typified by traditional leadership as represented by the 'hard men' of the industry. Organisational change is guided by a stubborn conservative culture and organisational change is only achieved through crisis.

There are widespread negative public and regulatory perspectives of the industry by 2029. These are based on the perceived greed and exploitative nature of quarries. They are viewed as a 'bad tenant' that cannot be trusted. Public demands to limit environmental permits for quarrying grow due to sub-standard practices. The industry fails to respond strategically and as a result the supply of quarrying product reduces driving up prices putting smaller operators under market pressure by the large corporates. Prices are driven up with the effect that government infrastructure project reduce dramatically. Media reports of industry mal-practices, environmental concerns, safety concerns and conflict with communities are unprecedented.

"Involuntary Administration" quarrying has less employees than 20 years ago due to stagnating demand of old products and rising costs. The quarrying industry is widely seen as an older industry, a relic from the 20th century. There is a clear lack of talent attraction to the industry and such talent turns over rapidly due to the stagnant nature of the industry and the toxic industry culture.

There has been a significant rise in quarry acquisitions with smaller quarry operations being taken over by large, well-funded competitors shaping an industry monopoly. This monopoly has created an absence of competition, which has led to high costs for consumers, inferior products, and unethical behaviours.

The lack of investment in quarrying has led to decreased productivity. The industry has fractured. Most remaining quarries are barely hanging on having been forced to restructure as the faced declining profits, unethical practice, increasing workplace accidents and deaths and litigation. Profits have declined as quarries have become uneconomic relaying on old-fashioned and uncompetitive technology and quarrying practices. Recycling rates have increased enormously as the circular economy has

become a reality. Unethical practice continues due to an increase in ethical and innovative practices from competitors. There has been a dramatic increase in workplace accidents and deaths due to poor workplace health and safety practices.

Significant lack of investment to reduce or eliminate the cumulative impacts of existing operations. There is a lack of commitment to the development and use of successfully site closures and remediation techniques to restore valuable land to the community.

Involuntary Administration leaders remain reactive without the capabilities to respond to the increasingly apparent industry troubles and deteriorating reputation. The leaders lack control of their projects, their people, and their business results. Their quarries lack proactive and progressive policies and procedures and are characterised by making on-the-spot decisions that reflect inconsistent, defensive, and incoherent decision. They continue to react to situations only as they arise and fail to anticipate crises or exploit a chance to succeed. Experienced leaders with future-orientated capabilities exit the industry. The Australian quarrying industry shifts from being an international industry benchmark typified by the monopolies of a few corporates.

6.4 “SMART QUARRYING” scenario

By 2029 the Australian quarrying industry is typified by its future-orientated, trusted, and progressive leaders. They do not depend on the successes of the past and generally believe that the future of the industry can be shaped and holds many opportunities. They prioritise attracting leading talent and create enabling environments that not only optimise sound operational management but promote ongoing and dynamic strategic conversations. They have an equal orientation to the past, present and future able to balance learning from the past, sustaining current operations and shaping the future. They adopt a primarily framing style of viewing the future and back this approach up by testing new solutions and innovations. They are able to conceive longer-term benefits at the cost of shorter-term profits through managed and informed investments.

The SMART quarrying leader continues to be adaptable but include sustainability and innovation as priorities. Their future orientation is expansive by believing that the future can be created through current action. They are influential and able to manage

stakeholder expectations in relation to their accountability, financial performance, and corporate citizenship. They can illustrate that informed risk taking in terms of increased investment in research and development has longer-term benefits that have a greater return on investment than the accumulation of short-term profits.

The SMART quarrying leader actively engages in strategic thinking. They have capabilities that engender a dynamic strategic intent and broad participation across all employee levels. Their strategic decisions are equally informed by the analysis of large data and the conceptualisation of new approaches, opportunities, and strategies. They can reconceive the Australian quarrying 'story' and actively collaborate with industry partners and competitors.

In SMART QUARRYING, much greater attention is put toward achieving sustainable outcomes. Sustainable development of business interests and environmental considerations are a priority. Corporate planning is aligned to commercial objectives with sustainability goals. Governments, communities, and quarries are increasingly collaborating on landscape approaches to land management, with Artificial Intelligence helping efficiently apportion the use of resources in order to ensure the efficient use and conservation of critical resources. Vast amounts of data, robust integration among related industries and a highly compliant quarrying industry have allowed for much more efficient use of resources. The circular economy is now a realisation for most quarrying products.

Larger quarries have engaged closely with a range of non-traditional suppliers and their technologies to enable a 'Whole of Life Quarrying' practice. The innovations of the quarrying industry are globally endorsed and recognised and have influenced a transformation of other industries in sustainability practices. The Australian Quarrying Industry becomes the world leader in quarry closure management that goes beyond remediation to regeneration. The industry is globally known for its increased ecological services, increased biodiversity, improved water quality, and better land management systems.

Although many traditional quarrying operators' jobs have been automated, many new jobs have been created to manage automated practices. Those working in the SMART QUARRYING industry want to work for businesses that are authentic, ethical, and socially aware. Employers are valuing creativity, empathy, and the ability to learn.

Industry-wide talent development programmes actively enhance industry professional development resulting in measurable improvement in workforce capabilities. In turn, people are looking for jobs that offer security while providing career paths that are attractive and respected. The industry also actively recruits and promotes female talent reducing the gender imbalance and increasing diversity in leadership. Staff turnover has been reduced which has created greater retention of knowledge and skills leading to key capabilities that drive the industry into new areas of growth.

Particularly valuable on a SMART QUARRYING quarry site is the ability to orchestrate assemblages of human and machine intelligence to draw upon the best that both people and machines have to offer. Artificial Intelligence professional development and training programs are rolled out to reskill workers. The SMART QUARRYING industry has embraced professional certification for its quarry managers and supervisors.

Community trust is recognised by the industry as paramount. Communities demand complete transparency about the environmental and social impacts of the quarrying industry. The industry has invested significantly into shaping the community perception of quarrying. This has decreased costs associated with managing community impacts and concerns. First Australians have increased level of participation in relation to land management.

Associated with sustainable environmental practices, public participation, and the building of trust the industry recognises the importance of investment in further developing advanced workplace health and safety initiatives. The absence of significant quarrying related deaths and accidents is officially recognised by regulators and commended.

Automated government monitoring provides community groups with information to gain greater transparency related to industry practices. The public want quarry products that have been ethically sourced, produced in a way that positively benefits people and the environment and designed for recycling and the industry meets most of the expectations through meaningful collaboration. A bigger portion of innovation efforts is also focused on resource efficiency, extended product lifetimes and waste reduction.

Quarrying at new sites remains a sensitive issue and under continuous scrutiny by government and environmental organisations. New technologies allow for more accurate exploration and some quarries are opened in remote areas given cost savings associated with automation and new transport solutions.

Intense global effort has gone into hastening the energy transition. Cheap decentralised alternative energy sources including highly effective battery technology have allowed quarries to provide for their own power. Quarries have moved to electric vehicles and machinery.

SMART QUARRYING leaders are actively developing a medium to long-term outlook and planning. They have a high tolerance for ambiguity, have developed contingency plans for possible negative events while and actively generate alternative ideas to current trajectories.

6.5 Conclusion

This chapter has presented scenarios for the Australian Quarrying industry by 2029. The process and inputs to developing the scenarios have been specified. The empirical basis for developing the scenarios include the results of an exploratory sequential mixed methods research design. The predominantly qualitative Delphi results informed the quantitative survey development. The survey sought to triangulate the Delphi results while also collecting data to develop the foresight and strategic thinking capability profiles of current leaders across the industry.

A PESTEEL analysis including the Delphi results were combined with the leadership capability profiles as inputs into the scenario development process. The process included using the four quadrant, certainty / uncertainty and high control / low control matrix. Three scenarios were developed; i) the “Same future, same industry”, ii) “Involuntary administration” and iii) “SMART quarrying”. The scenarios were developed as short, impactful narratives aimed at being communicated to the quarrying industry to increase their understanding of a broader scope of possibility. The narratives used plain language and were intended to be memorable. Based on the study and the resultant scenario work the industry designed and implemented a SMART Quarrying project. This project is specified in the next chapter.

Chapter 7 SMART QUARRYING PROJECT

7.1 Introduction

Work-based research is a largely a pragmatic response to a research problem or phenomenon. As such, it seeks to make a meaningful contribution, not only in terms of creating original knowledge but as it is problem focused. It also seeks to make an evidence-based contribution to practice. This chapter reports on an industry project that has been informed by the research outcomes, in parallel to the study, in order to contribute to the practice of leadership in the Australian Quarrying industry. This contribution is based on a futures analysis and scenario development process intended to understand a broader scope of possibility for the industry by 2029.

The work-based project was termed the "SMART QUARRYING" project and was based on the research reported earlier in the thesis. The purpose of the SMART QUARRYING project was to develop a futures outlook for the industry primarily as associated with the leadership capabilities needed for industry progress and sustainability. A practical outcome of this process was to establish the Australian Academy of Quarrying to be the premier quarrying educational institution aimed at delivering excellence in learning and teaching, research and advanced extractive industry practice globally. The project was developed and implemented during 2015-2018 during the time the researcher was the Chief Executive Officer of the Institute of Quarrying Australia.

7.2 Background to the SMART QUARRYING Project

The quarrying industry needs to be innovative to explore solutions to ensure safe work environments, establish profitable business that provides individual customers and the economy in general with the products they need whilst carrying out this primary function with due regard to the legislation of the day and the expectations of society. The Australian Quarrying Industry has been under increasing pressure to introduce fundamental changes in business practices.

In addition to ongoing rollout of state-based Acts and Regulations the industry has had to respond to increasingly stringent local authorities' requirements on consents

for both new and existing sites. Further pressure for change has come from the environmental and sustainability agenda. Despite the acknowledged need to increase the amount of recycled materials and decrease environmental impacts there remains a need to continue extracting primary aggregates. Quarry product customers are seeking higher quality products at minimum costs while also responding to their own environmental and sustainability agendas|.

Quarries are experiencing increasing production costs along with increased competition and changing demand. New materials and automation are on the horizon that will benefit early adopters but disrupt the industry generally. Quarries must minimize aggregate extraction through increased use of recycled materials, minimize the environmental effects from past, present and future quarry operations, and abide by occupational health and safety regulations, acts and other mandatory requirements for employees, contractors and visitors.

The industry has found it increasingly difficult to attract, retain and develop talent into the industry even though it has made significant efforts to maintain a positive profile. Senior managers commissioned to recruit staff frequently complain that they are unable to locate competent and capable staff with the necessary expertise to occupy the vacant positions.

It is no longer enough to just be productive in the Australian Quarrying Industry. The demand from the industry shareholders, not unlike other industries, is that quarries must always be increasing profitability, prioritize safety as well as demonstrate corporate social responsibility. The latter two imperatives are necessary and ‘good’ for business.

The Australian Quarrying Industry will not be able to achieve these objectives unless the leadership of its workforce are fit-for-future to respond to the emerging challenges of sustainable development and lead an industry typified by innovation. In view of the need to drive a sustainable and innovative industry, quarrying talent must translate into a higher level of professionalism. This project represents an evidence-based response in translating the study findings into a practice solution.

7.3 SMART QUARRYING Research and Development Project Committee

In order to guide the project, a SMART Quarrying Research and Development Committee was convened. The committee consisted of twelve strategy-level leaders from the Australian Quarrying Industry. Membership included Industry Chief Executive Officers, an Industry Regulator, an Industry Association State Manager, Industry Regional Managers and Quarry Managers and Supervisors. Membership was through an invitation issued by the Institute of Quarrying Australia's Chief Executive Officer. The aims of the committee were to:

- Identify drivers of the future.
- Identify strategic priorities.
- Consider key leadership capabilities.
- Serve as a Delphi panel.
- Define SMART Quarrying

The SMART Quarrying project was developed, delivered and adopted by undertaking seven steps:

- Step 1: The researcher conducted a Delphi to define 'SMART QUARRYING' and identify the key drivers and characteristics that will define SMART QUARRYING. An online survey was then developed and deployed to validate/reject the Delphi findings and develop baseline leadership profiles (Chapter 4). All findings were presented to the committee for consideration and discussion.
- Step 2: The researcher undertook a PESTEEL analysis (Chapter 5) and presented findings to the committee for consideration and discussion.
- Step 3: Members of the SMART Quarrying Research and Development Committee collaborated to create a Certainty Control Matrix illustrating key uncertainties, certainties and potential system breaks facing the future of the industry. This exercise produced a chart which illustrates the understanding of the landscape within the operations of the Australian Quarrying Industry operates (Appendix 2).

- Step 4: The researcher developed three scenarios (Chapter 7) for the industry for consideration by the SMART Quarrying Research and Development Committee. The scenarios were presented to the committee for consideration and discussion.
- Step 5: The committee presented its findings and recommendations to the Institute of Quarrying Australia's Board of Director for consideration. The board approved the establishment of the Australian Academy of Quarrying to deliver the recommendations of the committee.
- Step 6: The terms of reference for the Australian Academy of Quarrying was established.
- Step 7: The researcher represented the committee at several industry national and international conferences to present the three scenarios, the Strategy-Level Leader Capability Framework and the concept of the Australian Academy of Quarrying to be responsible for managing the Strategy-Level Leader Capability Framework.

7.4 The Australian Academy of Quarrying

It was accepted by the Australian Quarrying Industry that an industry-based consolidation of educational services would direct, streamline and make more accessible and consistent, industry-wide skills development, innovation and research. This, in turn would fulfil the need to:

- Meet the mandate of the Institute of Quarrying Australia in providing educational standards, quality and services.
- Provide a more focused and consistent impetus in the industry to develop, attract and retain talent required for the future needs of the industry.

7.4.1 Mission Statement of the Australian Academy of Quarrying

To be the premier quarrying educational institution aimed at delivering excellence in learning and teaching, research and advanced extractive industry practice globally.

7.4.2 Vision of the Australian Academy of Quarrying

To be the premier global 'go to' extractive industry education entity delivering excellence in professional development and career progression for the extractive industry.

7.4.3 Purpose of the Australian Academy of Quarrying

To recognize, develop and promote the competencies and capabilities of extractive industry professionals.

7.4.4 Value Propositions of the Australian Academy of Quarrying

- Provide ongoing foresight to extractive industry professionals.
- Assimilation, creation and dissemination of new industry-based knowledge.
- Guided by independent reference group reporting directly to the AAQ Board.
- Partnered with quality assured education institutions (Universities and Registered Training Organisations).
- Strategically aligned with industry professional organization's nationally and internationally.
- Directly aligned with industry nationally and internationally.

7.4.5 Aims of the Australian Academy of Quarrying

- Develop fit for future strategy-level industry leaders with a focus on the capabilities of foresight and strategic thinking.
- Deliver excellence in multi-disciplinary vocational and tertiary learning and teaching, certification (technical and management) and customized career path programs.
- Conduct and promote multi-disciplinary industry relevant research.
- Achieve high levels of collaboration and co-creation of systemic value by optimally engaging local and international stakeholders.
- Create, disseminate and share industry relevant and industry multi-disciplinary knowledge to achieve international recognition as the lead quarrying educational institution.

7.4.6 Products and Services of the Australian Academy of Quarrying

- Learning and teaching for Australian Qualification Framework Levels 3 to 10 educational outcomes.
- personalized career path professional development, mentoring and coaching programs.
- Support to achieve quarry management certification.

- Research outputs to influence/guide leading industry practice.
- Collation and dissemination of industry research knowledge.
- Delivery of continuing non-accredited professional development programs.
- Solution management services based on research and knowledge management capabilities.

7.4.7 Capabilities of the Australian Academy of Quarrying

- Provided a foundation guided by fit-for-future research.
- Demonstrated development and delivery of leading evidence-based professional development and training products and services.
- Opportunities for quality assured partnerships with universities and registered training organizations.
- Demonstrated core competence of delivering on- and offshore customized professional development packages.
- Delivering a certification system (operations and management) for industry as supported by industry and regulatory bodies.

7.5 Conclusion

Chapter seven outlines the work-based SMART QUARRYING project and the proposed model, purpose, aims and products of the Australian Academy of Quarrying as a response to achieving the preferred future of the industry based on leader capability development. Chapter eight will provide the conclusion.

Chapter 8 **CONCLUSION**

8.1 Introduction

This thesis sought to report on a work-based research study related to leader capabilities of the Australian Quarrying industry within the context of developing its possible futures by 2029. The study was conducted by the Chief Executive Officer of the Institute of Quarrying Australia (IQA) as an insider researcher. The purpose of the study was to undertake an analysis of the Australian Quarrying Industry's strategy-level leadership, conduct a futures analysis and develop scenarios of the Australian Quarrying Industry by 2029 (10-year horizon). The study is based on the core premise that current leader capabilities shape the future of the industry as determined by the strategic leadership theory (Finkelstein & Hambrick, 1996; Hambrick, 2007). Strategic Leadership Theory states that the characteristics and abilities of leaders are indicative of how an industry will evolve and serve as proxies for predicting the industry's future state. Combined with an environmental scan (PESTEEL analysis), Delphi study and scenario development model, the study combines mainstream leadership theory with the futures studies methodologies associated with scenario development.

The study provided an opportunity to i) design a rigorous research methodology (Ch3) based on a review of the literature (Ch2), ii) measure industry leader capabilities associated with strategic decision making (Ch4), iii) assess stakeholder's perspectives and validate insights gained from the survey (Ch4), iv) analyse the industry's current operating environment, trends, drivers, and wild cards (Ch5), and v) develop scenarios of the Australian Quarrying industry by 2029. Based on the research insights the evidence was used to inform a work-based project and study artefact in the form of an educational blueprint (Australian Academy of Quarrying) that is aimed at developing capabilities that are aligned with the "SMART Quarrying" scenario (Ch6).

Chapter 7 (Conclusion) will provide conclusions related to the study's research findings, the study's contributions to knowledge and practice, the study's limitations and suggestions for future research.

8.2 Research findings

The study was based on a line of enquiry informed by the overarching research question; *What are the possible futures of the Australian Quarrying Industry by 2029?*

In order to answer the overarching research question two sub-questions needed to be addressed:

Sub-Research Question 1.1: What are the drivers of the future that are associated with the futures of the Australian Quarrying Industry? Quarrying Industry and how may they reflect the possible futures of the industry?

Sub-Research Question 1.2: What are the foresight and strategic thinking capabilities of current strategy-level leaders in the Australian

The study integrated the establishment of a baseline measurement of industry leaders' foresight and strategic thinking capabilities with a traditional futures studies methodological approach to develop scenarios (environmental scan and Delphi study). This approach is unconventional but, it is argued, adds academic rigor to the study by including the compelling Strategic Leadership Theory from mainstream management literature to the scenario development approach.

8.2.1 Sub-Research Question 1.2: What are the drivers of the future that are associated with the futures of the Australian Quarrying Industry?

Phase one of the study included a Delphi study with senior industry experts on the panel. The panel identified the drivers (forces of change), trends (linear change) and possible wild cards (low likelihood high impact events) associated with the future of the Australian quarrying industry and b) identified the challenges, enablers, priorities and obstacles associated with a strategic response to what was termed "Smart Quarrying". These were presented to a conference of industry leaders and broadly endorsed.

In summary, the following key drivers / trends / wildcards were identified by the Delphi panel of experts and validated / expanded upon by the PESTEEL analysis:

- Political perceptions.

- Changes in government.
- Community perceptions.
- Economic growth.
- Availability of quarry products near market.
- Infrastructure spend.
- Workforce health and safety.
- Resistance to change.
- Innovation.
- Automation.
- New technologies.
- Environmental politics.
- Rehabilitation.
- Ethical practice.
- Unethical practice.
- Corporate greed.
- Regulations.
- Unemployment.
- Community expectations.
- New materials.

8.2.2 Sub-Research Question 1.1: What are the foresight and strategic thinking capabilities of current strategy-level leaders in the Australian Quarrying Industry and how may they reflect the possible futures of the industry?

The foresight capability of leaders has previously been operationalised and validated by van der Laan (2010) as a latent variable made up of leaders' orientation to time and foresight styles. The results suggested that the leaders of the Australian quarrying industry had a dominant orientation to the present. Present-oriented leaders typically spend little time thinking about the future and how the future may evolve. Such leaders are described as predominantly concerned with short-term concerns and outcomes. The back-up orientation was to the future suggesting that where possible, leaders recognise that longer term considerations are important. Similarly, the leaders had a dominant foresight style of 'adapter'. This style suggests that leaders respond to issues emerging in the (immediate) future by placing an emphasis on being adaptable

to changing conditions. They change as what they see as demanded by the future rather than a long-term outlook. Improvements that they make have short-term rather than long-term implications.

The strategic thinking capabilities of leaders indicate a dominant orientation to analytical thinking. Their strategic decisions are based interpreting past data and analytical projections usually on a supply and demand basis. They show significantly less attention to basing their strategic decisions on conceptualisations of what is possible and generating new ideas and innovations. As a result, it is likely that leaders perceive the future in terms of what is probable as an extension of the past instead of creating new spaces of strategic opportunity despite their operational environment indicating that access to quarrying resources are declining and are limited.

8.2.3 What are the possible futures of the Australian Quarrying Industry by 2029?

The main research question was answered in the form of a set of scenarios that illustrated an expanded view of possible futures. The scenarios do not serve to predict the industry's future but rather expand the range of possibilities that can feasibly take place. The scenarios were developed based on the conclusions of the research sub-questions (sections 8.2.1 and 8.2.2 above). Following a traditional matrix approach to developing scenarios (on control and certainty axes) the drivers, trends and wild cards were designated the extent to which they likely to occur and the extent to which the industry has control over the futures of these event. The matrix was adjusted in terms of changes in control and the level of impact the change would have on the industry to develop a set of three scenarios.

Scenario 1: "Same future, same industry". This is the probable future scenario for the industry based on current trends (see full description in Section 6.3). By 2029 the Australian quarrying industry is typified by leaders that are predominantly orientated to the present and optimising day to day operations. They have a view of the future and know it is important but fail to action this orientation. They adopt a primarily adaptive style of viewing the future. This is dominated by a focus on optimising current productivity, profit margins and problem solving as the situation demands it. They promote but fail to realise innovation due to limited board-approved investment in research and development.

Quarrying leaders predominantly believe that the future will not change dramatically, and that change will be linear. They do not envision an industry that will be very different. Despite these general characteristics there is evidence that industry leaders are becoming more proactive. The leaders are starting to be open to experimentation and risk-taking and are encouraging innovation among their employees.

Quarrying remains a conservative industry. They are typified by business-as-usual approaches driven by supply and demand and an old industry culture. Social and environmental impacts continue to be a problem for securing and maintaining social license. Leaders fail to address these ongoing environmental concerns and do not adequately change public and governmental perceptions.

A combination of perceived conservative industry culture, traditional extractive industry techniques and a negative public perception detract from industry efforts to attract talent.

The national economic performance is stable suggesting that the "Same future, same industry" quarrying industry is sustainable but under pressure. There is increased vulnerability to discontinuous changes in the operating environment.

The Australian quarrying industry remains overregulated due to instances of poor health and safety records and unethical practice. The industry is generally not trusted. Due to increasing vulnerability to market conditions, small quarrying operators increasingly go into administration or are purchased at lower than market value by large corporate operators.

Scenario 2: "Involuntary administration". This scenario represents a deterioration of market conditions, the high impact of unlikely events occurring and leadership that by 2029 the Australian quarrying industry is typified by leaders that are predominantly orientated to the past. The leaders rely on the successes of the past and generally believe that the same patterns of business cycles will repeat. They overwhelmingly focus on optimising day to day operations in the present. They adopt a primarily reactive style of viewing the future and back this approach up by aiming to adapt to conditions as they occur. Their future orientation is limited by believing that the future cannot be anticipated due to rapid and discontinuous change. Stakeholder expectations for short-term returns further limit their orientation to the future. Their strategic decisions are primarily based on analytical projections of budget, supply,

demand, and short-term profit targets based on zero-based budgets and percentage growth ambitions.

The quarrying industry of 2029 remains conservative and somewhat isolated from other related industries. It is typified by traditional leadership as represented by the 'hard men' of the industry. Organisational change is guided by a stubborn conservative culture and organisational change is only achieved through crisis.

There are widespread negative public and regulatory perspectives of the industry by 2029. These are based on the perceived greed and exploitative nature of quarries. They are viewed as a 'bad tenant' that cannot be trusted. Public demands to limit environmental permits for quarrying grow due to sub-standard practices.

The industry fails to respond strategically and as a result the supply of quarrying product reduces driving up prices putting smaller operators under market pressure by the large corporates. Prices are driven up with the effect that government infrastructure project reduce dramatically. Media reports of industry mal-practices, environmental concerns, safety concerns and conflict with communities are unprecedented.

There has been a significant rise in quarry acquisitions with smaller quarry operations being taken over by large, well-funded competitors shaping an industry monopoly. This monopoly has created an absence of competition, which has led to high costs for consumers, inferior products, and unethical behaviours. There has been a dramatic increase in workplace accidents and deaths due to poor workplace health and safety practices.

Involuntary Administration leaders remain reactive without the capabilities to respond to the increasingly apparent industry troubles and deteriorating reputation. The leaders lack control of their projects, their people, and their business results. Their quarries lack proactive and progressive policies and procedures and are characterised by making on-the-spot decisions that reflect inconsistent, defensive, and incoherent decisions. Experienced leaders with future-orientated capabilities exit the industry. The Australian quarrying industry shifts from being an international industry benchmark and is typified by the forced closure of small operators and the dominance and monopoly of a few corporates.

Scenario 3: "Smart Quarrying". By 2029 the Australian quarrying industry is typified by its future-orientated, trusted, and progressive leaders. They do not depend on the successes of the past and generally believe that the future of the industry can be shaped and holds many opportunities. They prioritise attracting leading talent and create enabling environments that not only optimise sound operational management but promote ongoing and dynamic strategic conversations. They are influential and able to manage stakeholder expectations in relation to their accountability, financial performance, and corporate citizenship. The leaders have reconceived the Australian quarrying 'story' and actively collaborate with industry partners and competitors.

Sustainable development of business interests and environmental considerations are a priority. Corporate planning is aligned to commercial objectives with sustainability goals. Governments, communities, and quarries are increasingly collaborating on landscape approaches to land management, with Artificial Intelligence helping efficiently apportion the use of resources in order to ensure the efficient use and conservation of critical resources

Larger quarries have engaged closely with a range of non-traditional suppliers and their technologies to enable a 'Whole of Life Quarrying' practice. The innovations of the quarrying industry are globally endorsed and recognised and have influenced a transformation of other industries in sustainability practices. The Australian Quarrying Industry becomes the world leader in quarry closure management that goes beyond remediation to regeneration.

Although many traditional quarrying operators' jobs have been automated, many new jobs have been created to manage automated practices. Industry-wide talent development programmes actively enhance industry professional development resulting in measurable improvement in workforce capabilities.

Particularly valuable on a Smart quarrying quarry site is the ability to orchestrate assemblages of human and machine intelligence to draw upon the best that both people and machines have to offer.

Associated with sustainable environmental practices, public participation, and the building of trust the industry recognises the importance of investment in further developing advanced workplace health and safety initiatives. The absence of

significant quarrying related deaths and accidents is officially recognised by regulators and commended.

The public want quarry products that have been ethically sourced, produced in a way that positively benefits people and the environment and designed for recycling and the industry meets most of the expectations through meaningful collaboration.

Intense global effort has gone into hastening the energy transition. Cheap decentralised alternative energy sources including highly effective battery technology have allowed quarries to provide for their own power. Quarries have moved to electric vehicles and machinery.

Leaders are actively developing a medium to long-term outlook and planning. They have a high tolerance for ambiguity, have developed contingency plans for possible negative events while and actively generate alternative ideas to current trajectories.

In summary, the study has presented evidence that first responded to the research sub-questions in order to arrive at a response to the overarching research question. As noted in Chapter 2 reported research in the quarrying industry worldwide is very rare. It is suggested that a) as an exploratory study, the research findings address this issue and b) provides empirically justifiable conclusions that may inform future research. This research, however, is subject to several limitations."

8.3 Limitations of the study

The aim of this work-based research study was to conduct a rigorous empirical study and futures analysis of the futures of the Australian quarrying industry by 2029. The outcome of the study included empirical evidence related to industry leadership (Chapter 4), identifying and validating industry trends, drivers of change and wildcards (Chapters 4 and 5) in developing the scenarios (Chapter 6) and a work-based project (Chapter 7) referred to as "SMART Quarrying".

The exploratory study was underpinned by a sequential mixed methods research design in order to culminate in an evidence-based industry outlook and unique knowledge contribution to professional practice. It is suggested that based on the data collected the evidence informing the development of the outcomes is compelling.

Nonetheless, these results must be interpreted with caution and a number of limitations should be borne in mind.

- *Futures Studies.* There is no such thing as a future fact. As such all studies of the future have the limitation that they cannot be empirically confirmed. Rather, such studies seek not to predict the future but to present possible outcomes in the future that represent a scope of feasible possibilities based on empirical evidence in the past and present. Such evidence may be in the form of projections of historical data (trends), drivers of change that have face validity and early manifestations (weak signals) of significant events. As such, the possible futures presented in Chapter 6 (Scenarios) are extrapolations of the past and present. That said, this study has sought to include rigorous qualitative and quantitative methods to establish an empirical foundation for these extrapolations.
- *Theory.* The primary limitation relates to the contribution to theory and generalizability of the findings. While the scope and aim of the study was to address a gap in the literature regarding the lack of research related to quarrying industries, theoretical conclusions could not be derived from the study as to the industry itself. As such, while the study is justifiably exploratory, further research is required to confirm the insights as justification of theoretical advancement.
- *Sampling.* Even though the sampling was purposive and aimed at certain criteria for inclusion, it cannot be deduced that the sample is representative of the population of interest (senior leaders in the quarrying industry). It is possible that there are senior leaders of the industry that are not associated with the Institute of Quarrying Australia. It is likely that an element of selection bias is present although it is suggested that for the exploratory nature of this study, these are justified. Both the membership of the Delphi panel and survey respondents originate from all the Australian states and territories and as such the selection bias is not geographic or at the requisite levels of leadership of interest. Rather the selection bias is due to the potential that the IQA membership and lack of random sampling therein limit the generalizability of the findings.

- *Sample size.* Sample sizes are important to a) achieve a sample that is representative of the population of interest, and b) conduct certain statistical analysis methods. Even though the sample size of the Delphi study experts (n=14) was adequate, the survey response of n=41 was of a limited size affecting the degree to which the sample is representative of the population. Recruiting survey participants in senior / executive leadership cohorts is difficult (Baruch & Holtom, 2008). Leaders typically have a lack of time and already suffer survey fatigue. The sample size was adequate to include correlation analysis (population size=400, confidence interval of 14 at the confidence level of 0.95). However, it fell short of further multivariate analysis techniques such as factor analysis and regression analysis.
- *Bias.* Work-based research often benefits from the close proximity of the researcher to the phenomenon of interest. In this study the researcher is regarded as an 'insider researcher'. There are numerous benefits to this including being able to gain a depth of meaning, being familiar with the history of the phenomenon, understanding the practice associated with the phenomenon and contributing professional expertise in the interpretation of results. A drawback of being an insider research is that the researcher having biased views due to their perspectives of certain phenomena. This can affect a study's legitimacy. It is possible that the study included bias toward only supporting their arguments. Section 3.4 indicated the awareness of this possible limitation and set out steps that were included in the methodology to address this. The Delphi study and leadership survey outcomes limited the possibility of bias. As such the empirical results supporting the development of the scenarios were sound. However, the focus of the environmental scane and development of the scenarios may include researcher bias. It is proposed that despite this, the benefits gained by having the researcher as an industry expert in identifying critical environmental scanning perspectives and developing the scenarios outweighed the effects of bias.

The study's findings include the limitations outlined above. It is proposed that future research includes addressing these limitations when addressing explanatory or confirmatory studies associated with this study. These may include increasing the sample size, including the perspectives of a broader range of stakeholders, testing the

results of the leadership survey, triangulating the environmental scan and Delphi results, and adopting the position of the researcher as an 'outsider researcher'. While these limitations do affect the findings presented by the thesis, it is proposed that certain compelling contributions have been made.

8.4 Contributions

Work-based research is pragmatic by nature. The Doctor of Professional Studies (DPRS) program is focused on making an original knowledge contribution to professional practice as specified in the Australian Qualifications Framework. However, it also seeks to make contributions to the researcher's development as a scholarly professional and extant theory if this can be justified by the evidence presented.

The point of departure of work-based research is to be problem focused with the intention of adopting a pragmatism perspective. Pragmatism suggests a mixed methods research design combining both the depth of meaning gained by qualitative enquiry and the breadth of empirical insights gained from using quantitative statistical analysis. The intention of this study was to present a) empirical findings measuring the foresight and strategic thinking capabilities profiles of Australian Quarrying leaders, b) conduct an environmental scan and Delphi study identifying trends, drivers and wild cards associated with the Australian Quarrying industry, and c) develop a set of scenarios illustrating the scope of possibility of the Australian Quarrying industry's futures. In order to achieve these outcomes the study utilised scenario methodology which included a Delphi Study and PESTE(E)L analysis.

The study also justified the inclusion of Strategic Leadership Theory in developing the scenarios. The theory asserts that the cognitions and values of leaders are reflected in organisations / industries and how they evolve into the future. By using measures of leaders' foresight and strategic thinking capabilities as proxies suggested by the theory, the futures of the industry can be extrapolated. It is proposed that by adding this approach to traditional scenario methodology the study has added rigor to the scenario method as meaningful and useful in informing industry decision making.

The following contributions, in particular have been made by the study:

8.4.1 Contribution to professional practice

Being a work-based research study, the usefulness of this project is in transforming the research, academic, and theoretical contributions in to usable, practical, and applied outcomes. This study was borne out of the need to provide an evidence-based insight as to the future potential of the Australian quarrying industry as compared to its current practice and trajectories. The study sought to inform industry leaders of the key characteristics of a broad scope of possible futures and how they may relate to current operating conditions. As an insider researcher and senior industry leader with a broad overview across all states, the researcher was well positioned to conduct this research and contribute to industry decision making and professional practice.

8.4.1.1 Decision making.

The study is proposed to have made the following original knowledge contributions that inform decision making:

At both industry and organizational level, the results of the leadership profiles provide an industry benchmark. The profiles, while subject to the limitations discussed in section 8.3, suggest certain focused areas of leader capability development that would enable a greater futures thinking capability and potentially better strategy. This has the potential to inform industry standards and differentiation.

The Delphi study and PEST(E)L analysis of the industry operating environment has not conclusively been reported before. The rigor of the environmental scanning process and triangulation with industry leadership perspective representative of all Australian states and territories provides an unprecedented source of information upon which the industry can inform its professional practice and future direction. The results provide a holistic system orientated view of the industry with some insights not traditionally in the scope of industry decision makers.

The set of scenarios describing the possible futures of the industry is arguably a valuable decision-making roadmap for leaders. Confidence in its findings and its link to what leader capabilities are needed have been clearly identified and can arguably inform strategic decisions at both the organizational and industry levels.

8.4.1.2 Professional practice.

- The Delphi study and PESTE(E)L analysis of the industry operating environment has not conclusively been reported before. The rigor of the environmental scanning process and triangulation with industry leadership perspective representative of all Australian states and territories provides an unprecedented source of information upon which the industry can inform its professional practice and future direction.
- The study artefact, the "SMART Quarrying" blueprint for the Australian Academy of Quarrying is an evidence-based talent development concept aligned with the study outcomes and could be operationalized as part of the industry's aims to achieve a preferable future.
- The study includes a focus on ethical considerations and beneficence. The Environmental scan and Delphi study discussed that to date there has been a dearth of content providing ethical practice guidelines. This current research addresses the long-term implications of unethical professional practice.
- The work-based study is educational in nature. It is interesting to have noted that in undertaking and participation in the study itself has contributed to increased knowledge of others. Feedback from the Delphi and survey participants indicated that simply reading the questions of the posed by the study and in its instruments increased awareness. Further, the study outcomes (leaders profiles, environmental scan, scenarios and work-based project artefact) may provide a means of initial discussion and education. The study also provides practical guidance on industry baseline vulnerability and potential areas requiring proactive intervention.

8.4.2 Contribution to theory

It was noted that research in the quarrying industry context is rare globally. To the knowledge of the researcher, a futures analysis of the industry has not been conducted previously. The methodological approach adopted by the study further provides a foundation for further studies. The inclusion of the Strategic Leadership Theory and application of the measures of the latent variables of foresight and strategic thinking capabilities is also unprecedented, not only in the industry context of this study but more broadly. As such, while the purpose of the study was to make an original

knowledge contribution to professional practice the following contributions to theory were also made:

- *Gap in context.* A literature review of research specifically conducted in the quarrying industry yielded minimal results. As such, the knowledge associated with this industry is rare especially as it relates to the a) leadership of the industry b) operational environment of the industry including political, economic, social, technological, environmental ethical and legislative dimensions of the environment.
- *Theory: Leader Capabilities.* The notion of competence is broadly used in both practice and theory. However, there is agreement that competence (abilities associated with pre-defined tasks) does not adequately capture the dynamic nature of leadership and the unexpected tasks and situations that leaders are required to respond to. As such the notion of leader capabilities has emerged as a key area of research. This study acknowledged that the breadth and number of such capabilities is expansive. However, it suggests that based on the decision making, vision setting and strategic nature of leadership, the capabilities most closely associated with effective direction setting are foresight and strategic thinking. This study demonstrates and provides evidence of the utility in using these constructs to determine the effect of leadership on the futures of organisations and industries.
- *Method: PESTEEL Analysis.* Since the Global Financial Crisis ethics in business leadership was recognized as a critical dimension of the industry's impact on the political, societal, economic, environmental and legislative conditions of local, national and international communities. It was proposed that the ethics of leaders and the industry would have an important impact on its future. As such the traditional PESTLE or PESTEL frameworks of analysis was expanded to include the ethics of leaders and the industry. The results provided a valuable insight to the operational reality of the quarrying industry. It is proposed that future studies of the industry, in fact all industries should include the 'ethics' dimension in an environmental scan.
- *Method: Application of Strategic Leadership Theory.* The use of Strategic Leadership Theory in using proxies of leader cognitions and abilities have been limited to the use of demographic proxies (Hambrick, 2007). However,

in order to more closely associate leaders cognitions and abilities as reflected by the organization and its futures, the study proposed that focusing on capabilities most closely associated with strategy making would yield valuable insights. This exploratory study demonstrates the utility and potential value of applying Strategic Leadership Theory in terms of cognitive abilities at individual, organizational and industry levels.

8.4.3 Method: Futures Studies.

Futures Studies methods are typically qualitative. With the exception of regression forecast based on historical data pointing toward probable futures, the other methods largely depend on the discernment of the researcher or group of participants. As such the field is typically aligned with a constructivist perspective of meaning making and the establishment of truth. This has been a strength of the field and also a criticism. Despite not being aimed at prediction and certain measure to triangulate assumptions and judgements, the field is both a science and an art. Ths is especially true in the case of developing scenarios. I is proposed that by adding a further indicator of possible futures in the form of Strategic Leadership Theory, the scientific rigor of futures methods, especially the scenario method, is enhanced. The study concludes by suggesting that this test application of this in the current study builds on the foundations of a new theory referred to as Futures Leadership Theory. Additional studies are applying the core tenets of this approach in different contexts.

8.4.4 Suggestions for future research

Based upon the findings of this study and having taken its limitations and purpose into account the following future studies are proposed:

a) Studies explaining the findings within certain aspects of the quarrying industry such as topics associated with human resources, technology application and development, environmental management, strategy, health and safety and similar others.
b) Studies confirming, expanding or rejecting the findings of this study.
c) Further measurement of the foresight and strategic thinking capabilities of leaders across a larger more representative sample.
d) Utilising the methodology adopted by this study in other industry and organizational contexts.

e) Building on this study to advance Strategic Leadership Theory development.
f) Studies that further validate and test the reliability of the instruments used in this study.

8.5 Conclusion

Little is publicly known about the Australian quarrying industry and quarrying industries globally. They are assumed to resemble the mining industry and in many respects they do. But it would be a false assumption that knowledge derived from the mining industry is directly transferable to the quarrying industry. Many nuanced differences exist at the business model, practice, operational, corporate and leadership levels. This study sought, at the outset to make a meaningful contribution to the professional practice of quarrying in Australia and more broadly. It sought to address the gap in the literature related to the reporting of rigorous empirical research on the industry. Further, it sought to describe the possible ways and outcomes of how the futures of the industry may evolve on a 10-year horizon. It also sought to establish a baseline profile of the industry leaders that can be used in further studies but more importantly in informing future industry leader development. The study culminated in developing a blueprint articulating educational services in the form of an academy that can be used by the industry as a strategic initiative.

Having taken the significant limitations of the study into account, the contributions and suggestions for future research provide a basis upon which this study can inform future research efforts in the industry.

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APPENDICES

APPENDIX 1 - ETHICS APPROVAL LETTER

OFFICE OF RESEARCH
Human Research Ethics Committee
PHONE +61 7 4631 2690| FAX +61 7 4631 5555
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UNIVERSITY OF SOUTHERN QUEENSLAND

6 April 2018

Mr Paul Sutton

Dear Paul

The USQ Human Research Ethics Committee has recently reviewed your responses to the conditions placed upon the ethical approval for the project outlined below. Your proposal is now deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* and full ethical approval has been granted.

Approval No.	H18REA070
Project Title	Australian quarrying futures: An evaluation of strategic thinking and foresight capabilities of strategy level leaders
Approval date	6 April 2018
Expiry date	6 April 2021
Status	**Approved with standard conditions**

The standard conditions of this approval are:

(a) responsibly conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal;
(b) advise the University (email: ResearchIntegrity@usq.edu.au) immediately of any complaint pertaining to the conduct of the research or any other issues in relation to the project which may warrant review of the ethical approval of the project;
(c) promptly report any adverse events or unexpected outcomes to the University (email: ResearchIntegrity@usq.edu.au) and take prompt action to deal with any unexpected risks;
(d) make submission for any amendments to the project and obtain approval prior to implementing such changes;
(e) provide a progress 'milestone report' when requested and at least for every year of approval;
(f) provide a final 'milestone report' when the project is complete;
(g) promptly advise the University if the project has been discontinued, using a final 'milestone report'.

For (d) to (g) forms are available on the USQ ethics website:

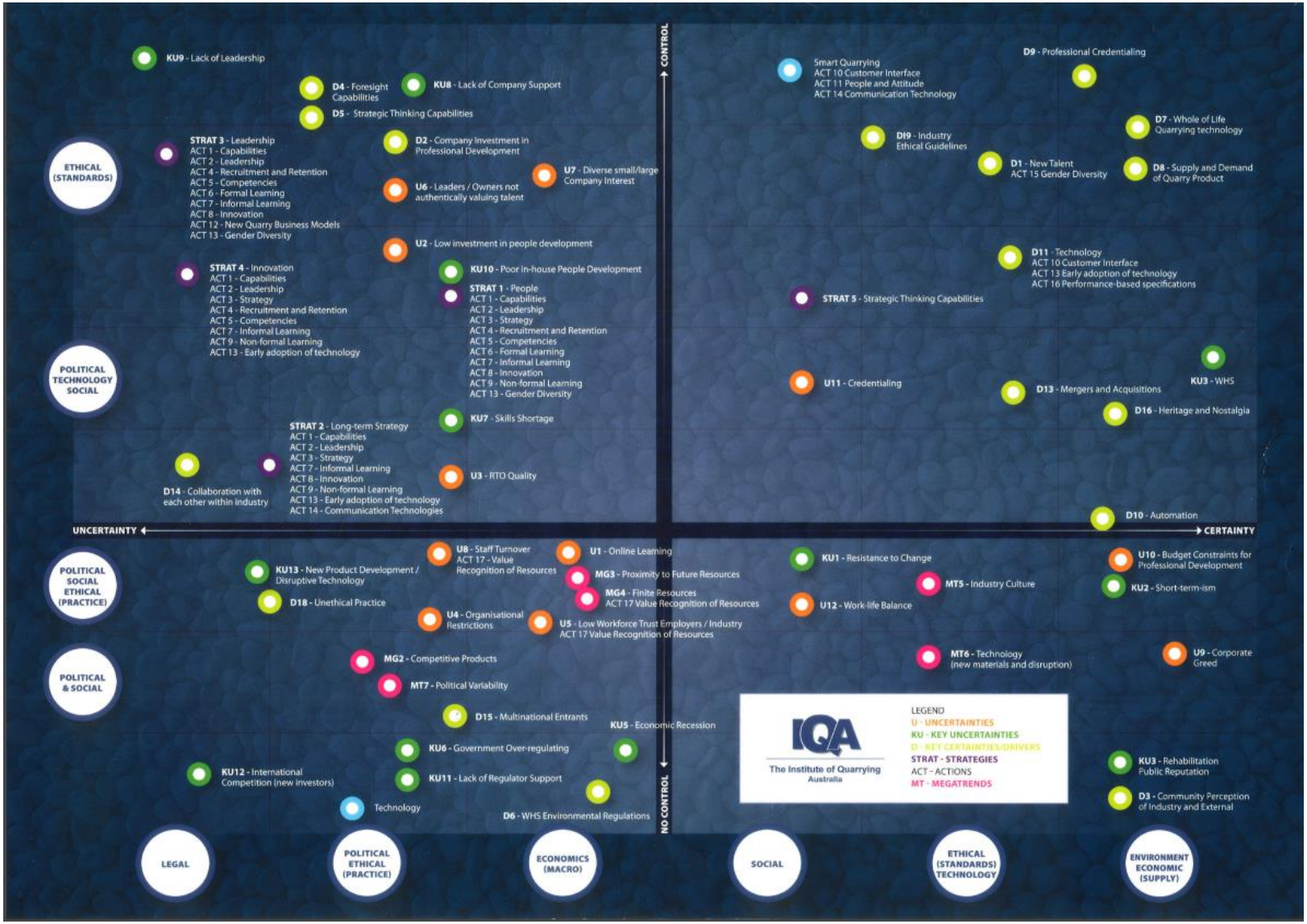
https://www.usq.edu.au/current-students/academic/higher-degree-by-research-students/conducting-research/human-ethics/forms-resources

Please note that failure to comply with the conditions of approval and the *National Statement (2007)*, may result in withdrawal of approval for the project.

Yours sincerely,

Mrs Nikita Kok
Ethics Officer

APPENDIX 2 CERTAINTY CONTROL MATRIX



APPENDIX 3 ROUND 1 DELPHI

SMART QUARRYING

Today's foresight…..
tomorrow's global advantage

The purpose of the *SMART QUARRYING* research and development project is to develop a fit-for-future Capability and Competency Development Models to ensure Quarry Managers have the necessary knowledge, skills and experience to ensure professional practice efficacy to meet legislative, workplace health and safety, productivity and profitability requirements.

The Australian Quarrying Industry has been under increasing pressure to introduce fundamental changes in business practices given the ongoing rollout of state-based Acts and Regulations. The industry has also had to respond to increasingly stringent local authorities' requirements on consents for both new and existing sites. Further pressure for change has come from the environmental and sustainability agenda. At the same time, the industry has found it increasingly difficult to attract young people into the industry even though it has made significant efforts to maintain a positive profile.

The project will use the Delphi Method to gather expert opinion in order to determine factors that are relevant to *SMART QUARRYING*. This information will then be used to develop an online organizational assessment survey, which will be piloted and validated.

Smart Quarrying Delphi Method v0.2
Paul Sutton

What is The Delphi Method?

The Delphi method seeks to synthesise contributions from a panel of experts aimed at addressing a clearly stated problem. Panel members respond to semi-structured questions, in this case via email. The primary researcher is responsible for the collation and distillation of responses, by processing the information and filtering out irrelevant content. This avoids the negative effects of face-to-face panel discussions and solves the usual problems of group dynamics. It also protects the identity of participants.

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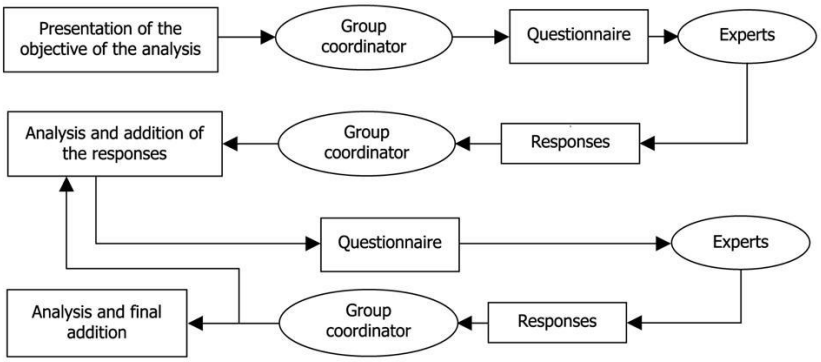

Source: Adapted from Landeta (1999)

Question 1

What is going to achieve SMART QUARRYING?

1A. The following words appear in the associated literature related to contemporary quarrying. Please rank from highest (1) to lowest (12) these key words to define *SMART QUARRYING* in the IQA context.

Key Words	**Rank from Highest (1) to Lowest (12)**
Continuous Professional Development	☐
Innovation	☐
Leadership	☐
Management	☐
Short-term strategy	☐
Long-term strategy	☐
People	☐
Culture	☐
Industry	☐
Efficiency	☐
Effectiveness	☐
Hard work	☐

1B. Please provide a definition/description and/or additional words explaining what *SMART QUARRYING* means to you that has not featured in the list above.

QUESTION 2

What factors do you consider INCREASE the likelihood of SMART QUARRYING?

2A. Previous studies provide insight on factors which may increase the likelihood of improving the quarrying industry. In addition, the following are current factors we are aware of through our February 2016 workshop. Please rate to what extent you agree or disagree that these factors contribute to increasing the likelihood of *SMART QUARRYING*.

Also, please highlight, in the last column, those factors from the first column that you believe are most critical or add your own that do not appear in column 1, in the last column.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Critical Factors
INDIVIDUAL FACTORS						
Example: Professional efficacy, credentialing, continuous professional development, research development and innovation	☐	☐	☐	☒	☐	Professional efficacy, innovation (important from column 1) and leadership (not in column 1)
Internal Professional efficacy, credentialing, continuous professional development, research development and innovation	☐	☒	☐	☐	☐	
External Imported overseas talent, talent from other Australian industries	☐	☐	☐	☐	☐	

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Critical Factors
ORGANISATIONAL FACTORS *Internal* Management, leadership, structure, new capabilities, new technologies	☐	☐	☐	☐	☐	
External Legislation, politics, economy, social, technical, ethical, environmental	☐	☐	☐	☐	☐	

2B. In this rapidly changing environment there might be emerging factors and we want to capture them. Please provide any further factors that you consider *increase* the likelihood of *SMART QUARRYING in the industry*.

QUESTION 3

What factors do you consider DECREASE the likelihood of SMART QUARRYING?

3A: Previous studies provide insight on factors which may decrease the likelihood of improving the quarrying industry. In addition, the following are current factors we are aware of through our February 2016 workshop. Please rate to what extent you agree or disagree that these factors contribute to decreasing the likelihood of *SMART QUARRYING*.

Also, please highlight, in the last column, those factors from the first column that you believe are most critical or add your own that do not appear in column 1, in the last column.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	Critical Factors
INDIVIDUAL FACTORS *Internal* Professional efficacy, credentialing, continuous professional development, research development and innovation	☐	☐	☐	☐	☐	
External Imported overseas talent, talent from other Australian industries	☐	☐	☐	☐	☐	
ORGANISATIONAL FACTORS *Internal* Management, leadership, structure, new capabilities, new technologies	☐	☐	☐	☐	☐	
External Legislation, politics, economy, social, technical, ethical, environmental	☐	☐	☐	☐	☐	

3B: Please provide any further factors or capabilities that you consider *decrease* the likelihood of achieving *SMART QUARRYING*.

QUESTION 4

4A: What approaches contribute to *Professional Efficacy?*

Please rank from highest (1) to lowest (10).

Approaches	Rank from Highest (1) to Lowest (10)	Comments
Professional Capabilities	☐	
Effective and Safe Professionals	☐	
Professional Credentialing	☐	
Confident and Resilient Professionals	☐	
Continuous Professional Development	☐	
Insightful and Trusted Professionals	☐	
Mentoring	☐	
Coaching	☐	
Performance Appraisals	☐	
Internship Programs	☐	

4B: Given your experience, please list any further **factors** that you consider *increase* the likelihood of achieving *professional efficacy*.

4C: Based on your experience, please list any further **factors** that you consider could *decrease* the likelihood of achieving *professional efficacy*.

QUESTION 5

Please rate to what extent you agree or disagree that the following may *increase* the likelihood of *Professional Efficacy*.

	Strongly Disagree	**Disagree**	**Neither Agree or Disagree**	**Agree**	**Strongly Agree**	**Comments (optional)**
Formal Education	☒	☐	☐	☐	☐	
Informal Education	☐	☐	☐	☐	☐	
Non Formal Education	☐	☐	☐	☐	☐	

QUESTION 6

6A: What in the future will shape the Australian Quarrying Industry?

6B: What in the Australian Quarrying Industry's present will continue into the future?

6C: What in the past will shape the future or hold back the Australian Quarrying Industry?

QUESTION 7

7A: Please cross the relevant boxes and describe what the Australian Quarrying Industry has **full** control of?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

7B: Please cross the relevant boxes and describe what the Australian Quarrying Industry has **more** control of?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

7C: Please cross the relevant boxes and describe what the Australian Quarrying Industry have **less** control of?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

7D: Please cross the relevant boxes and describe what the Australian Quarrying Industry have **no** control of?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

QUESTION 8

8A: What is **certain** about the future of the Australian Quarrying Industry?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

8B: What is **not certain** about the future of the Australian Quarrying Industry?

☐ Political	
☐ Economic	
☐ Social	
☐ Technological	
☐ Legal	
☐ Environmental	
☐ Ethical	

QUESTION 9

Are there any further considerations you wish to describe related to the ***professionalization*** of the quarrying industry?	

QUESTION 10

Are there any further considerations you wish to describe related to the ***future*** of the quarrying industry?	

QUESTION 11

Where/what in the industry needs the most innovation? e.g. business models, technologies etc	

APPENDIX 4 ROUND 2 DELPHI

SMART QUARRYING

Today's foresight…..
tomorrow's global advantage

ROUND 2

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CONFIDENTIAL

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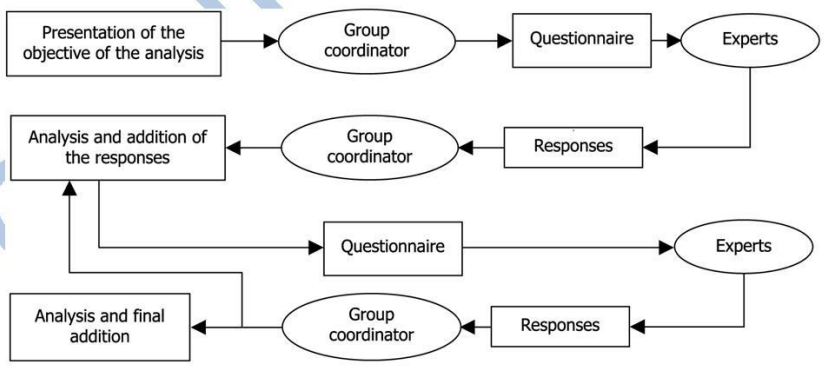

Source: Adapted from Landeta (1999)

CONFIDENTIAL

In Round 1, the panel was asked: *What is going to achieve SMART QUARRYING?*

Only the top five (5) responses from the panel were calculated. Across the panel there was consensus that *people*, *leadership* and *the culture of the industry* were most important in achieving SMART QUARRYING. These were followed by an average to high consensus that *long term strategy* and *innovation* would drive SMART QUARRYING.

Two panel responses did not reach consensus with the rest of the panel. The dissenting view was that *leadership* and *long-term strategy* were most critical with *people* rated in the last quartile of importance.

TASK 1: Please rank from highest (1) to lowest (5) these key words to define *SMART QUARRYING* in the Institute of Quarrying Australia context.

Key Words	**Rank from Highest (1) to Lowest (5)**
Innovation	
Leadership	
Long-term strategy	
People	
Culture	

Generally, there was strong agreement on the key words associated with describing SMART QUARRYING. These have been assimilated into the descriptions below.

SMART QUARRYING was described by the panel as primarily being future- and people-orientated in order to develop a sustainable industry for the future while maintaining good stewardship of natural resources. It was noted that collaboration with customers and other stakeholders would develop new value previously untapped by the industry. The ways in which this is to be achieved was described as primarily being strategically ambidextrous (short-term, strategic exploitation; long-term strategic exploration), highly innovative and focused on developing and retaining talent that over time transforms the industry culture and perceptions of the industry. It was noted as important to exceed customer expectations and embrace change.

TASK 2: I would like to explore to what degree the panel agrees with the descriptions above. Please indicate any words that should be removed or added.

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Referring to the description above, a number of responses indicated the ways in which SMART QUARRYING can be achieved.

TASK 3: Please rank the panel-identified ways in which SMART QUARRYING can be achieved by using **LOW – MEDIUM – HIGH** indicators.

Ways in which SMART QUARRTYING can be achieved	**Description**	**Your Ranking**
Informal learning	On the job learning	
Formal learning	VET or Higher Education, professional development courses	
Competencies	Skills that meet tasks	
Capabilities	Future orientated capacity leading to innovation and sustainability	
Non-formal learning	Conferences, workshops	
Leadership	e.g. leadership development, leader collaboration.	
Talent recruitment and retention	Purposeful people orientated activities to increase industry talent	
Innovation	New or repurposed ideas that increase value	
Strategy	Ability to purposefully exploit short-term opportunities and map long-term direction	

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In Round 1, the panel was asked: *What factors do you consider increase the likelihood of SMART QUARRYING success (ENABLERS)*?

Members of the panel suggested that in addition to rapid change in the operational environment, (a) reducing margins; (b) decreasing talent availability; (c) negative perception of industry in the community and (d) increased pressure to adopt new/advanced technologies all contribute to the need for the SMART QUARRYING initiative.

In Round 1, the panel was asked to identify additional factors that would increase the likelihood of *SMART QUARRYING in the industry*. In response the panel listed that the following additional factors that would increase the likelihood of the success of the SMART QUARRYING initiative (ENABLERS).

The additional enablers identified by the panel are:

- Innovation – incremental and radical industry ideas
- Institute of Quarrying Australia leadership – futures orientated and strategic thinking
- Enhanced career profile – communication of talent expertise and best practice
- Whole of life quarrying
- Functional experts – industry developed expertise
- Consistent education – refined educational pathways
- Global connectivity – engaged connectivity in the digital environment
- Collaboration – co-creation of value
- Improved OH&S statistics

TASK 4: If you disagree with any of the above additional enablers (if so, please list) and/or would like to add to the list of enablers, please do so in the text box below?

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In Round 1, the panel was asked: *What factors do you consider DECREASE the likelihood of SMART QUARRYING (OBSTACLES)?*

Members of the panel suggested that in addition to an industry culture resistant to change due to traditional views and short-term profit interests, the pressure of consistent WH&S statistics and rehabilitation reputation will continue to decrease the industry's ability to self-regulate.

In Round 1, the panel was asked to identify additional factors that would decrease the likelihood of *SMART QUARRYING in the industry*. In response the panel listed that the following additional factors that would decrease the likelihood of the success of the SMART QUARRYING initiative (OBSTACLES).

The additional obstacles identified by the panel are:

- Economic recession
- Government over regulation
- Skills shortage
- Lack of company support
- Lack of industry leadership
- Poor in-house talent development

TASK 5: If you disagree with any of the above additional obstacles (if so, please list) and/or would like to add to the list of obstacles, please do so in the text box below?

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In Round 1, the panel was asked: *What approaches contribute to Professional Efficacy?*
The six highest ranked response were calculated. Across the panel there was consensus that capabilities, confidence and safety were most important in achieving professional efficacy.

One panel response did not reach consensus with the rest of the panel. The dissenting view was that coaching and mentoring were most critical in achieving professional efficacy.

TASK 6: Please rank from highest (1) to lowest (6) the approaches that contribute to professional efficacy.

Approaches	**Rank from Highest (1) to Lowest (6)**
Professional Capabilities	
Effective and Safe Professionals	
Confident and Resilient Professionals	
Professional Credentialing	
Insightful and Trusted Professionals	
Mentoring and Coaching	

In Round 1, the panel was asked to identify additional factors that would increase the likelihood of achieving professional efficacy.

The additional factors identified by the panel are:

- Owner/executive support and investment
- High quality and personalized learning opportunities
- Industry agreed credentialing standards
- Succession planning
- Rewards

TASK 7: If you disagree with any of the above additional factors (if so, please list) and/or would like to add to the list of factors, please do so in the text box below?

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In Round 1, the panel was asked to identify additional factors that would decrease the likelihood of achieving professional efficacy.

The additional factors identified by the panel are:

- Self-paced or online learning
- Low investment in skills
- 'Tick the box' VET qualifications
- Organizational restrictions
- Low work-force trust
- Owners/executives devaluing quarrying professionals
- Diversity of small/large company interests
- Staff turnover
- Corporate greed

TASK 8: If you disagree with any of the above additional factors (if so, please list) and/or would like to add to the list of factors, please do so in the text box below?

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In Round 1, the panel was asked: *Please rate to what extent you agree or disagree that the following types of education may increase the likelihood of Professional Efficacy.*

Types of Education	Round 1 Results
Formal Education	• **70%** of the panel agreed that formal education may increase the likelihood of Professional Efficacy • **20%** of the panel neither agreed or disagreed that formal education may increase the likelihood of Professional Efficacy • **10%** of the panel disagreed that formal education may increase the likelihood of Professional Efficacy
Informal Education	• **50%** of the panel strongly agreed that informal education may increase the likelihood of Professional Efficacy • **40%** of the panel agreed that informal education may increase the likelihood of Professional Efficacy • **10%** of the panel neither agreed or disagreed that informal education may increase the likelihood of Professional Efficacy
Non Formal Education	• **30%** of the panel strongly agreed that non formal education may increase the likelihood of Professional Efficacy • **40%** of the panel agreed that non formal education may increase the likelihood of Professional Efficacy • **30%** of the panel neither agreed or disagreed that non formal education may increase the likelihood of Professional Efficacy

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In Round 1, the panel was asked: *What approaches in the future will shape the Australian Quarrying Industry?*

TASK 9: Please rank the panel-identified approaches that will shape the Australian Quarrying Industry by using **LOW – MEDIUM – HIGH** indicators.

Approaches that will shape the Australian Quarrying Industry	**Your Ranking**
New talent/talent	
Supply and demand	
Industry responsibility to invest in talent development	
Economy	
Foresight	
Multinationals	
Regulations (WH&S and environmental)	
Collaboration	
Technology	
Automation	
Mergers and acquisitions	
Professional credentialing	
Whole of life quarrying	
Community/external perception	

In Round 1, the panel was asked: *What in the Australian Quarrying Industry's present will continue into the future?*

TASK 10: Please rank the panel-identified present elements that will continue into the future by using **LOW – MEDIUM – HIGH** indicators.

Present elements that will continue into the future	**Your Ranking**
Legislation and Regulation	
Incremental innovation	
Consistent demand from engineering and construction	
Perception of product limitation	

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In Round 1, the panel was asked: *What in the past will shape the future or hold back the Australian Quarrying Industry?*

TASK 11: Please rank the panel-identified past elements that will shape the future or hold back the Australian Quarrying Industry by using **LOW** – **MEDIUM** – **HIGH** indicators.

Elements that will shape the future or hold back the Australian Quarrying Industry	**Your Ranking**
Hold back: Owners/managers resistance to change	
Hold back: Poor end of life closures	
Hold back: Poor WH&S standards	
Hold back: Regulator perceptions	
Shape: Heritage and nostalgia	
Shape: New talent	
Shape: Industry profile	

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **full** control of.

The panel regarded the industry having full control over the following elements:

- Economic (high)
- Technological (high)
- Environmental (high)
- Ethical (high)

TASK 12: What dimension of the above elements do you feel the industry has full control of?

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In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **more** control of?

The panel regarded the industry having more control over the following elements:

- Environment and Technology (high)
- Social and Ethical (medium)
- Legal (Low)

TASK 13: What dimension of the above elements do you feel the industry has more control of?

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **less** control of?

The panel regarded the industry having less control over the following elements:

- Legal (high)
- Political (medium)
- Social and Environmental (Low)

TASK 14: What dimension of the above do you feel the industry has less control of?

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In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **no** control of?

The panel regarded the industry having no control of the following elements:

- Political (high)
- Legal (medium)
- Social (Low)

TASK 15: What dimension of the above do you feel the industry has no control of?

In Round 1, the panel was asked select what elements are certain about the future of the Australian Quarrying Industry

The panel regarded the following elements are certain about the future of the Australian Quarrying Industry:

- Technological and Ethical (very high)
- Economic, Social and Environment (high)
- Legal (Low)

TASK 16: What dimension of the above elements do you feel are certain about the Australian Quarrying Industry?

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In Round 1, the panel was asked select what elements are not certain about the future of the Australian Quarrying Industry

The panel regarded the following elements are not certain about the future of the Australian Quarrying Industry:

- Legal (very high)
- Political (high)
- Economic, Social and Environmental (medium)
- Technological and Ethical (low)

TASK 17: What dimension of the above elements do you feel are not certain about the Australian Quarrying Industry?

In Round 1, the panel raised the following further considerations related to professionalization of the quarrying industry.

- Logistics and distribution to market
- Degree in quarrying/educational pathways
- Government subsidization at tertiary level
- Increased strategic and innovative thinking
- Internationally recognized credentialing
- Talent defining industry profile

TASK 18: Are there any further considerations you wish to describe related to professionalization of the quarrying industry?

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In Round 1, the panel raised the following further considerations related drivers that will shape the future of the quarrying industry.

- Faster rate of change
- Influential industry leaders
- Enhanced talent
- Increased rate of innovation/technology

TASK 19: Are there any further considerations you wish to describe related to the future of the quarrying industry?

In Round 1, the panel highlighted the following areas most in need of innovation:

- Customer interface technologies
- People and attitudes
- New quarry business models
- Early adoption of technology
- Communication technologies
- Gender diversity

TASK 20: Where/what in the industry needs the most innovation? e.g. business models, technologies etc.

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APPENDIX 5 ROUND 3 DELPHI

SMART QUARRYING

Today's foresight…..
tomorrow's global advantage

ROUND 3

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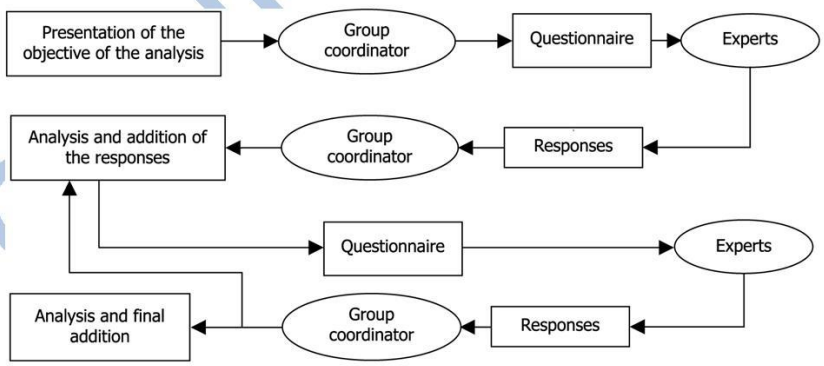

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CONFIDENTIAL

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Two panel responses did not reach consensus with the rest of the panel. The dissenting view was that *leadership* and *long-term strategy* were most critical with *people* rated in the last quartile of importance.

In Round 2, the panel was asked to rank from highest (1) to lowest (5) these key words to define *SMART QUARRYING* in the Institute of Quarrying Australia context.

Round 2 results:

Round 2 Panel Rankings	Key words defining SMART QUARRYIN
1	People
2	Long-term strategy
3	Leadership
4	Innovation
5	Culture

In Round 1, generally, there was strong agreement on the key words associated with describing SMART QUARRYING. These were assimilated into the descriptions below.

SMART QUARRYING was described by the panel as primarily being future- and people- orientated in order to develop a sustainable industry for the future while maintaining good stewardship of natural resources. It was noted that collaboration with customers and other stakeholders would develop new value previously untapped by the industry. The ways in which this is to be achieved was described as primarily being strategically ambidextrous (short-term, strategic exploitation; long-term strategic exploration), highly innovative and focused on developing and retaining talent that over time transforms the industry culture and perceptions of the industry. It was noted as important to exceed customer expectations and embrace change.

In Round 2, the panel was asked to indicate any words that should be removed or added.

Given the Round 2 feedback the description now reads…

SMART QUARRYING was described by the panel as primarily being future- and people- orientated in order to lead a sustainable industry for the future while maintaining good stewardship of natural resources. It was noted that collaboration with customers and other stakeholders would develop new value previously untapped by the industry. The ways in which this is to be achieved was described as primarily being strategically focused, ambidextrous (short-term, strategic exploitation; long-term strategic exploration), highly innovative and focused on developing and retaining talent that over time transforms the industry culture and perceptions of the industry. It was noted as important to exceed customer expectations and embrace change as well as explore the 'bench strength' for succession planning.

Referring to the description above, a number of responses indicated the ways in which SMART QUARRYING can be achieved.

In Round 2, the panel was asked to rank the panel-identified ways in which SMART QUARRYING can be achieved.

Round 2 results:

Ways in which SMART QUARRTYING can be achieved	Description	Round 2 Panel Rankings
Capabilities	On the job learning	1
Leadership	VET or Higher Education, professional development courses	2
Strategy	Skills that meet tasks	3
Talent recruitment and retention	Future orientated capacity leading to innovation and sustainability	4

Competencies	Conferences, workshops	5
Formal learning	e.g. leadership development, leader collaboration.	6
Informal learning	Purposeful people orientated activities to increase industry talent	7
Innovation	New or repurposed ideas that increase value	8
Non-formal learning	Ability to purposefully exploit short-term opportunities and map long-term direction	9

In Round 1, the panel was asked: *What factors do you consider increase the likelihood of SMART QUARRYING success (ENABLERS)*?

Members of the panel suggested that in addition to rapid change in the operational environment, (a) reducing margins; (b) decreasing talent availability; (c) negative perception of industry in the community and (d) increased pressure to adopt new/advanced technologies all contribute to the need for the SMART QUARRYING initiative.

In Round 1, the panel was asked to identify additional factors that would increase the likelihood of *SMART QUARRYING in the industry*. In response the panel listed that the following additional factors that would increase the likelihood of the success of the SMART QUARRYING initiative (ENABLERS).

The additional enablers identified by the panel were:

- Innovation – incremental and radical industry ideas
- Institute of Quarrying Australia leadership – futures orientated and strategic thinking
- Enhanced career profile – communication of talent expertise and best practice
- Whole of life quarrying
- Functional experts – industry developed expertise

- Consistent education – refined educational pathways
- Global connectivity – engaged connectivity in the digital environment
- Collaboration – co-creation of value
- Improved OH&S statistics

In Round 2, the panel was asked if they disagreed with any of the above additional enablers and to add to the list of enablers.

Round 2 results:

90% of the panel agreed that *Improved OH&S statistics* is not an enabler.

Additional enablers introduced by the panel:

- Whole of industry talent bench strength
- Mentoring programs for leaders
- Functional experts
- Adopting externally developed expertise

In Round 1, the panel was asked: *What factors do you consider DECREASE the likelihood of SMART QUARRYING (OBSTACLES)?*

Members of the panel suggested that in addition to an industry culture resistant to change due to traditional views and short-term profit interests, the pressure of consistent WH&S statistics and rehabilitation reputation will continue to decrease the industry's ability to self-regulate.

In Round 1, the panel was asked to identify additional factors that would decrease the likelihood of *SMART QUARRYING in the industry*. In response the panel listed that the following additional factors that would decrease the likelihood of the success of the SMART QUARRYING initiative (OBSTACLES).

The additional obstacles identified by the panel were:

- Economic recession
- Government over regulation
- Skills shortage
- Lack of company support
- Lack of industry leadership
- Poor in-house talent development

In Round 2, the panel was asked if they disagreed with any of the above additional obstacles and to add to the list of obstacles.

Round 2 results:

100% of the panel agreed with the obstacles listed above.

Additional obstacles introduced by the panel:

- Lack of support/endorsement from regulators/industry bodies
- International competition
- Government overregulation
- Poor personal professional development

In Round 1, the panel was asked: *What approaches contribute to Professional Efficacy?*

The six highest ranked response were calculated. Across the panel there was consensus that capabilities, confidence and safety were most important in achieving professional efficacy.

One panel response did not reach consensus with the rest of the panel. The dissenting view was that coaching and mentoring were most critical in achieving professional efficacy.

In Round 2 the panel was asked to rank from highest (1) to lowest (6) the approaches that contribute to professional efficacy.

Round 2 results:

Approaches	**Round 2 Panel Rankings**
Professional Capabilities	1
Mentoring and Coaching	2
Effective and Safe Professionals	3
Insightful and Trusted Professionals	4
Confident and Resilient Professionals	5
Professional Credentialing	6

In Round 1, the panel was asked to identify additional factors that would increase the likelihood of achieving professional efficacy.

The additional factors identified by the panel were:

- Owner/executive support and investment

- High quality and personalized learning opportunities
- Industry agreed credentialing standards
- Succession planning
- Rewards

In Round 2, the panel was asked is they disagreed with any of the above additional factors and to add to the list of factors.

Round 2 results:

100% of the panel agreed with the factors listed above.

Additional factors introduced by the panel:

- Industry wide networking for peer groups
- Improve industry perception of Quarry Management as a whole
- Harmonization of legislation to permit national credentialing
- Identifying the right individuals to successfully deliver the initiative – this will be more about natural ability and attitude rather than experience and credentials.
- Management succession planning
- Incentives rather than rewards

In Round 1, the panel was asked to identify additional factors that would decrease the likelihood of achieving professional efficacy.

The additional factors identified by the panel were:

- Self-paced or online learning
- Low investment in skills
- 'Tick the box' VET qualifications
- Organizational restrictions
- Low work-force trust
- Owners/executives devaluing quarrying professionals
- Diversity of small/large company interests
- Staff turnover
- Corporate greed

In Round 2, the panel was asked if they disagreed with any of the above additional factors and to add to the list of factors.

Round 2 results:

90% of the panel agreed that *Self-paced or online learning* will not decreased the likelihood of achieving professional efficacy.

Additional factors introduced by the panel:

- Budgetary constraints for professional development
- Difficulty aligning credentialing and training with job requirements
- Work/Life balance

In Round 1, the panel was asked: *Please rate to what extent you agree or disagree that the following types of education may increase the likelihood of Professional Efficacy.*

Types of Education	**Round 1 Panel Results**
Formal Education	• **70%** of the panel agreed that formal education may increase the likelihood of Professional Efficacy • **20%** of the panel neither agreed or disagreed that formal education may increase the likelihood of Professional Efficacy • **10%** of the panel disagreed that formal education may increase the likelihood of Professional Efficacy
Informal Education	• **50%** of the panel strongly agreed that informal education may increase the likelihood of Professional Efficacy • **40%** of the panel agreed that informal education may increase the likelihood of Professional Efficacy • **10%** of the panel neither agreed or disagreed that informal education may increase the likelihood of Professional Efficacy
Non Formal Education	• **30%** of the panel strongly agreed that non formal education may increase the likelihood of Professional Efficacy

	• **40%** of the panel agreed that non formal education may increase the likelihood of Professional Efficacy • **30%** of the panel neither agreed or disagreed that non formal education may increase the likelihood of Professional Efficacy

In Round 1, the panel was asked: *What approaches in the future will shape the Australian Quarrying Industry?*

In Round 2, the panel was asked to rank the panel-identified approaches that will shape the Australian Quarrying Industry.

Round 2 results:

Approaches that will shape the Australian Quarrying Industry	**Round 2 Panel Rankir**
New talent/talent	1
Industry responsibility to invest in talent development	2
Community/external perception	3
Foresight	4
Regulations (WH&S and environmental)	5
Whole of life quarrying	6
Supply and demand	7
Professional credentialing	8
Automation	9
Technology	10
Economy	11
Mergers and acquisitions	12
Collaboration	13
Multinationals	14

In Round 1, the panel was asked: *What in the Australian Quarrying Industry's present will continue into the future?*

In Round 2, the panel was asked to rank the panel-identified present elements that will continue into the future.

Round 2 results:

Present elements that will continue into the future	**Round 2 Panel Rankings**
Legislation and Regulation	1
Incremental innovation	2
Perception of product limitation	3
Consistent demand from engineering and construction	4

In Round 1, the panel was asked: *What in the past will shape the future or hold back the Australian Quarrying Industry?*

In Round 2, the panel was asked to rank the panel-identified past elements that will shape the future or hold back the Australian Quarrying Industry.

Elements that will <u>shape the future</u> or <u>hold back</u> the Australian Quarrying Industry	**Round 2 Panel Rankings**
Shape: New talent	1
Hold back: Poor WH&S standards	2
Hold back: Regulator perceptions	3
Hold back: Owners/managers resistance to change	4
Hold back: Poor end of life closures	5
Shape: Industry profile	6
Shape: Heritage and nostalgia	7

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **<u>full</u>** control of.

The panel regarded the industry having full control over the following elements:

- Economic (high)
- Technological (high)
- Environmental (high)

- Ethical (high)

In Round 2, the panel was asked what dimension of the above elements do they feel the industry has **full** control of.

From the Round 2 data, the panel listed the following elements that the industry has full control of:

- Ethical
- Environmental

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **more** control of?

The panel regarded the industry having more control over the following elements:

- Environment and Technology (high)
- Social and Ethical (medium)
- Legal (Low)

In Round 2, the panel was asked what dimension of the above elements do they feel the industry has **more** control of.

From the Round 2 data, the panel listed the following elements that the industry has **more** control of:

- Social
- Technical

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **less** control of?

The panel regarded the industry having less control over the following elements:

- Legal (high)
- Political (medium)
- Social and Environmental (Low)

In Round 2, the panel was asked what dimension of the above do they feel the industry has **less** control of.

From the Round 2 data, the panel listed the following elements that the industry has **less** control of:

- Political

In Round 1, the panel was asked to select the elements that the Australian Quarrying Industry has **no** control of?

The panel regarded the industry having no control of the following elements:

- Political (high)
- Legal (medium)
- Social (Low)

In Round 2, the panel was asked dimension of the above do you feel the industry has **no** control of.

From the Round 2 data, the panel listed the following elements that the industry has **no** control of:

- Legal

In Round 1, the panel was asked select what elements are certain about the future of the Australian Quarrying Industry

The panel regarded the following elements are certain about the future of the Australian Quarrying Industry:

- Technological and Ethical (very high)
- Economic, Social and Environment (high)
- Legal (Low)

In Round 2, the panel was asked what dimension of the above elements do they feel are **certain** about the Australian Quarrying Industry?

From the Round 2 data, the panel listed the following dimensions that are **certain** about the Australian Quarrying Industry:

- Economic

- Social
- Environmental
- Ethical

In Round 1, the panel was asked select what elements are **not certain** about the future of the Australian Quarrying Industry

The panel regarded the following elements are not certain about the future of the Australian Quarrying Industry:

- Legal (very high)
- Political (high)
- Economic, Social and Environmental (medium)
- Technological and Ethical (low)

In Round 2, the panel was asked what dimension of the above elements do they feel are **not certain** about the future of the Australian Quarrying Industry.

From the Round 2 data, the panel listed the following dimensions that are **not certain** about the Australian Quarrying Industry:

- Legal
- Political
- Technological

In Round 1, the panel raised the following further considerations related to **professionalization** of the quarrying industry.

- Logistics and distribution to market
- Degree in quarrying/educational pathways
- Government subsidization at tertiary level
- Increased strategic and innovative thinking
- Internationally recognized credentialing
- Talent defining industry profile

In Round 2, the panel were asked if there were any further considerations they wish to describe related to **professionalization** of the quarrying industry

From Round 2 data, the panel listed these further considerations that describe the **professionalization** of the quarrying industry:

- Collaboration with peers
- Logistics and distribution
- Continuous improvement
- Technical challenges
- Material quality

In Round 1, the panel raised the following further considerations related drivers that will shape the **future** of the quarrying industry.

- Faster rate of change
- Influential industry leaders
- Enhanced talent
- Increased rate of innovation/technology

In Round 2, the panel were asked if there were any further considerations they wish to describe related to the **future** of the quarrying industry.

From Round 2 data, the panel listed these further considerations that describe the **future** of the quarrying industry:

- Globalization
- Competitor products
- Access/proximity to resources
- Finite

In Round 1, the panel highlighted the following areas most in **need of innovation**:

- Customer interface technologies
- People and attitudes
- New quarry business models
- Early adoption of technology
- Communication technologies
- Gender diversity

In Round 2, the panel was asked to list other areas in the industry that **need the most innovation**.

From Round 2 data, the panel listed the following other areas in the industry that **need the most innovation**:

- Performance-based specifications
- Social media
- Value recognition of resource and resources
- Product efficiency
- Process control of materials
- Technical performance control
- Resource supply chain management

ROUND 3 TASKS

Given current research, there appears to be two main capabilities required to ensure fir-for-future leaders:

1. Foresight
2. Strategic Thinking

Foresight

"Foresight is the product of deep insight and understanding" requiring a sustained and deliberate deconstruction of cognitions that dominate our habits of thought (Chia 2004, p. 21). Chia confirms that foresight is a "highly valued human capacity" that is manifested in human cognition and evokes a "generative field of potentiality" . Chia asserts that foresight can be cultivated by systematically developing 'peripheral' rather than 'frontal' vision. This aligns with more recent literature that urges peripheral vision and foresight in becoming more effective leaders (Day & Schoemaker 2008) and optimize performance in developing the *cognitive intelligence competencies* (Boyatzis 2008). Foresight is a "cognitive temporal perspective that leaders use to anticipate, clarify, and structure the future, so as to guide their organization in the present based on future opportunities" (Gary 2008, p. 4).

Many strategy authors concur that foresight is a critical leadership competency Place these into table with their references (Alsan 2008; Attila 2003; Boyatsis 2008; Boyatsis & Saatcioglu 2008; Buchen 2005; Chermack 2004; Chia 2004; Costanzo & MacKay 2009; Day & Schoemaker 2008; de Geus 1997; Hamel 2009; Hamel & Prahalad 1994; Kouzes & Posner 2002; Major et al. 2005; Montgomery 2008; Sanchez 2004; Sanchez & Heene 2004; Tsoukas & Shepherd 2004a; Yukl 2006). Ahuja illustrates that all major theories of strategy related to competitive advantage assume that strategy-level leaders must all have some degree of foresight (Ahuja et al. 2005).

Literature on the subject of foresight can be regarded as sparse (Fuller et al. 2004). Foresight as a concept has been used in terms of describing an individual's competences, cognitions, a distinct process or institutional program (Major et al. 2002). Table 1.1 illustrates some of the definitions of foresight that appear in the

literature. These often overlap and can be a source of confusion. In an attempt to differentiate foresight concepts terms such as *strategic foresight, foresight process, organizational foresight, pathfinding* and others have arisen in the literature.

Table 1.1: Definitions of foresight

SOURCE	DEFINTION	APPLICATION
WEBSTER'S	Act or power of foreseeing, prescience, and act of looking forward with provident care or prudence.	Human cognition
OXFORD	The application of care and attention to the likely outcome of something or to future needs.	Human cognition OR Technique
(Reid 2004)	Understanding and anticipation of the future.	Human cognition
Raymond, 1996)	Foresight has to be both predictive and creative ('creative imagination'). Predictive – the ability to identify critical factors in external environment, how they will behave in the future and how they will affect the organization along the planned course of action. Creative – not concerned with predicting but what the future ideally could be if we could make it happen. Imagination of ideal futures then seeks ways to make it a reality.	Institutional technique
(Slaughter, 2007)	An emergent capacity of the brain-mind system. Boundaries of perception are pushed forward by (1996): a) Consequence assessment – assessment of implications of present actions b) Early warnings and guidance – detecting and avoiding problems before they occur c) Pro-active strategy formulation – considers present implications of possible future events d) Normative visions – envisioning desired futures	Human cognition

(Coates, 1985)	A process by which one comes to a fuller understanding of the forces shaping the long-term future which should be taken into account in policy formulation, planning and decision-making.	Technique
(Voros, 2003)	'Foresight opens up an expanded range of perceptions of the strategic options available so that strategy-making is potentially wiser' (2003, pp.12)	Technique
(Horton, 1999)	Foresight is a process of developing a range of views of possible ways in which the future could develop, and understanding these sufficiently well to be able to decide what decisions can be taken today to create the best possible tomorrow (1999, pp.5). Foresight is a key business skill linked to knowledge creation and areas such as innovation. It is a combination of understanding possible futures of an organization and acting upon that understanding.	Technique
(Amsteus, 2008)	Degree of analysing present contingencies and degree of moving analysis of present contingencies across time, and degree of analysing a desired future state or degrees or states a degree ahead of time with regard to contingencies under control, as well as degree of analysing courses of action a degree ahead in time to arrive at the future state.	Human cognition OR Technique
(Hayward,, 2005)	The capacity to bring a consideration of the future into the present decision perspective (as opposed to foresight actions) An attribute or competence Important element of a person's foresight competence is their Future Time Perspective (FTP)	Human cognition

	– cognitive understanding of expectations of the future (2003, p. 5) a) Detection and avoidance of hazards b) Assessment of consequences of actions c) Envisioning desired future states.	
(Tsoukas, 2004)	The engagement of memory and expectation that enlarges the consciousness of the present – know how is brought forward from the past and extrapolations to the future are made (2004a, p. 11) a) Act of looking forward b) Taking provident care c) Ability to anticipate beyond seemingly ambiguous and complex systems d) Understanding ways in which patterns of the future can emerge (2004b)	Human cognitive
(Cuhls, 2003)	a) Enlarge the choice of opportunities, assess impacts and chances. b) Prospect for the impacts of current research c) Ascertain new needs, new demands and new possibilities d) Focus selectively on the environment / system e) Define desirable and undesirable futures f) Start and stimulate continuous discussion processes.	Technique

Of critical importance to the study of foresight is the differentiation of; a) foresight as a cognitive capacity from foresight as a technique or method, and b) foresight from strategic foresight.

As noted in Table 1, numerous studies have recognized the *cognitive perspective* of foresight. It is described as 'innate', 'a human capacity', 'a vision of the mind' and based on 'deep insight and understanding'. In its simplest form, foresight is described as anticipation before action (Godet 2001) but is underpinned by the concept of 'self'. The concept of 'self' relates to seeing oneself as an

agent of future change, being able to 'create' the future. Foresight is also defined in the literature as a process (Horton 1999) or technique. As both relate to process, the process perspective will be termed *foresight technique* to avoid confusion.

A number of national and international initiatives (Blind et al. 1999; Cragg & Spurgeon 2007; Héraud & Cuhls 1999; Kuwahara 1999; Martin & Johnston 1999) adopt the *foresight technique* view of foresight in that it is an institutionalized technique of gathering, interpreting and understanding information in order to develop a range of views of the future and develop actions to achieve the preferred possible futures. Foresight at an organizational level institutionalizes the technique combining the perceptions of multiple contributors to develop a range of alternative formulated views of how the future may unfold *and* the best decisions that will be organizationally useful (Martin & Johnston 1999). However, foresight at an individual level focuses on the mental processes, both rational and irrational, used in developing images of the future as a form of cognitive intelligence. Individual foresight competence therefore compliments the institutionalized technique or process of foresight in its aggregated form.

Foresight technique could be described as emulating the cognitive processes of foresight in an individual's mind but is distinctly different in that it resembles a methodology that primarily a) implies necessary action, and b) has structure (Horton 1999). If foresight in terms of the *cognitive perspective* is 'a vision of the mind' and 'anticipation before action' (Godet 2001) it can be deduced that it precedes further tasks or actions. Nor does it necessarily follow a conscious structure but does involve a process that seeks to identify and understand the forces that shape the long-term future that should be taken into account in decision making (Coates 1985). Foresight in individuals can be developed and enhanced (Hayward 2005). It does not imply any external method, decision, action or fulfilment of an organizational task.

This paper adopts the perspective that individual foresight is a cognitive function common to all humans according to differing styles and is primarily concerned with the mental processes involved in creating images of the future in the mind of an individual. Foresight competence is therefore defined as:

A human ability to creatively envision possible futures, understand the complexity and ambiguity of systems and provide input for the taking of provident care in detecting and avoiding hazards while envisioning desired futures.

TASK 1

The following table lists the dimensions of the Foresight Capability.

The panel is asked to categorize each of the dimension as either **HIGH** important or **MEDIUM** importance or **LOW** importance to ensure fit-for-future leaders of the Australian Quarrying Industry.

	Dimensions	**e.g. of Quarrying leaders' foresight considerations**	**Categorize as HIGH or MEDIUM or LOW**
Foresight Capability	Envisioning possible futures	Markets, product	
	Future emerging patterns	Recycled products and rehabilitation	
	Anticipate beyond ambiguous and complex systems	Political, social and legislative	
	Detection and avoidance of hazards and risks	Health and Safety, markets, new technologies	
	Creative development of images of the future that appeal to human advancement	Talent development, assessment of normative images of the future of the industry.	

Strategic Thinking

A great deal of contemporary work on leadership and strategy (Beer & Eisenstat 2000) indicates that there is an increasing need, at the practising end of strategy, to enhance the role and capacity of leadership in strategic thinking. Whittington (Whittington 2004)indicates that there is a large gap in strategy literature defining strategic thinking. Kanter (Kanter 1995) confirms the need for new ideas, experimentation and innovation in strategy practice in the 2000s. Handy (Handy 1995) argues that today's organizations are in an environment of rapid flux and uncertainty in a discontinuous form and are required to address meaningfully these challenges or face an unsustainable future. Therefore, organizations need to renew continually, reinvent and reinvigorate themselves. While acknowledging the important role, at all levels of the organization in strategy, this paper will focus on the role of leaders' at the most senior level.

Strategic thinking precedes strategy formulation and strategic planning in organizations (Tavakoli & Lawton 2005). Decision making is a fundamental process of all organizations and the quality thereof influences the effectiveness of the leaders (Leonard et al. 1999) and the performance of the organization.

Citing various studies, Bronn et al. (Brønn & Olson 1999) indicate that a key characteristic of strategic thinking is the competence to think prospectively and act pro-actively. Both strategic thinking and strategic decision making are regarded by this study as tasks; the task of thinking which precedes the task of decision making and are linked to the ability to anticipate possible futures.

Strategic thinking offers leaders and their organizations the opportunity to move beyond the traditional application of strategy, primarily in terms of intended strategy, to identify and achieve breakthrough emerging strategies (Mintzberg 2004). Foresight, or "the ability to create and maintain a high quality, coherent and functional forward view and to use the insights arising in organizationally useful ways" (Slaughter 1998) has been linked to strategic thinking (Voros 2003), or "a particular way of solving strategic problems and opportunities at the individual and institutional level combining generative and rational thought processes" (O' Shannassy 2005). By investigating the relationship between these two concepts related to organizational strategy, this thesis will seek to provide insights as to how these concepts and their underlying constructs are linked.

The literature is indecisive about what strategic thinking is (Bonn 2001; Goldman 2007; Heracleous 1998) and faces the possibility to being used so broadly and generically that it runs the risk of being "almost meaningless" (Liedtka 1998, p. 121). In a review of strategic thinking research, O'Shannassy (2005, p. 14) deduces that strategic thinking as "a particular way of solving strategic problems and (opening up) opportunities at the individual and institutional level combining generative and rational thought processes". Mintzberg (1994) describes strategic thinking as a synthesis involving intuition and creativity. Strategic thinking is seen as having to be both analytical and creative (Raimond 1996). Table 1.2 illustrates leading definitions of strategic thinking in contemporary literature.

Allio (2006) defines strategic thinking as the "systematic analysis of the organization and the formulation of its longer-term direction". From these definitions it is clear that strategic thinking is regarded as analytical in terms of current conditions and involves a level of creativity in terms of choosing a future direction. Allio's definition seeks to balance this choice of direction between the longer-term (implying beyond short-term as opposed to long-term) and the realistic anticipation of long term ambiguity and disruption. It also implies making a choice from alternative future options and makes provision for possible emergent strategies that will contribute to realized strategies. This is a significant observation that focuses the leader's thought processes to the evaluation of strategic choices based on a mixture of analysis and creative prospects. The outputs of foresight competence then, contribute to this evaluation of options by providing representations of possible futures.

Table 1.1: Definitions of Strategic Thinking

WEBSTER'S	Thinking - higher cognitive function and comprises activities like creative thinking, problem solving, and decision making. The analysis of thinking processes is part of cognitive psychology.
Inter-American Development Bank (Personnel Decisions, 2001)	A leadership competency. Going beyond the questions that are routine or required for one's job recognizing the broader 'context' of 'the big picture'. Identifying key or underlying issues in complex situations.
(Allio, 2006)	The systematic analysis of the organization and the formulation of its longer-term direction.
(Mintzberg, 1994)	A way of thinking that synthesises intuition and creativity whose outcome is an integrated perspective of the enterprise. Strategic thinking is not strategic planning.
(Hamel, 2005)	Crafting strategic architecture emphasizing creativity, exploration and understanding discontinuities.
(Bonn, 2001)	Strategic thinking at an individual level comprises of i) a holistic understanding of the organization and the environment, ii) creativity and iii) a vision for the future of the organization.
(Liedtka, 1998)	A particular way of thinking that includes five elements i) a systems perspective ii) intent-focussed iii) thinking in time. iv) Hypothesis-driven and v) intelligent opportunism
(Goldman, 2007)	A distinctive management activity whose purpose is to discover novel, imaginative strategies which can rewrite the rules of the competitive game and to envision potential futures significantly different to the present including being conceptual, systems-orientated, directional, and opportunistic.
O'Shannassy, 2005)	A particular way of solving strategic problems and opportunities at the individual and institutional level combining generative and rational thought processes.

(Dickson, 2001)	The mental models used by managers in the conjectures they make in their planning and strategizing.
(Tavakoli, 2005)	A cognitive capability. The cognitive process that precedes strategic planning or action whereby an individual contemplates the future development of the organization whilst considering its attributes, it's past and present and the external realities within which it operates.

Of particular importance in terms of Conceptualizing strategic thinking is agreeing on what it is not. Mintzberg states that "strategic planning is not strategic thinking" (1994, p. 107). This distinction is a common theme in strategic thinking literature as it separates the purposes of each in terms of outputs. The output of strategic planning is a plan which has been analytically programed according to already determined strategies. The output of strategic thinking on the other hand is "an integrated perspective of the enterprise" (Mintzberg 1994, p. 107) aiding strategy formulation and decision making.

Strategic thinking is a way of thinking encompassing certain characteristics. Liedtka (Liedtka 1998) indicates that strategic thinking connects the past, present and future and in this way uses both the institution's memory and its broad historical context as critical inputs into the creation of the future. It is the oscillation between past, present and future which is essential for both strategy formulation and execution (Hayward 2005).

Liedtka presents a model based on identifying the characteristics of strategic thinking as a way of thinking. She identifies elements of strategic thinking which are: Intent focus; thinking in time; hypothesis driven; systems perspective; and intelligent opportunism. Liedtka's model and elements have broadly been endorsed in the literature (Atance & O'Neill 2001; Malan 2010; O' Shannassy 2005; van der Laan 2010) and provide a meaningful framework that aligns with the work of numerous mainstream strategy scholars.

Systems perspective; The strategic thinker has a holistic understanding of the organization's complete system, both internally and externally, and how value is created in terms of its inter-dependencies. Understanding the competing networks of inter-acting system components in the external environment is therefore critical in terms of thinking strategically about how to position the

organization in the future. Similarly, understanding the inter-relationships among the internal components that make up the organization's whole allows for determining how the internal resources are organized. This is especially pertinent to the development of core-competencies. Liedtka notes that it is critical to understand the internal personal dimension of these relationships as a leader, encouraging participation and the optimisation of co-creation in the organizational system as a whole.

Intent-focused; The strategic thinker is focused on the intent to realize a longer-term competitive position for the organization. The intent "conveys a sense of direction" and "implies a competitively unique point of view about the future" (Hamel & Prahalad 1994, p. 129). Drawing from social psychology, Liedtka illustrates that strategic intent creates an impetus for individuals in the organization to achieve goals by harnessing their energy toward increased performance. This resonates with the notion of discretionary effort introduced earlier in the book. The intent is recognized to be subject to 'shaping' and 're-shaping' of intent as per a dynamic model of strategy. Liedtka is careful not to define intention in terms of the rational analytical perspective of strategic planning approaches. Rather, intention is focused on what, why and how to achieve the envisaged competitive position.

Thinking in time: The strategic thinker connects the past, present and future and as such 'thinks in time'. They recognize the predictive value of the past and what matters in the future. The ability to compare continuously the present to the future taking into account the past in an iterative cycle of thought constitutes thinking in time. The historical context of the organization, its memory and de facto current circumstances facilitate cognitions related to what is required in creating the future. Of importance in this element is being able to choose the strategic direction based on deep and broad insights as to how the past, its emerging patterns and the discontinuities of the future are able to merge in diverse ways.

Hypothesis driven: the strategic thinker recognizes that strategy is a hypothesis-driven process in that judgements need to be formulated so they underpin the assumptions of realistically achieving a future position. Its predictive value of strategic thinking is innately curbed by the need to manage risk and short term objectives. The analytical - intuitive debate is avoided in that strategic thinking is regarded as both creative and critical. It has long been considered that in order to think creatively, critical or analytical thought needs to be suspended. However, despite troubling cognitive

psychologists for a long time(Liedtka 1998)[52][52][52][52][52] [40-52] numerous models recognize that decision makers oscillate between most-preferred styles of thinking and back-up styles of thinking which, in the case of strategic thinking would include styles that balance analysis with creativity.

Intelligent opportunism; The strategic thinker is open to new ideas and opportunities as they emerge. Intelligent opportunism includes the ability to recognize the potential of rapidly emerging opportunities and having the agility of mind to cognitively adapt / challenge previous strategic assumptions. This aspect of strategic thinking is participative and encourages the possibility of strategy emerging from all employees while also being perceptive of the opportunities that may arise within the system as a whole.

Stacey (Stacey 1992) whose work predates those critical of the rational approach to strategy such as Hamel and Prahalad, and Mintzberg, is also critical of bounded rationality, but from a different perspective - that of complexity theory. Stacey asserts that strategic thinking is not a determination of the likelihood of what will happen as determined by pre-programming. Rather, it is about learning and creating new ideas using qualitative similarities and analogies. "New strategic directions emerge spontaneously from the chaos of challenge and contradictions through a process of real time learning and political interaction" (Stacey 1992).

Leaders need to invent, discover and create their long-term intentions as they proceed not to seek to repeat or imitate successes of the past. Stacey therefore agrees with the contemporary view that strategic thinking includes a synthesis of creativity and intuition based on learning through interactive strategic considerations. This corresponds to Allio's perspective in that 'longer-term' direction setting of strategic thinking is dynamic and changeable.

The essence of Stacey's argument is that in the context of strategy one needs to handle current issues that will have long-term consequences in a more creative and innovative way, by not abandoning the long-term view but by realizing that the future is unknowable but can be influenced by current decisions. This is the point of departure of foresight. Its "processes … are realistically available for dealing with the long term" (Stacey 1992, p. 18) and as such its outputs have high strategic value for the strategic decision-maker within the context of their task of strategic thinking. Strategic thinking is therefore defined as:

Strategic thinking is the synthesis of systematic analysis (rational) and creative (generative) thought processes that seek to determine the longer-term direction of the organization.

TASK 2

The following table lists the dimensions of the Strategic Thinking Capability.

The panel is asked to categorize each of the dimension as either **HIGH** important or **MEDIUM** importance or **LOW** importance to ensure fit-for-future leaders of the Australian Quarrying Industry.

	Dimensions	**Quarrying Leaders**	**Categorize as HIGH or MEDIUM or LOW**
Strategic Thinking Capability	Systems perspective ambiguous, inter-related, complex, multi-faceted holistic understanding of the system and value creation	Identifying position and interaction with the external environment.	
	Intent focused directional, competitively unique, dynamic	Clearly defined activity; profit-orientated; sustainability intent.	
	Hypothesis driven; inspires sense of direct and goal orientation	Quarrying industry is foundational to construction	
	Thinking in time, oriented in time, connects past, present and future in oscillating cycles	Resource limitation and management	
	Intelligent opportunism ambiguous, innovative, embraces new ideas	Recycled products; rehabilitation	
	Formulated judgements of assumptions required to achieve envisaged future position	Licence to operate now and in the future	
	Generative thinking	Different ways of doing business given environmental, economic and societal changes	

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APPENDIX 6 SURVEY FINAL IQV2

Australian Quarrying Industry Futures
AUSTRALIAN QUARRYING INDUSTRY FUTURES: SCENARIOS & CAPABILITIES Wonder what the futures of the quarrying industry in Australia looks like? This study will explore the possible futures of the quarrying industry and profile the leadership capabilities needed to succeed. Your contribution is critical in gaining these insights.Leadership is the primary enabler of organisational success. Increasingly, successful enterprises of the future are typified by their sense of purpose and ability to innovate beyond client imagination. For this to be established a strong commitment to creating future value is needed as guided by quarrying industry leaders.Leaders and employees know that innovation and envisioning future value is critical for success. CEO's worldwide acknowledge that foresight and strategic thinking are the most important capabilities organisations should have in driving future success. That said, some studies suggest that up to 90% of leaders also rate these capabilities as their biggest challenges. This study will profile the foresight and strategic thinking of strategy level leaders. This survey is a highly validated and reliable assessment of foresight and strategic thinking capabilities. The survey is able to profile leadership capabilities that promote innovation and identify professional growth and development opportunities required to meet future challenges of the 21st century.The survey will also explore what futures may be possible from your perspective. It will present political, economic, social, technological, environmental, ethical and legal drivers of the future. From these, possible scenarios will be presented that you can rate as likely or unlikely.By participating in this survey you will be contributing to a study of the quarrying industry that seeks to find ways for improving the success of your organization and industry. You may further benefit by requesting the final reports of the research to develop organizational and professional insights in this under-researched area. Participation in the survey is voluntary and anonymity is guaranteed. By submitting the survey response, your consent to participate is deemed to have been given.There are no anticipated risks beyond normal day-to-day living associated with your participation in this project.Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy. Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project. If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.Participation in this project will take approximately 30 minutes to complete. Participation is entirely voluntary. If you do not wish to take part you are not obliged to. If you decide to start the survey you are welcome to answer only the questions you would like to and you may stop at any time by closing your web browser. Once the survey has been submitted, you cannot change or withdraw the data you have entered.Thank you for taking the time to help with this research project. Please start with the survey now by clicking on the I Agree button below.Kind regardsPaul Sutton(Chief Investigator)

The following statements describe how individuals relate to time in an organisational context.

Read each statement carefully then decide how well the statement describes you by indicating the extent to which you agree or disagree with that statement.
Please indicate the most applicable option by clicking on the corresponding option.

In my organisation;

	Strongly disagree	Moderatel y Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Moderatel y Agree	Strongly agree
I am known for generating ideas.	❑	❑	❑	❑	❑	❑	❑
Being organized is important to me.	❑	❑	❑	❑	❑	❑	❑
People think of me as a visionary	❑	❑	❑	❑	❑	❑	❑
People think of me as organized.	❑	❑	❑	❑	❑	❑	❑
I tend to dwell on "what was"	❑	❑	❑	❑	❑	❑	❑
People think of me as structured.	❑	❑	❑	❑	❑	❑	❑
I am known for invention/innovation.	❑	❑	❑	❑	❑	❑	❑

Please contact Paul Sutton if you have any questions regarding this survey.

People think I am best at planning and organization.	❑	❑	❑	❑	❑	❑	❑
I often think about past decisions	❑	❑	❑	❑	❑	❑	❑

The following statements describe how individuals relate to the future and orient their behaviour, especially with regards to their organisational function.

Please indicate your response by clicking on the most applicable option as to how each statement best describes you.

In my organisation, I / I am;

	Does not describe me	Describes me a little bit	Describes me	Describes me very well	Describes me extremely well	Described me perfectly!
Test new products/trends very early	❑	❑	❑	❑	❑	❑
Don't like changes that disrupt opportunity	❑	❑	❑	❑	❑	❑
Quickly adjust to new situations	❑	❑	❑	❑	❑	❑
Hold the line when new plans are imposed	❑	❑	❑	❑	❑	❑
Don't want too much change	❑	❑	❑	❑	❑	❑
Consider how trends interact	❑	❑	❑	❑	❑	❑
Against changes that threaten one's position	❑	❑	❑	❑	❑	❑
Focus on future questions	❑	❑	❑	❑	❑	❑
Conscious of big trends in society	❑	❑	❑	❑	❑	❑
Go along when new trends come	❑	❑	❑	❑	❑	❑
Interested in future questions	❑	❑	❑	❑	❑	❑
Focus on greater future questions	❑	❑	❑	❑	❑	❑
Make things happen when future demands it	❑	❑	❑	❑	❑	❑
Take advantage of trends that pop up	❑	❑	❑	❑	❑	❑
Flexible person	❑	❑	❑	❑	❑	❑

Please contact Paul Sutton if you have any questions regarding this survey.

The following section is related to the strategic thinking of individuals.Use only the following numbers to answer each question:Please rank the following questions based on how each statement best describes you 4 (most),describes you moderately 3 (moderately),describes you a little 2 (slightly)least describes you 1 (least). You may use each number (4, 3, 2 and 1) only once. For example, your answer may look like this:My prime objective is to: Have a position with status 4 Be the best in my field 2 Achieve recognition for my work 3 Feel secure in my job 1It is important to record what first comes to mind about how you feel and not what you prefer or think is the right thing to do. There are no right or wrong answers.

My prime objective is to:

- Have a position with status _____
- Be the best in my field _____
- Achieve recognition for my work _____
- Feel secure in my job _____

I enjoy jobs that:

- Are technical and well defined _____
- Have considerable variety _____
- Allow independent action _____
- Involve people _____

I expect people working for me to be:

- Productive and fast _____
- Highly capable _____
- Committed and responsive _____
- Receptive to suggestions _____

In my job, I look for:

- Practical results _____
- The best solutions _____
- New approaches or ideas _____
- Good working environment _____

I communicate best with others:

- In a direct one-to-one basis _____
- In writing _____
- By having group discussions _____
- In a formal meeting _____

In my planning I emphasise:

- Current problems _____
- Meeting objectives _____
- Future goals _____
- Developing people's careers _____

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When faced with solving a problem, I:

- Rely on proven approaches _____
- Apply careful analysis _____
- Look for creative approaches _____
- Rely on my feelings _____

When using information I prefer:

- Specific facts _____
- Accurate and complete data _____
- Broad coverage of many options _____
- Limited data which is easily understood _____

When I am not sure about what to do, I:

- Rely on intuition _____
- Search for facts _____
- Look for a possible compromise _____
- Wait before making a decision _____

Whenever possible, I avoid:

- Long debates _____
- Incomplete work _____
- Using numbers or formulas _____
- Conflict with others _____

I am especially good at:

- Remembering dates & facts _____
- Solving difficult problems _____
- Seeing many possibilities _____
- Interacting with others _____

When time is important I:

- Decide and act quickly _____
- Follow plans and priorities _____
- Refuse to be pressured _____
- Seek guidance or support _____

In social settings I generally:

- Speak with others _____
- Think about what is being said _____
- Observe what is going on _____
- Listen to what is going on _____

I am good at remembering:

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- People's names _____
- Places we met _____
- People's faces _____
- People's personality _____

The work I do provides me:

- The power to influence others _____
- Challenging assignments _____
- Achieving my personal goals _____
- Acceptance by the group _____

I work well with those who are:

- Energetic and ambitious _____
- Self confident _____
- Open minded _____
- Polite and trusting _____

When under stress, I:

- Become anxious _____
- Concentrate on the problem _____
- Become frustrated _____
- Am forgetful _____

Others consider me:

- Aggressive _____
- Disciplined _____
- Imaginative _____
- Supportive _____

My decisions typically are:

- Realistic and direct _____
- Systematic or abstract _____
- Broad and flexible _____
- Sensitive to the needs of others _____

I dislike:

- Losing control _____
- Boring work _____
- Following rules _____
- Being rejected _____

Personal and organizational information:

The following questions seek general anonymous information about you and your organization. Please provide your response by

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clicking on the appropriate option.

Personal and organizational information: The following questions seek general anonymous information about you and your organization. Please provide your response by clicking on the appropriate option.

What is your gender?

1. Male
2. Female

What is your age?

1. 20-24
2. 25–34
3. 35–44
4. 44–59
5. 60+

What is your level of education?

1. Primary school
2. High school
3. Diploma
4. Bachelor degree
5. Postgraduate Degree

What position do you hold in your organisation?

1. Quarry Owner
2. CEO of Quarrying Operation
3. Senior Manager
4. Quarry Manager
5. Quarry Operator
6. Regulator
7. Student
8. Industry Supplier
9. Other _____

Rate your influence on the strategy of your organisation?

1. High
2. Medium
3. Minimal
4. None

In terms of strategy formulation in my organisation; (You may select more than one option)

1. The main managers understand strategy in the same way
2. There is conflict between the managers
3. It is very much 'top / down'
4. It is a 'team effort' by all employees

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5. There is no clear strategy formulation

How much influence do you have on developing new ideas / solutions in your organization?

1. Very High
2. High
3. Average
4. A little
5. None

Innovation in my organisation is mostly done by:

1. Senior Managers
2. Managers
3. Consultants
4. Everyone
5. Nobody

How innovative is your organisation?

1. The leading innovator in our industry
2. Very innovative
3. Innovative
4. A little innovative
5. Not innovative

Please rate to what extent the following drivers will influence the future of the industry (from "no influence" to "very strong influence"

	No influence	Limited Influence	Some Influence	Strong influence	Very Strong Influence
Changes in Government	❑	❑	❑	❑	❑
Regulation	❑	❑	❑	❑	❑
Economic growth	❑	❑	❑	❑	❑
Environmental Politics	❑	❑	❑	❑	❑
Rehabilitation	❑	❑	❑	❑	❑
Automation	❑	❑	❑	❑	❑
New Transport Solutions	❑	❑	❑	❑	❑
Community Perceptions	❑	❑	❑	❑	❑
New Products	❑	❑	❑	❑	❑
Culture of the Industry	❑	❑	❑	❑	❑

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Professional Development	❑	❑	❑	❑	❑
Professional Certification of quarry managers	❑	❑	❑	❑	❑
Leadership	❑	❑	❑	❑	❑
Corporate Greed	❑	❑	❑	❑	❑
Mergers & Acquisitions	❑	❑	❑	❑	❑
New Competitors	❑	❑	❑	❑	❑
New Technologies	❑	❑	❑	❑	❑
Availability of Quarry products	❑	❑	❑	❑	❑
Ethical Practice	❑	❑	❑	❑	❑
Unethical Practice	❑	❑	❑	❑	❑
Workplace Health & Safety	❑	❑	❑	❑	❑
Infrastructure Spend	❑	❑	❑	❑	❑
Resistance to Change	❑	❑	❑	❑	❑

The following section will present 4 scenarios of how the future of the industry may look like by 2030. Each scenario will have a name and certain characteristics. The scenarios are not intended to be precise predictions but rather to develop a 'picture in the mind' of generally how the industry may look. Once you have read the scenario and considered "a picture" of that future, please rate the % likelihood of that "picture of the future" becoming a reality.

Scenario 1: **THE 'NANNY' QUARRY**
Very high levels of regulation / Very high levels of owner greed and direct intervention /

% likelihood

80%

Please contact Paul Sutton if you have any questions regarding this survey.

APPENDIX 7 CONSENT FORM INTERVIEW OVER 18 YEARS

University of Southern Queensland

Consent Form for USQ Research Project
Interview

Project Details	
Title of Project:	Australian Quarrying Futures: an evaluation of strategic thinking and foresight capabilities of strategy level leaders.
Human Research Ethics Approval Number:	HXXREAXXX

Research Team Contact Details

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Statement of Consent

By signing below, you are indicating that you:

- Have read and understood the information document regarding this project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that you are free to withdraw at any time, without comment or penalty.
- Understand that you can contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au if you do have any concern or complaint about the ethical conduct of this project.
- Are over 18 years of age.
- Agree to participate in the project.

Participant Name	
Participant Signature	
Date	

Please return this sheet to a Research Team member prior to undertaking the interview.

APPENDIX 8 INFORMATION SHEET QUESTIONNAIRE STUDENT RESEARCHER V0.1

University of Southern Queensland

Participant Information for USQ Research Project Questionnaire

Project Details	
Title of Project:	Australian Quarrying Futures: an evaluation of strategic thinking and foresight capabilities of strategy level leaders.
Human Research Ethics Approval Number:	HXXREAXXX

Research Team Contact Details

Principal Investigator Details

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Description

This project is being undertaken as part of Doctor of Professional Studies.

The purpose of this project is to explore the possible futures of the quarrying industry and profile the leadership capabilities needed to succeed. Your contribution is critical in gaining these insights.

The research team requests your assistance because of your futures' interest in the Australian Quarrying Industry.

Participation

Your participation will involve participation in an online survey that will take approximately 30 minutes of your time.

Questions will focus on the political, economic, social, technological, environmental, ethical and legal drivers of the future and ask you to rate the level of influence on the Australian Quarrying Industry.

Your participation in this project is entirely voluntary. If you do not wish to take part, you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You may also request that any data collected about you be destroyed. If you do wish to withdraw from this project or withdraw data collected about you, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland or The Institute of Quarrying Australia.

Expected Benefits

It is expected that this project will benefit you and the Australian Quarrying Industry you will be contributing to a study

of the quarrying industry that seeks to find ways for improving the success of your organization and industry. You may further benefit by requesting the final reports of the research to develop organizational and professional insights in this under-researched area.

Risks

There are no anticipated risks beyond normal day-to-day living associated with your participation in this project.

Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law.

Any data collected as a part of this project will be stored securely as per University of Southern Queensland's Research Data Management policy.

Consent to Participate

The return of the completed questionnaire is accepted as an indication of your consent to participate in this project.

Questions or Further Information about the Project

Please refer to the Research Team Contact Details at the top of the form to have any questions answered or to request further information about this project.

Concerns or Complaints Regarding the Conduct of the Project

If you have any concerns or complaints about the ethical conduct of the project you may contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

Thank you for taking the time to help with this research project. Please keep this sheet for your information.