

Requisite skills for effective executive leadership of infrastructure assets.

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Student Declaration

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Abstract

Historically, infrastructure assets such as roads, ports and utilities, the heart of economic and social development in today's society, were developed and operated by governments for the benefit of the community. Pressure on public budgets in the past thirty years has resulted in many of these assets being privatised. Privatisation has created a new investment class for institutional and retail investors to furnish a return for their funds. This transition from state owned organisations to private (often publicly listed) organisations has created a distinctive, atypical, and challenging business environment for existing and future executive leaders.

Executive leaders of infrastructure businesses historically have had technical backgrounds (for example, engineering qualifications) and, more often than not, had been promoted from within the ranks of a workforce dominated by an engineering culture. A direct result of privatisation has been the promotion of leaders with business, financial or legal qualifications instead. These new executive-types have been entrusted with the dual role of delivering acceptable returns to investors and meeting community expectations of asset performance, levels of service, and safety, all for the lowest possible price. Balancing these objectives is a difficult and complex task and requires outstanding leadership.

The primary aim of this study was to examine the requisite skills for effective executive leadership of infrastructure businesses. The leaders under particular focus were those currently operating in the upper three levels of an organization (senior management to executive and Board levels) and who may or may not have obtained engineering qualifications. The study explored whether these leaders, as exemplars of executive leaders of infrastructure businesses, were deemed to be effective or ineffective as perceived by expert reviewers who also operated at these executive levels. A secondary aim was to develop a methodology that would enable access to these leaders.

Using a mixed-method approach, this research examined the skill sets and leadership styles of Australian executives across a number of asset classes and their perceived leadership effectiveness. The methodology incorporated an unconventional approach due to time constraints and work commitments of the interviewees but proved to be effective, efficient, practical and robust.

The results of this research demonstrated that leaders of infrastructure assets can be effective with or without engineering qualifications but that technical skills (those skills required to ensure the physical assets continue to function and provide service to the community) are a requisite for

effective leadership even at the most senior levels of an organisation. Five skills (people, business, strategic, technical and administrative) were found to be necessary for effective leadership, but, in terms of priority, technical skills ranked behind people, business and strategic skills at the executive level. The leaders of infrastructure displayed leadership style characteristics typical of general leadership for all three constructs of influence, behaviour and derailment. The results demonstrated that both the ranking and the weighting of the skill varied depending upon both the level of a leader in the organization and the effectiveness of the leader.

This research has contributed to theory and practice through identifying the weighting and balance of the five skills required to ensure effective leadership. For engineering qualified leaders to advance within their organizations they must recognize both the ranking and weighting of the five skills. Development, training and certification of engineers for senior management requires appropriate courses and a framework that reflects this skill ranking and weighting. Current certifications such as those developed by the Institute of Asset Management (UK) and Institute of Engineers Australia do not currently reflect the findings of this research and continue to focus the engineering qualified leader on technical and administrative skills.

This research recommended that for infrastructure organizations, rather than pre-judge leadership effectiveness based upon initial tertiary qualifications (whether technical or not), leaders be identified, developed and assessed using the five skills required for effective leadership, namely, people, business, strategic, technical and administrative. It is crucial for both leaders and mentors to acknowledge the importance of all five skills and the criticality of balance in their use to ensure effective leadership of infrastructure businesses.

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(Gal 2:20)

Abbreviations and Definitions

AM	Asset Manager
AMC	Asset Management Council - Australia
AMP	Asset Management Plan
AO	Asset Owner
AS	Asset Services
ASX	Australian Stock Exchange
BCG	Boston Consulting Group
BCM	Business Centred Maintenance
CELM	Centre for Engineering Leadership and Management
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIEAM	Centre for Infrastructure and Engineering Asset Management
COO	Chief Operating Officer
CPI	Consumer Productivity Index
EA	Engineers Australia
GFC	Global Financial Crisis
GJ	Gigajoule of energy
GNT	Good Non - technical exemplar
GOC	Government Owned Corporation
GT	Good Technical exemplar
HRO	High Reliability Organisation
IAM	Institute of Asset Management – UK

ICF	Integrating Conceptual Framework
kwhr	Kilowatt hour of electricity
L of S	Level of Service
MD	Managing Director
MLQ	Multifactor Leadership Questionnaire
MSM	Management Skill Mix
NEM	National Energy Market
OCI	Organisational Cultural Index
PNT	Poor Non-technical exemplar
PT	Poor Technical exemplar
RAB	Regulated Asset Base
SP	Service Provider
WACC	Weighted Actual Cost of Capital

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1. Introduction

This thesis examines executive leadership of infrastructure assets and the skills required for this leadership to be effective.

This introductory chapter outlines the background to the research and why the research is significant; states the aim of the research and the research questions; states the justification for the research (suggests how the research contributes to new knowledge while highlighting some of the limitations of the scope); gives an overview of the research methodology and design; provides a structural outline of the remainder of the thesis; and defines key concepts used.

1.1. Background

Infrastructure assets provide the services that are at the heart of both economic and social development within society. These services, such as electricity, water, roads, ports, airports etc., are often taken for granted yet have significant impact if ever they fail in any way to provide the level of services required to maintain society's lifestyles. Historically, the creators and maintainers of this asset class were government bodies at local, state, and federal levels, who not only provided what is considered to be basic services to the community, but also other basic requirements such as health and education. These assets reflect, in many ways, the living standards and quality of life expected in modern society.

The Infrastructure assets themselves often reflect the growth of the community as it spreads out. The timeline of a city can often be seen in the spend and age profile of infrastructure from early development within the central business districts to more rapid urban growth as the population increases and demands the services expected of a modern economy. Since the Government provided the economic structures to develop these assets (often with a long term view in mind) they became widely known by members of the public as 'public' assets. These public assets often covered vast areas and employed thousands of people to construct, maintain, operate and manage their performance. However, during the past thirty years, many of these assets, especially electricity, gas, water/sewerage, and ports, have been sold to private investors. The income from

these sales provided government with additional equity for other projects such as health and education and released the community from the often high level of funding required to expand, replace and maintain these infrastructure assets. Under private ownership funding for any future infrastructure expansion comes from increasing the rates for services to the community. These increases in rates provide the revenue for private investors to put more capital to work whilst making a return on their new investment.

Private investment is not risk free as seen by the impact upon investors that were impacted during the Global Financial Crisis (GFC) in 2008 where many investors in the infrastructure class lost considerable equity and distributions due to the financial structure of high debt levels and/or inaccurate revenue assumptions based on aggressive volume assumptions, e.g. traffic on toll roads (Phibbs 2008; Sykes 2010).

Leadership, and, more importantly, effective leadership, is critical for successful business performance (Katz 1955; Badawy 1978; Yukl 1994; Bass 2008). However, leadership cannot be explored in isolation, but must be evaluated within the environment and culture in which it operates. This study focuses upon infrastructure organizations which have a predominantly engineering culture. The culture of an organization is impacted by the leadership and, in turn, may impact the leadership. Schein notes, *'in an age in which leadership is touted over and over again as the critical variable in defining the success or failure of organizations it becomes all the more important to look at the other side of the leadership coin – how leaders create culture and how culture defines and creates leaders'*, Schein (2004, p. xi). This research focuses on the executive levels of an organization from Board level down to the senior management who are the creators and maintainers of organizational culture.

Historically the leaders of infrastructure assets were engineers and the dominant engineering culture within these businesses was a reflection of this leadership (Wolmar 2005). However, the introduction of privatisation of infrastructure businesses and the necessity for investors to make a return on their investment has created a very strong business driver in the running of these assets. This has been reflected in changes to the focus of the leadership, away from the strong customer/engineering solution to a more business centric approach. Typically this has been achieved by removing the traditional engineering skilled leadership and replacing it with leaders

who have more generic business skills and who better understand the commercial requirements of these new businesses. This change in leadership resulted in cultural changes that clashed with the dominant engineering culture and in some ways reinforced the anecdotal perception that engineers do not make good leaders of businesses that require commercial outcomes (Whitmore 2004; Strangleman 2004; Wolmar 2005).

Consequently, executives in leadership have often been blamed for any failures of infrastructure such as failing to provide adequate services once guaranteed to the community, or failing to adequately maintain the assets themselves which, in turn, can lead to catastrophic events causing loss of life. Such failures have been touted as evidence that the leadership was ineffective and at fault (Hopkins 2005). At the same time the investors, or new owners, stated that the reason for replacing the original leadership team was because it had an inadequate understanding of the 'Big Picture' and was unable to manage the complex commercial realities of running a monopolistic business for profit and not purely for the community's benefit (Strangleman 2004; Wolmar 2005; Moran 2006). The stereotyping of engineers as poor leaders is embedded in folklore and is both contentious and emotive (Kniflick 2002; Gowland & Aiken 2003; Whitmore 2006, Wolmar 2005).

Goodall (2009) discovered this type of stereotyping is not distinctive to engineers and infrastructure businesses when she explored the current trend to replace traditional leadership of universities (academics) with managers and general leaders from business. Goodall (2009, p. xiii) states, *'I often respond to these claims — that an academic cannot be a leader — by posing a scenario: imagine that one hundred nurses and the same number of lawyers, chefs, advertising executives, engineers, journalists, and academics are randomly selected. Will we find one group or profession stands out as natural managers? If the answer is no then why do we stereotype one group as unsuitable to be managers?'*

Adams, Jochim and Cutting (2008) highlight the difficulties for infrastructure to develop the leaders within this new commercial environment. *'It is no secret that infrastructure organizations across the country are faced with large problems. Baby boomers are retiring and there is a much smaller supply of talent to replace them [leaders], organizations are faced with looming capital needs but lack resources to manage and implement projects; and Boards across the country are demanding greater efficiency from organizations they oversee'*, Adams, Jochim and Cutting (2008, p. ii)

This research explored the requisite skills (Katz 1955) and leader styles (Lombardo & McCanley 1988; Blake & McCause 1991; Yukl, Lepsiner & Lucia 1992) necessary to describe an effective leader in a typical business such as infrastructure with a dominant engineering culture. This research is significant because effective leadership is critical in order for infrastructure businesses to keep pace with the requirements of economic growth and with the wide spread backlog of infrastructure requiring replacement as it reaches the end of its design lives. All this must be done whilst managing risk to ensure the balance between asset integrity and profitability of the business is maintained.

1.2. Aim of research and questions.

The aim of this study is to (1) investigate the requisite skills for effective infrastructure leadership at the executive organisational level of the business; and (2) to explore a practical methodology for systematically and efficiently accessing the expert opinions and experience of senior executives regarding the skills and capabilities that characterize good and poor executive infrastructure leadership. This research addresses ten focus questions which appear below:

Table 1 Research questions

1	Are technical <i>qualifications</i> required to be an effective leader of infrastructure?
2	Do leaders in infrastructure have <i>styles</i> similar to those outlined in the broader general research and literature of leadership effectiveness?
3	Do the <i>qualifications</i> of the leaders in infrastructure influence their styles?
4	Are technical <i>skills</i> the most important skill in leadership of the engineering cultured infrastructure?
5	Are technical <i>skills</i> requisite for effective leadership?
6	Does an imbalance in the use of the <i>skills</i> diminish the effectiveness of the leader?
7	Do <i>qualifications</i> , technical or non-technical, of the leader amplify the imbalance of the use of the skills?
8	Can technically <i>qualified</i> leaders be developed to become more effective?
9	Can technically <i>unqualified</i> leaders be developed to become more effective?
10	Did the <i>methodology</i> enable the large sample of senior executives to describe their exemplars in a framework which provided logical empirical data for analysis based on historical proven measures of effective leadership?

The research and methodology draws upon the literature of leadership effectiveness from industry practice and general leadership research to examine the description of technical and non-

technical qualified executive leaders of infrastructure. It drew upon the current literature and research within a number of key areas, specifically:

- Infrastructure and the impact of privatization.
- Leadership and culture within infrastructure businesses.
- Senior leadership in the broader engineering profession.
- Executive leadership in general leadership.

1.3. Justification for the research

The privatisation of infrastructure assets has created a step change in what is expected of the businesses with regards to profits and performance. This, in turn, has created pressure on the traditional leader to change their focus, formerly on ‘public service’ i.e. provision of quality services to all. These services have historically been cost-inefficient as the respective owners (that is, governments) were not focused on profitability, but rather on attempting to provide quality services at a price that was essentially subsidized by all taxpayers. Consequently large corporate overheads were developed and infrastructures assets were typically ‘*over-engineered*’ and ‘*gold-plated*’ (Altman 2010, p. xiii).

Privatization has typically placed this demand for profitability and high quality service within the context of a government determined regulatory framework which has prescribed an appropriate return for shareholders and a requirement for service provision to all. These regulatory frameworks have been largely driven by the essentially monopolistic position held by infrastructure utility businesses. The demands on leaders when these were state owned gave greater emphasis to service provision than to the generation of profits. At an organisational level, the difference in emphasis is reflected in state owned infrastructure leaders reporting to a government minister whereas under private ownership corporate governance requires reporting to the Board whose primary responsibility is to all shareholders, not just the public. This creates an atypical business model where the executive leaders must work in a complex framework of often competing demands of investors, public, regulators and the long-life, monopolistic structure of infrastructure assets.

Traditionally, the leaders, mostly engineering qualified, have been slow to respond to change and were often replaced by non-engineering executive leaders (Whitmore 2004; Wolmar 2005; Altmann 2010). Engineers, with their risk- aversion and ‘gold-plating’ of solutions, were seen to

be the problem and, as such, deemed unsuitable as leaders (Wolmar 2005; Gowland & Aiken 2003) in this new complex business environment. Some leaders with engineering qualifications sought other qualifications which would help them gain acceptance. A Masters in Business Administration (MBA) was one such approach (Seethamraju 1997; Dudman & Wearne 2003). After thirty years of privatisation the industry has matured and moved towards a more balanced view of an effective leader in this complex business. This has been reflected in the attempts of industry professional bodies to define the competences of effective leaders in an engineering dominated environment (CEAM 2006; IAM 2008a; IAM 2008b). Questions still remain as to whether or not these industry bodies, dominated by engineers, understand the leadership style and skills required by an industry no longer dominated by engineers and the public service focus.

This research builds from the classic work of Katz (1955) who described effective leadership not by the qualifications one has but by the skills the leader displayed in completing their tasks. These skills may or may not derive from the qualifications of the leader.

Leadership literature is replete with detail regarding what constitutes effective leadership style and what contributes to effective leadership. Yukl's integrating conceptual framework (Yukl 2004) provides a structure for this research to link skills and effective leadership style. Effective leadership can result in the much needed profits for investors and, also, services to the public at an affordable price. Ineffective leadership can result in, not only financial failure for the company, but also significant asset failure and may impact the public by way of inconvenience from loss of supply, to economic disruption through to catastrophic impact of multiple fatalities.

1.4. Methodological Overview

The methodology is a mixed-method approach consisting of a structured phase utilizing constructs of proven measures to gather statistical information and a semi-structured phase to elicit the experiences and knowledge from expert reviewers who selected and described executive leaders, one good and one poor exemplar, with whom they had worked. A total of 46 expert reviewers provided both quantitative and qualitative data on a total of 91 exemplars of executive leaders. All reviewers and exemplars worked in the field of privately funded infrastructure.

The integrating conceptual framework was chosen as a framework that linked leader skills and leader style to ensure the research did not get '*trapped within the traditional narrow focus and lack of integration of the findings from the different [leadership]approaches*' Yukl (2006, p.

447). Yukl's (2006) three core elements of Leader Skill (LS), Leader Influence (LI), and Leader Behaviour (LB) were used from his framework to flesh out descriptions of the leader and the constructs from the measure Leader Derailment (LD) is used as an 'antitype' of effective leadership style. LI and LB provided additional indirect measures of leadership effectiveness based on the impact on followers as perceived by the reviewers.

In the structured phase the methodology utilized constructs from established measures to ensure the descriptions were consistent with past research. The use of constructs of the measures rather than the full measure was a compromise required for the methodology to be practical and effective with expert reviewers who had limited time to spare. These measures are summarised below.

Table 2 Summary of the measures from which their constructs were utilized to describe the exemplars of leadership

QUANTITATIVE PHASE		
ELEMENT	MEASURE	REFERENCE
Leader Skill (LS)	Leader skill Mix	(Katz 1955; Badawy 1978)
Leader Influence (LI)	Influence Tactics	(Yukl, Lepsinger & Lucia 1991)
Leader Behaviour (LB)	Grid®	(Blake & McCause 1991)
Leader Derailment (LD)	Derailment	(Lombardo & McCanley 1988)

The methodology's qualitative phase draws upon the semi-structured interviews of 46 reviewers. The interviews provided the ability to confirm the results covered in the structured phase and explored the rich experiences of these leaders regarding what they believe or have seen with effective leaders and the skills they possess or require in the complex business of infrastructure.

1.5. Structure of Thesis

The thesis begins in Chapter 2 with an introduction to infrastructure businesses, risk in infrastructure and the competing demands of executive leaders after privatization of infrastructure businesses. Chapter 3 explores the literature regarding leadership style and leader skills within (1) executive leadership in the infrastructure industry, (2) engineering professional; and (3) general leadership literature. Chapter 4 details the selection of the chosen methodology

(mixed-method with a structured and semi-structured phase) and the compromises required to ensure the methodology was practical and effective. Chapter 5 presents the results and analysis from phase B of the methodology, highlighting demographics of the reviewers and their exemplars and the results from using the constructs of the three historical measures to describe good and poor exemplars. Chapter 6 presents the results and analysis from phases C & D, the skills assessment and how the description varied between the reviewer's good, poor and ideal exemplars. The final chapter discusses the results from the Chapters 5 and 6, and how the descriptions varied between effective and ineffective exemplars of executive leaders of infrastructure and what the implications are for practice and future research.

1.6. Definitions and concepts

The following definitions clarify the terms and concepts used within this thesis.

Infrastructure: Infrastructure describes the physical assets and necessary service provision which provide energy, water, transportation to economic entities and/or wider public to maintain and enhance social living conditions (Weber & Alfen 2010; Altmann 2010).

Effective Leadership: The term 'effective leadership' is used broadly throughout this thesis and picks up the predominant concern of leadership style. Leadership style is dominated by five approaches of research (Yukl 2009) and the terms 'leadership' and 'management' are used interchangeably (Jaques 1989).

The leader's effectiveness can be measured using any of the four approaches listed below (Yukl 2009):

- (1) How an organization performs its tasks successfully;
- (2) The attitude of followers towards the leader;
- (3) The leader's contribution to the group's processes as seen by external stakeholders; and
- (4) The extent to which a person has a successful career as a leader.

This research utilizes points (2) —attitude of followers to leaders, and (4) —leader's contribution, as the measures of effective leadership and this will be explained in greater detail in Chapter 4.

Engineering culture: The term ‘culture’ is the other side of the leadership coin. Schein (2004, p. 10) says, *‘Neither can be understood without the other. Leadership changes culture while management acts within a culture.’* This research utilizes Schein’s (2004, p. 17) definition of culture i.e. culture is *‘defined as a pattern of shared basic assumptions that was learned by the group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.’*

This is a long definition but the critical observation for leadership is that once a culture exists it determines the criteria for leadership and thus determining its effectiveness. Schein (2004) goes even further states that the *‘bottom line for leaders is that if they do not become conscious of the cultures in which they are embedded, those cultures will manage them,’* Schein (2004, p. 23).

Schein analyses culture as having three levels. On the top level are **artefacts** (visible organizational structures and processes) followed by a middle level of **espoused beliefs and values** (strategies, goals and philosophies), and on the bottom level there are the **underlying assumptions** (unconscious beliefs, perceptions, thoughts and feelings) or, basically, the DNA of a culture.

Schein also classifies all organizations into three distinct **subcultures**. These are those of:

- (1) The CEO or **executive culture** which focuses on the financial element of the organization and its financial successes;
- (2) The **operator culture**, focussing on the day-to-day line management of people to get a process done and with little finance built into this culture; and
- (3) The **engineering culture**, focused on the enablers, engineers and technical specialists who are focused on solving problems and are driven by creating an ideal world often ignoring the financial element of the business. This culture and the consequences will be explored in detail in Chapter 3.

Skills: The skills referred to within this thesis are based upon the work of Katz (1955) and Badawy (1978). The skills are core managerial skills which expand Katz’s original three-category typology into a modified five-category. These are the skills necessary for successful performance of leaders doing their work, the task they do rather than the traits which describe

how they do it (Yukl 2004; Peterson & Van Fleet 2004). The five skill definitions utilized in this research are:

- *People skills*: How the leader leads and utilises people to work towards a common goal of the business.
- *Business skills*: How the leader directs business to make a profit for investors.
- *Strategic skills*: How the leader develops and shapes the future of the business.
- *Technical skills*: How the leader influences the physical assets to function to meet the objectives of the business and risk to stakeholders.
- *Administrative skills*: How the leader develops systems and processes to ensure the gains within the business are maintained and governed to corporate standards.

Reviewer: The reviewer is the person used within this research to provide their perceptions of effective and ineffective leaders of infrastructure assets. They are experts in the field of infrastructure businesses having many years of experience and successful careers enabling them to reach senior levels in an organization. They are defined as being technical if they have an engineering type qualification/background and non-technical if they do not.

Exemplar: Exemplars are the leaders, selected by the reviewer, whom the reviewers describe in the structured phase of the methodology. They too can be either technical or non-technical depending on whether their qualifications/background is engineering or not. The exemplars must lead teams which are responsible for the functioning of the assets which provide the services to the community/customers.

Levels of the organization: This research focuses upon the top three of five levels model of an organization (Jaques & Clement 1991).

- *Level 5*: Consists of Board of Directors and Managing Director.
- *Level 4*: Consists of CEO and the executive team reporting to the CEO.
- *Level 3*: Consists of the senior managers reporting to the executive team.

Executive Leadership: Executive leadership is a generic term used to describe the management positions that dominate levels 3 to 5 of an organization. Traditionally, they are experienced, successful leaders and have been promoted to these positions because of their general leadership capabilities.

Infrastructure Businesses: The Infrastructure businesses to which the reviewers and their exemplars belong are significant businesses within the Australian corporate environment. They can be defined corporately as:

1. Private companies, which may or may not be listed on the Australian Stock Exchange (ASX).
2. Not Government owned corporations (GOC).
3. All governed by a Board of Directors as per the Corporations Act of Australia.
4. Demographically with asset bases valued at greater than \$1billion and employing in excess of 500 people.

Technical and Non-technical: The skills of the reviewers and their exemplars are defined as being either 'technical' or 'non-technical'. 'Technical' refers to a person who has either qualifications and/or a background in engineering or science. They may only have trades-based qualifications. What defines them is that they have skills that impact the functions of the operations, maintenance, and construction of the assets that provide the services to the community. 'Non-technical' skills are all those skills such as business, finance, law, investor relations etc. and those who old such skills are not working directly with the infrastructure assets.

1.7. Conclusion

This chapter provided an introduction to the research. It introduced privatization of infrastructure businesses and how the changes have driven the need for effective executive leadership in order to balance the technical and business drivers to meet the demands of all stakeholders. The chapter continued on to briefly explain the justification for this research and the approaches that infrastructure businesses and professional bodies have taken to ensure executive leaders can operate effectively in this complex, monopolistic, atypical business environment. The chapter outlined the aims of the research and the ensuing research questions which led to the development of the methodology which will utilize a mixed method approach which must be efficient and practical if it is to be effective with expert reviewers who are time constrained. Finally, a brief outline of the structure of the thesis was given. A list of terms and concepts used within this thesis provides the reader with a reference guide for the remainder of the thesis.

The following chapter provides further detail regarding the background of private infrastructure, an atypical and complex business. The chapter also explores the approaches embarked upon by

the new owners of these assets to enable management to better meet the new demands and how governments introduced regulation to ensure affordable security of supply within these long-life often monopolistic businesses. The detail regarding infrastructure will provide a context for better understanding the requirements for executive leaders' style and skills to be effective.

2. Historical and Professional Context of the Research

This chapter provides the historical and professional content of the research of this thesis. The research is fundamentally about executive leadership of infrastructure and the skills which enable this level of leadership to be effective. Investors and governments have shown significant interest in infrastructure businesses (Weber & Alfen 2010), and the quality and volume of the businesses has a positive impact upon the economic growth and competitiveness of cities and countries. Australia, in the context of the current mining boom, is all too aware of the need for infrastructure to maximise returns to the community and trigger growth and investment (ACIL Tasman 2009). Infrastructure as an asset class and business will be expanded on in the following sections. An important element of this research is the executive leadership whom are responsible for leading and managing these companies. The leadership roles at this level of an organization are often strategic in nature (Yukl 2009) and require a level of skill to manage the complexity driven by the strategic nature of their level in the organization and the multiple stakeholder requirements (Jaques & Clement 1991). The nature of infrastructure businesses adds to the complexity for these executive leaders because these businesses have a number of atypical of attributes.

The review of the literature examines the infrastructure as an asset class and the businesses built upon these assets. The nature of infrastructure is identified in the literature and it also outlines the nature of risk that needs to be managed for these assets. Risk, if not adequately managed, can have significant impact on community safety, cost of services to the community, and growth of the economy. These risks have created competing demands for the executive leaders as they balance returns to investors, cost and level of service. These executive leaders have seen a cultural shift from an engineering focus to a business focus due to infrastructure assets being privatized from previous government ownership.

The chapter also examines the infrastructure leadership and the transition of skills from technical to financial/commercial as a result of privatization. Engineers have traditionally held the executive roles and the observations have been that they lack the necessary business acumen. Gowland and Aiken (2003) note the failure of assets, commercially and impact upon community safety, has led to the community and governments to question the appropriateness of this leadership transition. Industry has identified this gap in the performance and has embarked on various approaches to improve performance by focussing upon the leadership style and skills.

The chapter illustrates how new investors have influence the replacement of executive leaders on the basis of their qualifications and how new executive leaders have been introduced, often from

outside the industry, who have qualifications more aligned to the investor's required business objectives.

2.1. Introduction to infrastructure

Effective infrastructure and infrastructure businesses are critical for economic growth and an efficient functioning community. Reduced government ownership and spending of infrastructure has provided an opportunity for private investment – the market size is estimated to be over US\$20 trillion globally (RREEF 2008). This transition from public to private ownership, often termed privatization, has seen a once engineering dominated leadership replaced with a leadership more skilled and focussed on financial returns for the new investors rather than the historical focus on levels of services within a public service culture. Tim Collins, shadow Minister of Transport, UK, Sept 2003 (AMC 2011b, p. 17) said, *'the rail industry...swings across the years from periods where you have engineers in charge, and they spend money like water, to periods when you have accountants in charge, and they don't spend any money at all. As in most things, the sensible place you want to be is somewhere in the middle.'* Thus the transition has seen tension between stakeholders (investors, regulators, the community and business itself) as to what is the most effective way to lead and manage these organizations.

There are a number of competing demands which require effective executive leadership if these new privately invested businesses are to meet community expectations and provide the required returns for the investors. This chapter explores the literature around infrastructure and their leaders. The nature of infrastructure and the nature of risk within infrastructure set the background for the nature of effective leadership in these businesses.

2.2. Nature of Infrastructure

Weber and Alfen (2010, p. 7, 8) describe the characteristics of infrastructure and why it is an attractive long term investment:

- Key public service –Infrastructure provides key requirements for everyday life such as energy, water, communication, roads, etc.
- Low elasticity of demand – The requirement of infrastructure is relatively independent of industry cycles and economic performance thus providing stable and predictable cash flows.

- Quasi-monopoly situation with high barriers to market entry – Infrastructure assets are hard to duplicate due to their large start-up investment and operational costs. Thus there is little or no competition.
- Regulation – In the industries of little or no competition, government through regulators provide the corrective function for the market to ensure public is not forced to accept excessive profits for infrastructure investors.
- Long service lives – Infrastructure often have long service lives, sometimes in excess of 100 years. This does not mean that once built there is no need for further capital, quite the opposite, this assets often required routing capital expenditure to ensure the assets can meet growing market demand and maintain their level of service.
- Inflation protection – Infrastructure can provide a natural hedge against inflation for investors as revenues from infrastructure investment is often contractually linked with CPI.
- Regular, stable cash flows – Because of the characteristics of the above for infrastructure and the revenues for investors being linked to CPI, investors receive regular, stable cash flows or returns on their investments.

These distinctive characteristics of infrastructure make them an attractive investment vehicle for investors who are expecting a greater performance than low return/risk options such as cash and bonds while not accepting the higher risk/return options of private equity and hedge funds (Lazard 2007).

Infrastructure as a business class was initiated by private investors in the 19th Century. The focus was on railways and urban services but as assets required significant ongoing capital which private investors could not provide government stepped in to ensure this critical element continued to provide support for the economy (Beito 1993). This was particularly the case for the railways in Australia in the late 1800s (Australian Government. Department of Infrastructure and Transport 2012).

Kong (2007) studied the changes in private participation in infrastructure and how it has vacillated backwards and forwards between government and private ownership. He notes a general trend in the past fifteen years away from the state-owned companies which occurred as a result of the two World Wars back to private ownership. He highlights that the *'see-sawing of shifts between public and private sector participation was driven by judgement of political leaders, rise of environmental concerns and changing ideas concerning the role of the state in*

society (e.g. nationalization of US electric utilities after World War II due to national security concerns)’, Kong (2007, p. 4).

Historically in Australia, infrastructure investment was not available as the asset was traditionally developed and funded by governments due to the critical link between enhancing a nation’s productivity and providing a service to the voting public. “Privatization” is the process of selling or transferring public sector (government) businesses to the private sector. Infrastructure businesses, because they are built around large revenue streams (customers) and large asset bases (large real asset balance sheets), make an ideal private investment. There are a number of arguments expressed both for and against privatization. Table 3 below delineates some of these.

**Table 3 Arguments for and against privatization of public assets to private sector.
(Gowland & Aiken 2003)**

FOR	AGAINST
Privatization generates funds for governments by selling off the assets/services. The funds are used on other public services such as health and education or to reduce public debt to ensure credit rating.	Once sold the government no longer has a long term revenues stream which could be used to fund future government initiatives.
Competition by the private sector drives effectiveness within these business sectors thus creating cheaper services.	Many jobs within the public sector are lost and profits take priority over public service.
Market forces see more and innovative services to consumers.	As these are essential services unprofitable areas/sectors may not be provided for rather than ensuring service for all.
Governments cannot afford to invest in the required capital for growth and maintenance without increasing rates to the consumers. Private investors obtain equity and debt outside government treasure.	Profit-driven organizations may focus on short term returns to investors rather than updating and growing infrastructure.

As a result of privatization within Australia billions of dollars have been raised from asset sales. The privatization of Victoria’s electricity and gas assets in late 1990’s realised over A\$30 billion which was used by the state to retire debt, thereby reducing interest payments of over A\$2.2 billion per year (Access Economics 2001). Privatization remains popular with governments who maintain that the private sector is better suited to run businesses than government. Reaction to the strategy and the results are mixed both in the short and long term (King & Pitchford 1998; Access Economics 2001). Reaction to the strategy is reignited whenever perceptions regarding

services and cost of the services do not meet community expectations. Further discussions are then raised in the public forum. In some cases the previously privatized assets have been nationalised to quell voter back lash (Wolmar 2005).

Government Owned Corporations (GOC) were created as a 'half-way house' between public services and private ownership. GOC business is still owned by and managed by the government usually through minister who is in charge of this portfolio. It is run like a private business however the returns go to Treasury rather than private investors and there is only one shareholder, namely, the government.

The GOC principles (McDonough 1998), are summarised by four objectives:

1. Clarity of objectives. Each GOC must set its own objectives such as financial performance and community obligations. Removal of any regulatory or policy being derived from a government department or agency.
2. Management autonomy and authority. A board must be established for each GOC and it must meet the performance targets set externally by the Ministers responsible for the GOC. The board must have autonomy to make commercial decisions and empower management to deliver performance.
3. Strict accountability for performance. Accountability for the performance of the GOC is from the board to the ministers who are the 'shareholders'.
4. Competitive neutrality. Each GOC must compete equally with private sector and any advantages/disadvantages because of public ownership must be remove or minimized.

The government's role in being the provider of public services, i.e. whether or not government agencies can deliver more effectively than the private sector, continues to be questioned. Whilst debt legitimately can be placed on the private sector's balance sheet, it cannot be for Treasury, and these factors will continue to enforce the migration from government provided and managed infrastructure to the private sector.

Australia, UK and Canada each now have a long history of private infrastructure investment. Other countries such as the US and some in Europe and Asia are starting to have an increasing focus in this class of investment. The investment has primarily been '*across economic infrastructure sectors of transport (e.g. toll roads, airports, seaports and rail), energy and utilities (e.g. water, electricity and gas) and communications (e.g. mobile phone networks and telecommunication networks)*', Newell, Peng and De Francesco (2011, p. 60).

Over 10% of Australia's 2009 superannuation investment of A\$1.2 trillion was in infrastructure (Newell, Peng & De Francesco 2011). Peng and Newell (2007) in their research identified 32 listed infrastructure funds with a market capitalisation of over A\$55 billion operating in the Australian market in 2006. The table below summarises the total assets in the funds.

Table 4 Summary of 2006 Australian infrastructure funds - total assets (Peng & Newell 2006).

2006 AUSTRALIAN INFRASTRUCTURE PROFILE – TOTAL ASSETS \$A	
<u>Listed funds</u>	21 entities @ \$79.7b
Transmission & distribution	9 entities @ \$22.8b (gas distribution & transmission, electricity distribution & transmission, power stations, water distribution)
Toll roads	5 entities @ \$21.6b
Integrated Utilities	3 entities @ \$14.7b (exploration, transportation & distribution & retailing)
Airport	2 entities @ \$10.4b
Communication	1 entity @ \$4.6b
Diversified utilities	1 entity @ \$3.0b
Generation	11 entities @ \$2.6b
<u>Unlisted funds</u>	18 entities @ \$4.4b-

Privatization enabled the assets to change from public to private ownership. With these changes *'two major factors which impact upon employees are (1) the need to restructure the organization prior to the sale; and (2) the cultural changes occurring with the new ownership'* Gowland and Aiken (2003, p. 43).

The process to assist this change was facilitated by the introduction of competition, creation of profit centres and introduction of external contracted resources. The key to changing was the appointment of change agents, leaders at the top of the organization who exemplified the new culture, and the organization was seeded with some key leaders with commercial experience. Gowland and Aiken (2003, p. 56) note that the key issues that were introduced to create the change include:

1. Downsizing of staff;
2. Introduction of private sector managers;
3. Reduced union power;
4. Operating in an open market;

5. Increased accountability for work practices performance and financial measurement;
6. Increased flexibility required of staff; and
7. Close attention to business/profit centres.

The result of these changes has seen financial benefits for the government in their sale and, new private investors (Moran 2002; Abbott 2006).

Moran (2006, p. 180) notes that the ownership of assets in the Australian National Energy Market (NEM) varies:

• Generation –	36% Private	64% Public
• Transmission –	43% Private	57% Public
• Distribution –	50% Private	50% Public
• Retail –	45% Private	55% Public.

This privatization lead to the introduction of government regulation, both commercial and technical, to ensure that the monopolistic nature of the infrastructure assets did not cause an increase in the cost of service, or reduction of service levels, to the community in which it operates. Readman (2010) expands this history in the utilities while Wolmar (2005) gives much detail of the privatization of the railways in Britain. Both their observations highlight the segregation of leadership from the engineering teams during privatization. The regulator soon also noted the separation and the impact of the tension between the commercial and technical requirement of the businesses and moved from a ‘light handed’ approach to a much more prescriptive approach.

The prescriptive approach to regulation has impacted these private and public infrastructure companies in the way that respond to adequacy of the quality of the assets that provide their investors a return. Engineers Australia (EA) completes an independent national review of the infrastructure assets to meet society’s needs. The report not only examines the issues concerning the asset but also the implementation of best practice provisions and management. The table below shows the results of past reviews.

Table 5 Summary of Engineers Australia’s review of Australia’s infrastructure performance (Engineers Australia 2010).

INFRASTRUCTURE TYPE	NATIONAL 2001	NATIONAL 2005	NATIONAL 2010	MAJORITY OWNERSHIP
Roads overall	N/R	C	C	GOC
National Roads	C	C+	C+	GOC
State Roads	C-	C	C	GOC
Local Roads	D	C-	D+	GOC
Rail	D-	C-	D+	GOC
Ports	B	C+	B-	GOC
Potable Water	C	B-	B-	GOC
Waste Water	C	C+	B-	GOC
Storm Water	D	C-	C	GOC
Irrigation	D-	C-	C	GOC
Electricity	B-	C+	C+	Private
Gas	C	C+	B-	Private
Telecommunications	B	N/R	C	Private
Airports	B	B	B-	Private
Overall:	C	C+	C+	-

SCALE	Description:
A	Very good – fit for current and future requirements
B	Good – minor changes required
C	Adequate – major changes required
D	Poor – critical changes required
F	Inadequate for current/future needs

Infrastructure assets require strong revenues and sufficient subsequent cash flows to meet all the costs incurred from debt servicing; major construction to match growth requirements and appropriate maintenance to ensure level of service is maintained.

Infrastructure Australia (2010, p. 8) notes that, ‘...*the effectiveness of current and future infrastructure in meeting economic, environmental and social needs is of critical national importance*’, and Helm (2009) in speaking about UK infrastructure states that, ‘...*poor infrastructure creates a significant drag on economic performance*’. The UK treasury has responded by releasing a National Infrastructure Plan, (Infrastructure UK 2010), to highlight the need, the challenge, the enabling processes and specific plans for investment. In particular the numerous ownership models and cost of capital have created a complex set of drivers which have created mixed delivery cultures and very different resulting levels of services and returns to investors. The table below from the plan highlights the complex delivery environment.

Table 6 Infrastructure commercial models – varying levels of ownership across different industry groups Infrastructure UK (2010, p. 44).

	ENERGY	DIGITAL COMMUNICATIONS	TRANSPORT	FLOOD MANAGEMENT, WATER AND WASTE
1. Private ownership		Cable mobile phone networks	Ports and M6 Toll	Commercial waste
2. Private ownership with targeted support	Electricity generation			
3. Regulated private ownership	Transmission and distribution networks	BT Openreach.	Some airports	Water supply and sewerage in England
4. Private ownership with regulated cash flows and government support			Network Rail	
5. Private ownership with public contracting for service delivery				Local authority waste management
6. Mutual ownership				Welsh Water and British Waterways
7. Public ownership with user charging				Scottish Water and commercial waste operations by local authorities
8. Direct public ownership			Roads	Flood management and Northern Ireland Water

Infrastructure assets generate sustainable income with capital growth over time, offering investors attractive total returns. This ability to produce stable cash flows over long periods is one of the measures used to quantify the performance of this asset class. Because some infrastructure assets operate under a regulated regime the amount of cash available for investors is often restricted to ensure services such as water, electricity, gas etc. are available to the whole

community and not just those that can pay. This is both a plus and minus for investors as it creates certainty of returns but limits the returns because of the lower risk compared to, for example, mining companies.

The stable cash flows that investors require has to be managed effectively. Recent history, e.g. during the GFC, highlighted some risks that were not adequately managed such as debt levels and volume/tariff risk on revenue. This resulted in significant financial issues for both investors and banks (Sykes 2010).

One example is Babcock and Brown Infrastructure (BBI) whose *'business model was to buy apparently desirable assets using some equity and great deal more debt...At its peak in 2008, BBI had accumulated a magnificent list of diverse assets supported by a mountain of debt..'*, Sykes (2010, p. 344). BBI's total assets reached \$14 billion in 2008 of which debt consisted of \$8.7 billion, equity of \$2.9 billion and the remainder of \$4 billion of intangibles. During the GFC the BBI share price began to drop from \$2.10 (May 2007) down to \$0.06 (June 2009) primarily due to the inability of BBI to refinance the large debt portfolio at the same rates available in the time before the GFC (Sykes 2010).

The GFC identified that another risk for infrastructure assets was demand risk and this was highlighted in the Australian toll road sector, examples include Cross-City tunnel and Lane Cove tunnels in Sydney, and the Clem 7 and BrisConnect in Brisbane. All these greenfield projects appeared to be prudent investments with foundational revenue assumptions sufficient to service the high debt profile and pay investors a return. Actual traffic volumes did not match (the numbers in the revenue forecasts) when the roads opened placing critical pressure on the businesses and ultimately placing them into administration. (Phibbs 2008; Infrastructure Partners Australia 2009; Regan, Smith & Love 2011).

Infrastructure assets in the majority are regulated because of their monopolistic characteristics. The majority of regulated assets have their allowable revenue calculated using the building block approach where the:

$$\begin{aligned}
\text{Maximum Allowable Revenue} = & \quad \text{Return on capital (weighted actual cost of capital)} \\
& \quad (\text{WACC}) * \text{Regulated Asset Base (RAB))} \\
& + \quad \text{Return of capital (Depreciation)} \\
& + \quad \text{Operating costs (Opex)} \\
& + \quad \text{Tax}
\end{aligned}$$

The regulator sets the maximum allowable revenue for a regulatory period, normally five years, and over that period any improvements from business efficiency are ‘kept’ by the business prior to the next reset when new maximum allowable revenue is determined. Over 70% of a network’s revenue is derived from the returns on and of capital ACCC (2009, p. 132). Opex accounts for approximately 25% and tax, the remainder.

This revenue for the infrastructure businesses is what is charged to the customers normally through a tariff based on usage i.e. kwhr of electricity or GJ per annum of gas. A typical annual retail electricity bill is made of a number of components derived from these infrastructure charges: generation (43%), transmission (6%), distribution (41%) and retail (11%) (Integral Energy 2008).

AER (2006) sites the opening RAB value for all Australian energy sectors is A\$44.1 billion. The primary area of privatization in Australia has occurred in this sector. Of the total RAB value, electrical distribution accounts of 60%, electrical transmission accounts for 21%, gas distribution accounts for 13% and gas transmission accounts for 6%. Taking electrical distribution with a RAB of A\$26.4 billion it also has a five year capital expenditure program of A\$13.9 billion and an operating expenditure program of A\$9.2 billion.

Thus, in terms the regulated energy sectors, the assets are measured in the billion dollars and billions of dollars are required to be spent to grow the assets to match complex demand requirements. To ensure that these assets meet the performance required by the community in terms of level of service and growth, over a five year period, the infrastructure companies will have funded, coordinated, operated and managed A\$20.3 billion of capital expenditure to match

growth requirements and A\$13.7 billion of operating expenditure to maintain the existing level of service AER (2006, p 12). These large ongoing capital expenditures see infrastructure businesses completing often very large complex capital projects within a greenfield/brownfield operating environment.

Figure 1 below illustrates an example of a typical network investment curve.

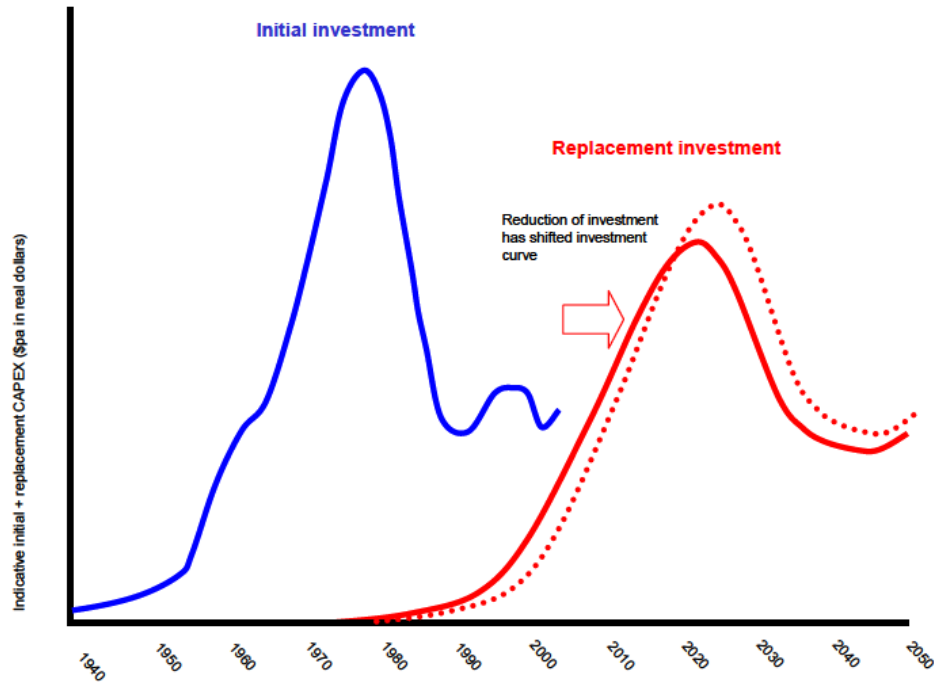


Figure 1 Network investment curve Western Power (2011, p. 1-5).

The shape of the curves above illustrates the initial investment from the early 1900's. A large amount of the network reaches its useful life and new investment is required. This new investment is restricted by the regulator as to not unnecessarily increase the maximum allowable revenue and provide a mechanism to force infrastructure companies to develop for effective and efficient ways to delivering capital and operating the networks. Reduction in new investment pushes the investment curve higher and into the future. Companies and regulators anticipate that over time more effective solutions may be found to minimise the new investment requirements.

Thus infrastructure business can range from a typical greenfield construction project, as in the case of a new coal port rail line, to a newly developed mine or a brownfield business, completing maintenance on existing assets and spending capital to expand the existing network to match growth requirements from users. Infrastructure as a business is not a typical business providing products within a competitive market where the market determines profitability and demand. Indeed, infrastructure is an atypical business in which it provides essential services in a monopolistic environment, where the whole community is directly impacted by tariffs and levels of service, and the previous owners apply regulation to minimise the returns to investors. This pressure to keep tariffs low (by minimizing returns) and gain public support does not provide incentive for investors to place more capital into the business to replace aging assets and build new assets to meet growth requirements. This is a complex business with drivers that are not typical of general business (Weber & Alfen 2010; Altmann 2010).

2.3. *Nature of risk in infrastructure*

Infrastructure was introduced in the previous section, its nature in business, its magnitude and the creation of a new investment class for private investors. All businesses have risk, from business risk around adequate returns to investors; meeting debt coverage; commodity volume risk, through to reputation, employee and public safety. The leaders of infrastructure must minimise the severity and consequences of the risks by putting in place adequate controls. A certain amount of risk remains in all businesses (Hopkins 2005). The reward for investors is a trade-off between risk and reward. In those businesses which are risk free (low volatility), the returns to investors are usually lower than those with more risky investments (higher volatility) where the rewards can be much higher but so also can be the losses. The figure below highlights the investment strategies available to investors compared to the risk return profiles.

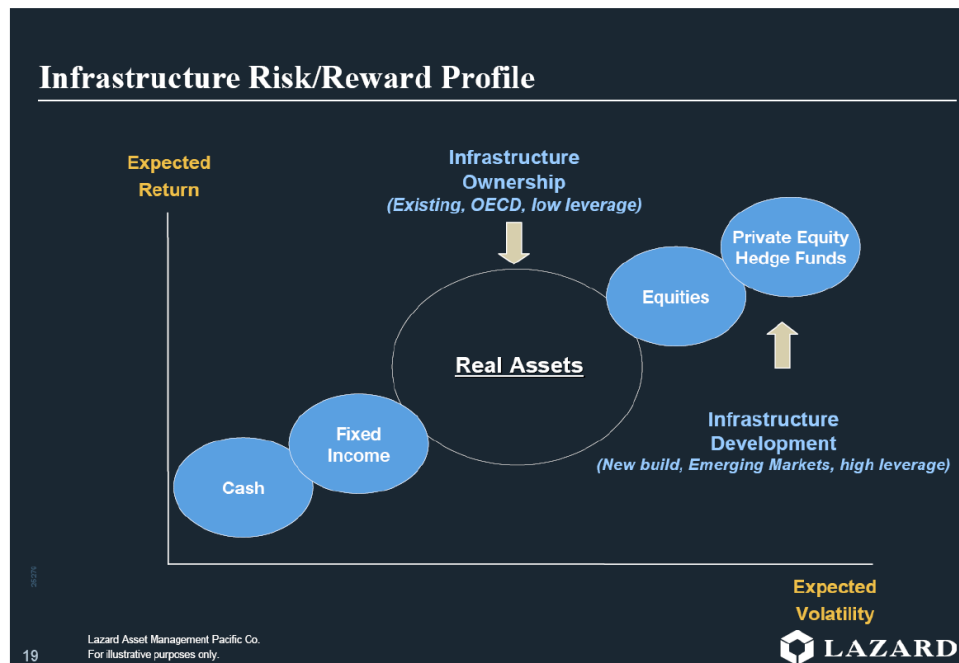


Figure 2 Risk-return profile of infrastructure investments vary widely in relation to traditional asset classes Inderst (2009, p. 42).

Risk, from a financial point of view, must be in line with the investor’s perceptions when they purchased the assets. The assets are often valued as multiples of RAB and/or EBITDA. These metrics and their assumptions determine value and justify why these investments are more risky than ‘cash’ and hence have higher returns (Altmann 2010).

Newell and Peng (2007), in their research, identified the ranking for motivating factors for infrastructure investment and the risk factors for this investment. They identified: long duration and liability matching; predictable and stable cash flows; and a greater understanding of infrastructure investment risk as the three highest motivating factors — or those that bring intrinsic reward—for infrastructure investment. They also identified: uncertainty of government policy regarding infrastructure; over-valuation of infrastructure assets; and lack of quality infrastructure stock as the three highest risk factors for infrastructure investment. The table below compares the characteristics of infrastructure with other investment opportunities.

Table 7 Characteristics Associated with infrastructure and other assets categories
Beeferman (2008, p. 17).

	Infrastructure	Institutional Bonds	Institutional Real Estate	Private Equity
Nature of Asset	Typically operating company dependent on control of large, physical assets	Financial security	Physical Property	Operating Company
Asset Availability	Asset scarcity, many in unique, monopoly situations	Deep volume in most markets	Moderate to deep volumes in most markets	Moderate volumes in most markets
Acquisition Dynamic	Competitive tenders, regulatory, environmental, social and political issues, often held for the long run	Efficient, on-market purchase	Competitive tenders, environmental and social issues common	Competitive tenders, management buy-out, negotiated trade sale, typically medium-term exit strategy
Liquidity	Moderate	Very high	Moderate in most sectors	Moderate
Income	Once assets mature, very stable, inflation/GDP growth relative. Typically higher than bonds and core real estate	Fixed coupon: sensitive to interest rates	Mixture of fixed and variable interest rate and sector dependent	Typically dominated by capital returns
Growth	Dependent on asset stage: modest (late-stage) to high (early stage/development) assets)	Low	Dependent upon asset characteristics; moderate to high	Dependent on asset characteristics; typically high
Volatility	Moderate (early stage) to low (late stage)	Moderate (market factors)	Low/Moderate	High (early stage) to Moderate (late stage) depending upon industry sector
Typical return expectation per annum post fees	Mature portfolio: 7-10% Development portfolio >10%	Approximately 5-7%	Core: ~7.9% Value added: ~12-18% Opportunity: >18%	Diversified portfolio >15%

To capture and maximise private investment prior to sale governments modified the structure of the government infrastructure businesses through consolidation into geographical areas, creating vertical separation (generation, transmission, distribution, retail businesses), and introducing regulation to ensure low volatility of revenue while ensuring community level of service are maintained and enhanced over time, (Gowland & Aiken 2003; Moran 2006). As a consequence some businesses were sold to private investors and others remained as GOC normally due to political pressure from the community concerned about “selling the family farm” to remove a treasury issue (Gowland & Aiken 2003).

Once the government assets were sold, these private investors, in an effort to maximise returns, looked to industry to develop new approaches to create value and drive effective operations from these ‘gold plated’ assets with asset lives often in excess of 50 years (Deadman 2010).

The most common approach was to remove the investors’ equity and replace it with debt which required a much lower return. These assets are often up to 70% debt funded depending on their risk profile. Independent investment ranking provides investors with guidance of the companies rating. The company rating provides guidance for debt lending institutions as to what ‘margin’ (normally a number of basis points above the Reserve Bank official interest rates) can be expected for the inherent risk within the business. The lenders of debt, like the investors of equity, need to be ‘comfortable’ that the risks upon their investment are adequately managed. The risks can be rated to demonstrate the risk level of a business. The leaders of the business must manage all these financial risks. Moody is one such rating agency and below is the quantitative and qualitative measures that they use to determine the rating. The lower the score, the lower the rating and the higher the margin in terms of basis points above a reference interest rate.

Table 8 Rating applied to infrastructure businesses to determine the margin to be applied to any debt finance, Moody (2009, p. 5).

RATING FACTOR/SUB-FACTOR WEIGHTING			
Broad Factor Ratings	Broad Rating Factor Weighting	Sub-Factor Rating	Sub-Factor Weighting
Regulatory Environment and Asset Ownership Model	40%	Stability and predictability of regulatory regime.	15%
		Asset ownership model.	10%
		Cost and investment recovery.	10%
		Revenue risk.	5%
Efficiency and Execution Risk	10%	Cost efficiency.	6%
		Scale and complexity of capital programme.	4%
Stability of Business Model and financial Structure	10%	Ability and willingness to pursue opportunistic corporate activity.	3%
		Ability and willingness to increase leverage.	3%
		Targeted proportion of operating profit outside core regulated activities	
			4%
Key Credit Metrics	40%	Adjusted ICR (or FFO Interest Cover)	
		Net Debt/RAV (or Fixed Assets)	15%
		FFO/Net Debt	15%
		RCR/Capex	5%
			5%
TOTAL	100%		100%

The 2005 report identified under-investment of A\$24.8 billion. Saving debt is a significant portion of operating cost of an infrastructure business and has priority before any returns can be given to investors. Engineers Australia (2010) highlighted that in Australian infrastructures this under-investment has increased in 2010 to A\$700 billion. The leadership required to select, specify, scope, construct and operate investment increases such as this is significant and is the reason for the focus by Engineers Australia. The report goes on to highlight an engineering skills shortage and the importance of utilizing engineering expertise in order to be an informed buyer or owner of infrastructure assets to prevent '*contractors taking advantage of the buyer's lack of knowledge*' Engineers Australia (2010, p. 16).

The issue of risk around debt and debt repayment is critical and one of the major elements in the failure of a number of infrastructure companies during the global financial crisis (Deadman 2010;

Van Jaarsveldt 2010). As a stakeholder, debt drives the financial focus of the executive leaders and strengthens the executive subculture Schein (2004). Another stakeholder – the community – has been driving the need for infrastructure to keep track with community expectations and ensure that the service they provide, often referred to as ‘level of service’ (L of S), is maintained and improved as technology develops. These community issues of development and L of S are more aligned to an engineering subculture. Adams, Joachim and Cutting (2008) highlights the issue, *‘It is no secret that infrastructure organizations across the country are faced with huge problems. Baby boomers are retiring and there is a much smaller supply of talent to replace them. Organizations are faced with looming capital needs but lack resources to manage and implement projects; and Boards across the country are demanding greater efficiency from organizations they oversee’* Adams, Joachim and Cutting (2008, p. X).

The management also saw internal structural changes as opportunities to maximise returns to investors. To drive the commercial focus; across a broader group of delivery resource, often external workforce, and demonstrate greater regulatory transparency, the management team adopted the separation of traditional infrastructure business into three distinct roles; Asset Owner (AO), asset manager (AM), and service provider (SP). Each function is a profit centre designed to drive commercial outcomes (Seibert 2002).

Table 9 Summary of the three subgroups of Infrastructure (Seibert 2002).

ASSET OWNER (AO)	ASSET MANAGER (AM)	SERVICE PROVIDER (SP)
Owner of the asset culture	Accountable to Asset Owner	Contracting/Services culture
Governed by regulator	Performance based contracts detailing improvement	Cost and works control systems
Corporate governance	Analytic and economic lifecycle culture	Efficient/Effective delivery process
M&A strategy development	Procurement and contracts management of the SP function.	Flat functional
		Accountable to Asset Manager.
		Synergies from accessing external contract resources.

The new model enabled the asset manager and service provider functions to focus on their strengths, develop culture and systems that enabled superior performance. Now only the asset owner was captured by the regulation thus the two new ‘businesses’ (AM & SP) were no longer vertically integrated and provided services for a fee to third parties. Some asset owners were able to completely outsource the business and were able to run large infrastructure business with a very small governance team often made up of only a Board and executive team (CEO, CFO and COO), (Woodhouse 2001; Deadman 2010; Mills, Brown & Waterhouse 2008).

These changes were dominated by financial and commercial drivers. As a result new skills were introduced to manage these step changes normally by executives from the private sector with proven financial skills (Gowland & Aiken 2003). Executives with engineering skills and not financial skills/experience were replaced and sometimes ‘purged’ to ensure the changes occurred (Wolmar 2005).

Engineers naturally deem themselves responsible for the safety of the community and are widely trusted by the community to provide this service. *‘Engineers alone are responsible for technical governance’* CELM (2007, p. 3). This governance is achieved by *‘application of quality assurance systems and management plans for risk, safety, the environment and sustainability, assists engineers to monitor, review and manage the lifelong performance of technical infrastructure from the initial idea’* and *‘where technical systems are complex and interconnected, continual overview by experienced engineering leaders is essential. In these circumstances, appointing experienced engineering leaders on to the project or business Board is vital for success’* CELM (2007, p. 3).

The assets of infrastructure, due to their physical characteristics (often many thousands of kilometres long for transmissions/distribution assets), provide essential services while still ensuring community safety. For example, a typical gas network of 500,000 customers has tens of thousands kilometres of pipe and these pipes enter into 500,000 homes carrying an explosive gas which with a leak and an appropriate ignition source can lead to catastrophic results. This risk and the business risk, level of service risk, demand risk, etc. must be managed by the leaders of infrastructure. It must be managed to an even higher community standard whilst ensuring maximum returns to investors while the new government regulator applies controls to ensure the services remain accessible to all in the community.

During the past twenty years a number of examples of failure to effectively manage infrastructure assets leading to a reduction of level of service and, in some cases, catastrophic failure causing injury and, in some cases, death to community members has been seen. Community expectations have increased and in the light of public investigations the role of both leaders and the absence of engineering controls have brought lack of engineering governance to the forefront as causation for the failure of the asset and the consequences of that failure (Hopkins 2005; Deadman 2010). A failure of asset management function to effectively control the risk of delivering a service to the community via infrastructure assets can lead to impact on public safety and, in the worst case scenario, disasters. Along a continuum of risk as shown below, failure of service, generally in maintenance, if left uncorrected will result in a deterioration of the infrastructure initially causing occupational health and safety issues, to ultimately causing catastrophic outcomes.

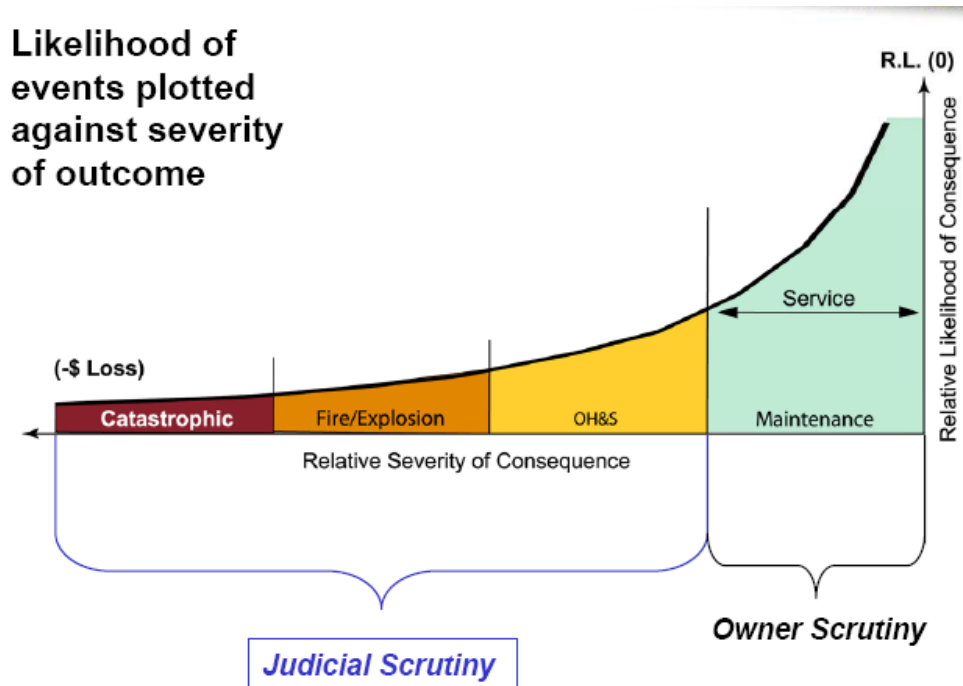


Figure 3 Continuum of risk that infrastructure businesses need to manage.
Failure to adequately control risks at the maintenance level where an owner has control can lead to catastrophic failure and impacting public safety Cooper (2003, p. 14).

Once the risk moves out from under the umbrella of the maintenance region it moves from asset owner scrutiny into judicial scrutiny such as Royal commissions to determine root causes of the failure. The Swiss-cheese model (Reason 2004) points out that failure of multiple controls are required before an incident can occur. This model recognizes that no one single issue causes an incident but that the convergence of a number of issues causes an incident to occur. The opposite is true as well. If one control had been effective the incident would not have occurred or the impact may have been significantly reduced. (Reason 2004; Hopkins 2005) point out that, under judicial scrutiny, dysfunctional organizational culture and ineffective leadership of infrastructure assets are two of the failed controls which have been identified as resulting in incidents escalating into disasters.

Understanding and balancing risk is an engineering skill. Hopkins (2008, p. 139) defines the term *'culture of risk blindness, to say that a group are generally unaware of and insensitive to risk'* to explain why an organization and its leadership fail to manage risk appropriately. Hopkins (2008) acknowledges Schein's (1992) work on culture and it is within this framework that his work on effective safety culture and 'high-reliability organizations' (HRO) is built. *'Some chief executives formalize this systematic lack of attention by stating that it is their job to look outwards while the job of deputies is to attend to the internal affairs of the organization. Such leaders express surprise and dismay when they discover, following some accident, that the organization for which they are responsible was systematically inattentive to safety, and that the practices of organization were geared to maximising production, not safety. According to Schein, however, there is nothing surprising about this. 'It is a direct outcome of the behaviour modelled by the leadership'* Hopkins (2005, p. 9). Hopkins goes on further to summarize: *'In these companies the top people are likely to have been appointed for their expertise in financial matters and may know nothing about the technical details of the assets under their control. In these circumstances they may decide to leave safety to others, without realising that in so doing they are inadvertently conveying an inaccurate message about priorities'* Hopkins (2005, p. 9).

Although a number of controls must fail for an incident to occur (Reason 2004), recent infrastructure incidents can be directly linked to the failure of leadership to adequately understand the risks and manage the controls (Reason 2004). Table 8 below highlights some significant incidents involving infrastructure, their impact upon the community, and the controls that failed to contain the incident.

Table 10 Examples of significant infrastructure asset failures which have resulted in public investigations.

INCIDENT	IMPACT	INFRASTRUCTURE FAILURE	ORGANIZATIONAL CAUSES	REFERENCE
Glenbrook Train Collision New South Wales, Australia 1999	7 killed 51 injured	Failure of signalling equipment & communication system	Privatisation & disaggregation of organization Commercial imperatives On time running & safety conflict Culture of regulator	(Hopkins 2004) - Special Commission of Inquiry into Glenbrook Rail Accident
Hatfield Rail Crack Hertfordshire, UK 2000	4 killed 70 injured	Broken rail	Privatization and disaggregation of organization Loss of engineering expertise Commercial drivers between infrastructure and above rail operation	(Wolmar 2005)
Potters Bar Rail Crack Greater London, UK 2002	7 killed 76 injured	Incorrect maintenance of rail points	Privatisation & disaggregation of organization Outsourced maintenance provider leading to reintegration of maintenance work to Railtrack	(Wolmar 2005)
Industry Review of Queensland Electricity Industry Queensland, Australia 2004	Significant power outages throughout Queensland	Inadequate capacity within the network to meet community demands of growth and security of supply	Commercialization of government owned utility – requirement to provide distribution Deskilling of workforce as part of cost saving initiatives	(DNR 2004) Somerville Report
Varanus Island Pipeline Explosion Western Australia 2008	Loss of 30% gas supply to WA industry and community for 2 months	Rupture of high pressure pipeline due to corrosion of pipeline	Ineffective inspection and maintenance regime	(NOPSA 2008) Varanus Island pipeline rupture 2005 Senate Inquiry
Black Saturday Victoria, Australia (Kilmore East, Beechworth, Coleraine, Horsham & Pomborneit – Weerite Bushfires – 5 of 11 Bushfires) 2009	119 killed Homes destroyed, major damage Total 173 killed in all bushfires	Electrical arc after conductor failed Ineffective design & aging equipment Maintenance programme	Acceptance of high level of fire starts from electrical equipment Conflict between funding for aging infrastructure & industry's economic regulation	(Victorian Government 2010) 2009 Victorian bushfires Royal Commission

The competing goals of financial returns and engineering excellence are highlighted as integral to the failure of management to effectively manage risk (Wolmar 2005; Hopkins 2005). In fact, the causes are multiple and complex, not singular (Hopkins 2004; Reason 2004) but the role of leaders and the leadership of these businesses is one control with sometimes too many 'holes in the leadership' control of the Swiss cheese model (Reason 2004).

Atkin, Fitzsimmons, Parsons and Punter (2011) in their review of twenty major corporate crises identified seven key risk areas why companies fail to manage their risks and result in crises that some companies survived and others did not. The seven key risk areas are:

1. Board skill. Limitations on Board competence and ability to control executives.
2. Board risk blindness. Failure for Boards to engage with important risks, including 'licence to operate' and reputations, in the same way they engage in reward and opportunity.
3. Poor leadership and culture.
4. Defective communication within the organization.
5. Excessive complexity in the business.
6. Inappropriate incentives for executives and management.
7. Risk 'glass ceilings'. Inability of risk issues to be escalated to the board/executive level within the organization.

A recent example highlights this risk blindness and inability to effectively manage the risk to the satisfaction of the community. A two year Western Australian parliamentary report into a GOC's (Western Powers) management of wooden power pole replacement, (initiated after 13 bushfires and the loss of three lives in ten years) concluded that the wooden power pole issues were only a symptom of a much larger management problem within the Board and executive team (Trenorden 2012). The management team were called to *'live up to the potential being demonstrated by the staff and contractors every day'* (Engineers Australia 2012). The Managing Director, with over 40 years' experience in Western Power, resigned three weeks after the report's release (Beset Western Power Boss resigns 2012).

The leaders of infrastructure have a wide range of risks to manage: (1) those that support the investor (and their many financial requirements to maintain the credit rating (moody 2009)); (2) those that are required from community often through the process of regulation (maintain the affordability of the services for all users); and (3) to ensure the physical assets continue to operate safely for many years often with technology that is no longer best practice (Deadman 2010). The

resulting demands on the time and resources of the executive management team can lead to suboptimal solutions in an attempt to manage these risk demands (Reason 2005).

2.4. Competing risk demands

The nature of risk within infrastructure, especially those businesses that have switched from public to private ownership, highlighted this more commercial focus while ensuring an acceptable level of service to the community. The new leaders were required to balance often competing demands on resources and funding. On one side was the traditional operational/construction productivity to match the expectations of demand, growth and level of service. While the other side required focus on managing the cost of debt and refinancing risk; changes to regulatory regime and re-sets; and adequate cash flow to ensure distributions to investors on a routine basis.

Failure to adequately balance the demands of operational and financial requirements can result in, worst case scenario catastrophic asset failure, or unacceptable levels of service to the community, or financial failure resulting in reduced returns to the shareholders, increased debt costing and reduced market capitalization (Peng & Newell 2007). Altmann (2009, p. 27) states that, *'the success or failure of an investment often relies on an investor's ability to manage the dynamic interest between owners, operators and regulators'*. Table 11 below summarises the competing interests of stakeholders in infrastructure.

Table 11 Summary of interests of stakeholders in infrastructure (Altmann 2009).

OWNERS	OPERATORS	REGULATORS
Infrastructure investor	Senior management and employees of the infrastructure company	Represent the public interest
Primary goal – investment/business plan achieves projected returns	Culture is generally intransigent to change due historically no competition	Comment on price and performance
	Implement the owners plans in light of the regulatory requirements	Ensure security/reliability of supply

Altmann (2009) goes on to highlight the fact that the operators, who are responsible for managing the competing demands between owners and regulators, are usually a *'management team and workforce that usually comprise engineers and (regulatory) accountants that are in many cases entirely unfamiliar with corporate finance. Most regulated assets are highly*

unionised, and in some instances, the unions play an active role on boards...many operators in these companies have a very strong public service ethos and do not have an understanding of cash flow, profitability and shareholder value', and, further, this is 'a huge paradigm shift for the operators of the acquired infrastructure entity to make a switch to the requirements of the new owner' Altmann (2009, p. 27).

Gowland and Aiken (2005) highlighted that cash return and accountability to shareholders are the two most significant accountability questions for managers of infrastructure. These competing demands on infrastructure leaders have resulted in mixed success over the past twenty years (Moran 2006; Abbott 2006; Gowland & Aiken 2009). Moran (2006, p. 174) notes that the reforms have resulted in reduction in pricing, *'increases in capacity in line with market needs and vast improvements in productivity and reliability across the industry'* but highlights the highly political nature of infrastructure and regulator risk has upon industry's efficiency. The leaders of infrastructure, especially those at the executive level, are required to balance the competing demands of investors and regulators while ensuring their employees have a productive culture to continue to drive efficient change while ensuring security of supply and reliability.

2.5. Executive leadership of infrastructure assets

Gowland and Aiken (2003, p. 43) stated that privatization *'can result in significant changes to the structure and culture of the organization. Two major factors which impact upon employees are: (1) the need to restructure the organization prior to sale; and (2) cultural changes occurring with new ownership'*. The demands of infrastructure changed from a level of service focus to that of ensuring returns to investors as stated by Yates (2001, p.62), *'Now a focus shift from production to profitability'*. The business focussed leadership perceived engineers as *'small picture people, focussed on a narrow technical view and seeking impractical, gold plated solutions'* and *'engineers are seen as having poor people and management skills'* and *'engineers are seen as a necessary evil and often resented'* Yates (2001, p. 70).

Gowland and Aiken (2003) highlight how new commercially focussed leaders from the private sector were introduced, and Wolmar (2005) noted that, *'Railtrack ... embarked on a "scorched earth" strategy, purging the upper levels of the company of anyone with engineering experience...'* Wolmar (2005, p. 254).

Andrews and Dowling (1998) examined 41 privatisations across 15 countries and noted that the superior post-privatization performance occurred primarily from changing the CEO as *'top*

management requires a completely new skill set once the firm is weakened from state support' Andrews and Dowling (1998, p. 614). A second significant finding was that where the state maintains some ownership the CEO is less likely to be replaced.

Gowland and Aiken (2003) highlighted in their research that significant change had occurred after privatization with the structure of the board and at the executive level due to a number of managers being appointed with private sector experience. These managers often did not have engineering or technical qualifications and this occurred as a result of privatization or the introduction of regulation. One example is Australia Gas Light Company (AGL) formed in 1837 and was the second company to list on the Australian Stock Exchange (ASX). Although a private company, AGL took advantage of the privatization occurring in Victoria and purchased newly created electricity businesses. With the introduction of regulation in NSW and these new electricity assets the tradition of having a technically qualified/background CEO was overturned in 2001 with a CEO appointed with business and law qualifications. After 164 year of having a technical CEO the subsequent three CEO's after 2001 have all been non-technical (Broomham 1987; AGL 2010).

A further example is the privatization of the south Australian electricity industry initially created in 1897 and called Electricity Trust of South Australia (ETSA). In 1988 The South Australian Government began preparing for privatization and in 1996 restructured ETSA into two infrastructure businesses ElectraNet (transmission assets) and ETSA (distribution assets). *'For the first time a person with no history in either ETSA or the electricity supply business became ETSA's Chief Executive'* Linn (2000, p. 64). The new CEO found *'at ETSA 'a typical public sector, technical product oriented organization' ... they had a lack of forward planning, high electricity tariffs, financial returns on assets were low, the organization was highly centralized, and management performance was never adequately addressed'* Linn (2000, p. 65). But the organization and subsequent culture struggled with the 'imported' CEO as one manager remembers, *'I never found it difficult to talk to the General Manager or any of our senior managers, because we shared parallel paths, and often worked in the same areas together. But when the reforms came, it was really unsettling to some of us'* Linn (2000, p. 66). From 1996 to the present day both ElectraNet and ETSA (privatised in 1998 and 2000 respectively) have been led by a non-technical CEO. The table below provides a snap shot of the background and qualifications of infrastructure businesses (GOC and Private) Board and executive teams with technical qualification/background.

Table 12 Percentage of leaders with technical based qualifications (Engineering or Science) at the board or executive levels of Australian Infrastructure companies both ASX listed and GOC – 2009/10 periods. (Authors list)

PERCENTAGE OF LEADERS WITH TECHNICAL BASED QUALIFICATIONS					
Energy Infrastructure Assets Groups	Chair	Board of Directors	CEO/MD	Executive Team	Australian Companies
Electricity Distribution/ Transmission	43%	34%	57%	41%	Water Power, Powerlink, TransGrid, Transend, ETSA, Energy Australian, Ergon, Energex, Intland Energy, Country Energy, SP AusNet, Spark
Gas Distribution/ Transmission	28%	39%	43%	31%	APA, Envestra, SP AustNet, DUET, Prime Infrastructure, Epic, DBP, Jemina
Rail	40%	17%	20%	22%	ARTC, QR, WNR, Railcorp, Asciano
Water Urban	20%	33%	60%	53%	Melbourne Water, Sydney Water, Hunter Water, Water Corporation, SE Water
Ports - large	50%	30%	50%	48%	Sydney Ports, Port of Melbourne, Port of Brisbane, Fremantle Port, Port of Waratah Coal, Newcastle Port Authority
Average	36%	31%	46%	39%	

As demonstrated in the table above there are significant numbers of non-technical leaders in the executive and Board levels of current Australian infrastructure businesses. This data raises the question as to whether or not these executives are effective or if the technical skills support or hinder a leader's effectiveness. While industry may have relented from the polarized approach of replacing all engineers from executive roles (Yates 2001; Wolmar 2005), the complexity and demands of managing these atypical businesses remain.

2.6. Conclusion

This chapter highlighted the nature of infrastructure and how it is critical for economies to grow and develop. Historically, most Australian infrastructure businesses had been government built

and owned to provide services to the community such as electricity, gas, water, roads etc. Governments, in an effort to raise capital for further social requirements, privatized or commercialised these businesses. The new private owners needed returns for their investment while still supplying significant capital to match demand growth and maintenance of the existing, often over fifty year old, assets.

These newly created businesses are complex and atypical in that they have a large capital base and cover large geographic areas providing often monopolistic services to the community. The assets' long-life characteristics, while enabling consistent reliable returns for investment groups such as superannuation funds, require substantial replacement investment funds to deliver to customers of the infrastructure assets the level of service required. The introduction of regulatory involvement introduces a new stakeholder responsible to manage the returns allowable to the investors and the charges payable by the users, often an essential service to the community such as electricity, water etc.

This atypical business requires outstanding management, through the executive leadership, to balance the objectives of the three shareholder groups (investors, regulator and community) and, significantly, will at times be competing objectives. This has created a change of focus for the executive team and the broader workforce.

This complexity has resulted in a more complex risk profile for the business to manage. The failure to adequately manage the controls can result in catastrophic failure of the assets impacting community safety through to financial duress as seen in the GFC. Failures such as these and/or loss of levels of service and affordability have the government and community revisiting the debate of privatisation versus government ownership. Re-nationalising a business is one significant approach but investors, businesses, regulators and industry groups have focussed on the leadership style and skills of the executives who are charged with managing this complexity. Initially a polarized approach saw some businesses replace the engineering qualified executives with business qualified executives. Over time the business structure has seen a balance of engineering and business qualified executives and businesses have begun to focus on the leader's style rather than their initial graduate qualifications.

All stakeholders of infrastructure require executive leadership that can operate effectively within this complex atypical business model. The following chapter explores the literature regarding the focus of infrastructure business industry bodies and professional bodies in order to support executive leaders in this business environment.

3. Literature Survey

3.1. Leadership in Infrastructure

The previous chapter introduced the distinctive aspects of infrastructure both as an asset and as an investment class. The business opportunity has arisen primarily from the privatization of government owned /funded community infrastructure such as energy networks, roads, ports, rail etc. The change in ownership from being public funded and providing services to the community to private investment still necessitated the business to ensure quality levels of service to the community and also provide a return for the new private investors. This created in the minds of some investors and owners the need to replace the existing engineering qualified executive leadership with financially qualified leaders who would be more aligned to managing their investment. The business remained asset centric and required employees with technical skills to effectively operate, maintain and develop. The rise of the financially savvy generalist leader saw a reduction in the number of engineers in managerial roles. The mentality was, *'keep specialist on-tap, not on-top'* Yates (2001, p. 62).

The displacement of engineers from these executive roles was due to a focus upon the skills, more accurately and in reality, the qualifications held by the leader. But as table 12 in the previous chapter indicates, not all infrastructure businesses have determined that a leader's qualifications provide the best measure to select effective leaders for these companies. The following sections examine the focus that (1) infrastructure businesses have taken in selecting and developing executive leaders in this new environment; and (2) the engineering profession has taken upon itself to ensure the profession remains relevant within the typical business environment that engages engineers in the senior roles. The final section of the chapter identifies the processes from literature that have enabled leaders to be described and how these descriptions align with executive leaders who are effective and those who are ineffective.

3.1.1. Skills of Infrastructure leaders

While the majority of the infrastructure in Australia has been developed by governments this is not necessarily the case in the US and UK, where in the 1840's private investors developed US railways and consequently drove the development of modern organisational decentralised structure and resulting in a decentralised resource structure (Chandler 1992). Chandler noted how the leaders of infrastructure businesses such as the US railways and telegraph *'pioneered in the modern forms of organisation, control and strategy'*, Chandler (1992, p. 264). He also

highlighted the challenges that leaders of this new business type were required to manage: *'capital required to build a major railroad was greater than any earlier business enterprise....and the operation was far more complex than any previous business enterprise. Not only were the sunk costs unprecedented, so too were the fixed costs'*. Further, *'In meeting these challenges American railway managers brought into being many institutions and practices of the modern corporate world. In the United States their financing created its modern capital markets – Wall Street'*, Chandler (1992, p. 264).

Chandler (1962) also notes that from the railways came complex organisational structure that placed the technical skills and resources along the physical railway line sections known as 'line management', then a divisional structure was introduced above the line management that enabled groups of these lines to be managed together under one management team and finally, on top of a group of divisional teams, a senior management group at a corporate level was introduced to focus on strategy and finance rather than technical and administrative tasks. Pfeffer and Salancik (1978, p. 2) stated that the *'the key to organisational survival is the ability to acquire and maintain resource'* and that the role of the executive leader is in *'the management of demands, particularly the demands of interest groups upon which the organisations depend for resources and support'*. The survival of the organisation depends on resources such as appropriately skilled leaders and access to adequate capital to enable these large complex businesses to grow and develop (Pfeffer & Salancik 1978; Chandler 1962; Chandler 1992).

Erakovic and Wilson (2005), in their review of radical transformation of the New Zealand businesses under privatisation, noted the significance of Pfeffer and Salancik's resource dependency theory and that their research highlighted that *'as managerial capabilities evolved organisational forms evolved as well..the strategic intent of the owners (the government for State owned enterprises, and acquirers for private entities) played an important role in part in the process of radical change'*, Erakovic and Wilson (2005, p. 310).

This dependence on the right resources requires increased control and coordination of resources between internal and external groups. This control creates a power source which arises from possession, ownership, control of access, control of, actual use of, and the making of the rules that regulate the resources (Pfeffer & Salancik 1978). These resources are more than skilled people and materials but include other resource items such as capital for growth, debt, customers for revenue and technology for service.

Lloyd (2010) sets a typical scene that infrastructure leaders find themselves in: *'you are the Managing Director of a business for which 90% of everything it spends goes on creating, maintaining, renewing and disposing of its assets, and which makes profits only when those assets are in service. Regulators are holding your prices down...Shareholders don't like your investment strategy but regulators and customers are demanding it.'* Lloyd (2010, p. xvi-xvii). The traditional leaders, engineering qualified and many years in the industry, are being replaced by new leaders, financially trained and from outside the industry (Gowland & Aiken 2003).

Table 12 shows that current boards and executive teams have a mix of the technical and non-technically qualified/background leaders in the key roles. *'With the focus shifting from production to profitability, these (traditional) engineering organizations became transformed into commercial organizations with an engineering arm' and 'resulted in a reduction of the number of engineers in management and the perception that engineering is just a support function, no different from information technology (IT) or accounting'*, Yates (2001, p. 62).

These infrastructure businesses, while being complex due to their financial and asset specific requirements, are physically very large businesses and require large numbers of employees to ensure effective and efficient operation. Personnel with technical skills dominate an infrastructure company and the table below provides an electrical infrastructure example and demonstrates the size of organization in terms of numbers of employees.

Table 13 An example of the number of employees and grouping for an electricity distribution business. Ergon (2011, p. 56)

ROLE	NUMBER OF EMPLOYEES	ROLE EXAMPLES
Board	7	Chairman and directors
Executive team	9	CEO, COO, Executive General manager, CIO, CFO
Senior Manager	49	General manager, Group managers
Professional and Managerial	964	Area operations managers, business analyst and traders, engineer
Administrative employees	1071	Personal assistant, meter readers, project coordinators, customer care representatives
System Operator or controller	63	Network controller, Network operations officer.
Para-professional	574	Design paraprofessional, Technical Officers, Inspection, auditor
Electrical system Design/advisor	98	Systems designer, estimating officer
Supervisor	367	Work group leader, trainer, Scheduler
Technical Service Person	1268	Electric Fitter mechanic, Linesperson, Apprentice
Power Worker	291	Power Station attendant, Warehouse, Labourer
TOTAL	4761	

The leaders and employees tend to be technical in background, company trained and have significant numbers of years of service with often the one company (Yates 2001). Entry into these organizations is normally through trade qualifications or into professional roles via tertiary qualifications (DNR 2004). These same technical-background employees are often promoted into leadership roles primarily as a result of their successful technical performance and the companies then provide people skills through the form of leadership training (Shepherd 2001).

The skills obtained by leaders tend to be company and/or industry specific. Industry and professional groups have identified this and, in an effort to codify the qualifications or experiences, they have developed competency standards to provide a measure for certification and guide development of individuals. The evolving concept of ‘asset management’ has grown in part from the need of infrastructure businesses to maximise the value from their assets and provide adequate return to investors either private or public, (Too 2010; Lloyd 2010; Deadman 2010). Too (2010, p. 32) refers to asset management as *‘a relatively new discipline and is clearly a contemporary topic’* which describes the core business of infrastructure – *‘the combination of investing in, exploiting and caring for appropriate physical plant and infrastructure over its*

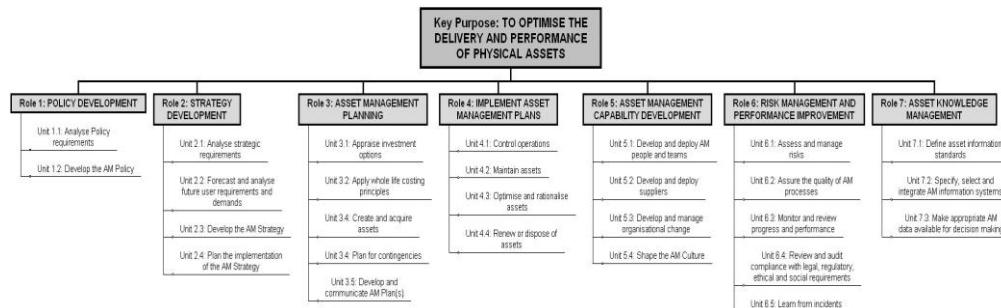
entire life’ Too (2010, p. 33) while transforming their businesses *‘from cost centres charged with carrying out budget projects into profit centres charged with contributing to earnings growth’* Too (2010, p. 33). Asset management’s acceptance and development has been hindered by two barriers, firstly it has the ‘step child’ status from the traditional business, financial and engineering communities and secondly it is frequently considered to be associated with maintenance and therefore not strategically important (Too 2010; Deadman 2010). Industry and industry groups are still consolidating both a definition for asset management and what it encapsulates. At one end the role of asset management is purely financial and investment bankers ‘asset manage’ a portfolio of infrastructure assets to deliver returns to investors – agents for the owners (Altmann 2009). At the other end, asset management has been utilised as a new term for maintenance (Too 2010). Current industry groups have asset management delivering the ‘operator’ role of Altmann (2009) definition as seen previously in table 9 and the operator’s functional role of asset owner and asset manager from Seibert (2002) model in table 7.

A number of recently developed industry groups have evolved around asset management. They include Asset Management Council (AMC), a technical society of Engineers Australia; Institute of Asset Management (IAM), an international UK based professional body; and Centre for Integrated Engineering Asset Management (CIEAM), an Australian cooperative research centre. These three industry groups are active in developing a common framework for asset management and a group of competences, or skills required for person to be effective.

Deadman (2010) and Lloyd (2010) both provide detailed historical descriptions of the development of asset management and the distinctiveness of infrastructure and the challenges that face asset management, as a philosophy, as it gains acceptance within the broader non-engineering business context. Asset Management is more the art and science of making the right decisions for the business using optimized processes. *‘It represents a cross-disciplinary collaboration to achieve best net, sustained value-for-money in the selection, design/acquisition, operations, maintenance and renewal/disposal of physical infrastructure and equipment’* IAM (2008, p. x).

IAM initially completed a guide on the competency requirements of Asset Management. The working panel and review panel included most of the major infrastructure owner operators in the UK. The framework was updated IAM (2008a; 2008b) and *‘embraces competencies in engineering, financial management, operations, business management and people development’* IAM (2008a, p. 4). As an output-based framework that defines the knowledge and skills required for effective asset managers, the framework consists of seven key roles as shown below:

Figure 4 The Institute of Asset Management’s competency framework for defining asset management. (IAM 2008a)



This framework is an example of industry recognizing the need for a wide range of skills outside of engineering and that those skills will vary depending on the role/position within the organizations. The framework contains:

1. Asset Manager purpose statement;
2. Key roles to meet the purpose;
3. Competence units to deliver the roles;
4. Sub elements of the competences which individuals should meet.

IAM (2008b) identifies five levels of asset management:

1. Business leader;
2. Head of asset management;
3. Asset Manager planner;
4. Asset Manager team leader;
5. Asset Management new entrant.

The framework also notes that ‘*style objectives and personal skills have been removed from the 2006 framework on the grounds that there is no need or case for the IAM to publish its own when validated frameworks and models are readily available in the public domain*’ IAM (2008a, p. 6). Unfortunately these other ‘frameworks’ are not identified. The framework is intended to provide ten uses: (1) developing a competence management system; (2) writing job descriptions; (3) planning recruitment and selection; (4) identifying learning and development needs; (5)

developing role profiles; (6) developing team profiles; (7) managing performance; (8) planning training activities; (9) career planning; and (10) planning continuing professional development, (IAM 2008a).

The seven key roles in the framework correspond to 27 units of competence. Each unit is subdivided into 143 small elements of competence. The table below demonstrates the link between the five levels of asset management and the competences.

Table 14 Profile of distribution of elements within the IAM Competency framework and the five levels of competency. (IAM 2008a)

SEVEN KEY ROLES OF ASSET MANAGEMENT								
Competency Levels	Policy Development	Strategy Development	AM Planning	Implement AMP	AM Capability Development	Risk Maintenance & Performance Improvement	Asset Knowledge & Management	Total
Business leader	X	X			X	X		
Head of AM	X	X	X	X	X	X	X	
AM Planner		X	X	X	X	X	X	
AM team leader			X	X	X	X	X	
AM new entrant	X	X	X		X	X	X	
Units of Competency	2	4	5	4	4	5	3	27
Sub Elements	10	21	29	22	19	24	18	143

For example, the most senior profile, which equates to an executive leader position, is the profile of a Business Leader and is defined as a leader who has to be able to direct the work of others in Policy development, Strategic requirements, Capability development, Risk Management, Performance improvement and *‘shaping the AM culture and championing the AM principles and best practice’* IAM (2008b, p. 14).

This profile of Business Leader is intended to capture the broad range of skills required by a senior leader and is focussed on expanding the breadth of skills and assumes a certain level of leadership skills. The competency list is very detailed and sets clear objectives for a technical or non-technical executive leader to consider.

The skills required by the executive leader within infrastructure most closely align with the description of ‘business leader’ under the IAM framework. The table below highlights the units of competency required under the framework.

Table 15 Summary of the key roles and corresponding units of competency for the Business Leader role under IAM competency framework into the five skill typology utilized in this research. IAM (2008a) and IAM (2008b)

KEY ROLE	UNIT OF COMPETENCY	SKILL TYPE
Policy Development	1.1 Analyse Policy requirements	Administrative
	1.2 Develop the AM Policy	
Strategic Development	2.1 Analyse strategic requirements	Strategic
Asset Management Capability Development	5.1 Develop and deploy AM people and teams	People
	5.2 Develop and deploy suppliers	Administrative
	5.3 Design and manage organizational change	People
	5.4 Shape the AM culture	People
Risk management and performance improvement	6.1 Assess and manage risk	Administrative
	6.2 Assure the quality of AM process	
	6.3 Monitor and review progress and performance	
	6.4 Review and audit compliance with legal regulators, ethical and social responsibilities	
	6.5 Learn from incidents	

The ‘picture’ formed from the IAM framework for a business leader implies a leader who spends time completing predominantly administrative tasks (8 of 12 units of competency) then people tasks (3 of 12) and then strategic tasks (1 of 12). The commercial/financial and leadership competences appear absent and may be within frameworks that IAM suggest are already in the public domain.

Another body of work is the competency framework developed by AMC (2011), the most senior role being the Certified Fellow of asset Management (CFAM) who should have a minimum of 12 years of experience and be able to demonstrate competency in 12 of the 25 available competency sets. These competency sets are derived from nine disciplines: (1) acquisition; (2) demand management; (3) configuration management; (4) continuous improvement; (5) operations and maintenance; (6) acquisition; (7) systems engineering; (8) business management; and (9) culture and leadership. Of the 25 competency sets, 17 were technical skills, 2 were people skills, 2 were business skills, 4 were administrative skills and no strategic skill sets (AMC 2011a). Both the IAM and AMC competency standards have been developed over the past five years and are still being accepted and refined by industry as they are applied, (Lloyd 2010).

While industry groups have been developing the competency standards to try and capture the skills of asset management, a number of researchers have been identifying the skills required for infrastructure leaders to be effective. Stapelberg (2006) identified ten groups of professional skills for asset management: (1) strategic planning; (2) risk management; (3) budgeting and costing; (4) data management; (5) condition monitoring; (6) tactic planning; (7) usage life cycle; (8) performance measures; (9) information systems ; and (10) financial management. The skills are focussed not at the executive leader level but at the leader responsible to develop and implement asset management functions.

Scott and Harker (1998) describe the need for leadership, especially executive leadership, to ensure that organizations are designed to further long-term welfare of the community. (Scott was CEO of a Power Generation infrastructure business). *'There is a groundswell of concern for the pursuit of ethics and an understanding based on values in the conduct of organizational life'* Scott and Harker (1998, p. 123). Scott focuses very much on the people skills and that *'the pursuit of quantitative success is supplanted by the pursuit of qualitative, individual, psychological and spiritual development, and overall social welfare. This will require a greater focus on values and ethics'* Scott and Harker (1998, p. 119). Scott has qualifications in engineering and economics and has been involved in infrastructure assets for many years.

The current literature is limited on the skills required for executive leaders in infrastructure. Industry is currently consolidating the competences into a framework to better define the skills. Most focus has been on the lower levels of the organisation to capture the large number of people (Lloyd 2010).

3.1.2. Culture of infrastructure and the perceptions of engineers as leaders

The value and impact of culture upon an organization's success is widely supported (Schein 2004; Yukl 2006; Murphy 2009) and the complex nature presents a challenge for leaders especially executive leaders. Much of the culture is driven top down from the leaders by their beliefs, assumptions and artefacts (Schein 2004). Schein groups organizations into three cultural subgroups: executive, engineering and operations. The strength of a subculture within the organization is a combination of the strength and size of each subculture group and the influence of their leaders.

Infrastructure assets are engineering intensive organizations (Murphy 2009), and the subcultures can be driven by the simple factor of number of employees in each group. The table below provides a view of the employee distribution in a sample of infrastructure organizations and the percentage of employees in the three cultural subgroups (Schein 2004).

Table 16 Percentage of employees within a number of typical Australian organisations as per (Schein 2004) model of three cultural subgroups #.

CULTURE SUBGROUP	EXECUTIVE	ENGINEERING	OPERATIONS
<i>Example A</i> Gas Transmission company	26%	70%	4%
<i>Example B</i> Gas Distribution Company	22%	71%	7%
<i>Example C</i> Electrical Distribution Company	38%	60%	2%
<i>Example D</i> Rail distribution Company	17%	67%	16%
<i>Example E</i> Port – General Cargo	3%	5%	92%
<i>Example F</i> Port - Bulk	15%	52%	33%

#Data from author's own database.

The large numbers of employees within the engineering subculture makes it a focus for leaders if a business is going to be successful. Lloyd (2010, p. 16) notes, '*effective organizational cultures result in high-performing companies while ineffective cultures result in internal conflict and poor performance. Knowing how to create a culture that will produce the performance you want is a key attribute of leadership and a good component of good asset management*'. Most cultures in infrastructure businesses have been maintained by the dominant engineering subculture (Yates 2001; Lloyd 2010).

Schein (2004) highlights that dysfunctional interactions can occur among the cultures even though initial alignment occurred with: tasks being handled by the *operators*; reliable and efficient operations handled by the *engineers*; and minimizing of cost/maximizing profits handled by the *executives*. This alignment exists within infrastructure businesses but with the transition of those assets from public ownership to privatization the alignment between the cultures has been challenged and it is necessary to reconsider the boundaries. Conrad (1995), in her review of the UK gas industry transition, identified a cultural change corporately from *Public Service* to *Commercial Business* to *Competition*. Conrad (1995) highlighted that the commercial business culture appeared within the first five years of privatization and was driven to a competitive culture by the introduction of regulation.

Conrad (1995) also noted the strength of the subcultures changed under each transition and this is illustrated using Schein (2004) subcultural groupings as shown below.

Table 17 Ranking (1 to 3) of strength in the subcultures across the transitions. (Conrad 1995)

TRANSITION OF ORGANIZATIONAL DESIGN.	PUBLIC SERVICE =>	COMMERCIAL =>	COMPETITIVE
Ranking of the strength of sub cultures within the three subcultures defined by Schein (2004).	Operations (2)	Operations (2)	Operations (2)
	Engineering (1)	Engineering (2)	Engineering (3)
	Executive (3)	Executive (1)	Executive (1)

Conrad (1995, p. 18) highlighted that '*another significant aspect of the culture of engineering excellence – top management in the public service were engineers and safety and security of*

supply were considered the primary goals. Financial considerations were considered purely secondary.’ The commercial culture saw the introduction of the Board to provide the governance structure which determined the directions of the organization. Directors ‘direct’ and Managers ‘manage’ became the standard.

Whitmore (2004, p. 130) highlighted the dissatisfaction of the leadership in a newly privatized rail network, *‘history of this organization, people in top management positions have traditionally been engineers... Usually they came from a civil background because that was where the dollars were spent’*, and goes on to note *‘Promotion resulted from seniority and technical ability’*.

Whitmore (2004, p. 130) also observed the *‘move away from the engineer in top management to people with a business background’*. Whitmore goes on to explore the culture of mistrust that developed within the organization with this leadership change and focus on ‘bottom line and financial targets.

The research also utilized grounded theory through in depth interviewing techniques and analysis with a small group of 15 leaders. The research focussed on the servant leadership model by Greenleaf (1977) as an ideal leader style to best manage the new commercial environment the leaders found themselves in. To better define the conflict and the way the leaders manage conflict and change her research identified three groups of leaders for research classified after Victor Hugo’s *Les Miserables*. They consisted of the:

- (1) ‘Cosettes’ who were negative towards the organizations and felt powerless to effect change;
- (2) ‘Javerts’ who were aligned to the organization and empowered to make change;
- (3) ‘Valjeans’ who were neutral to the organisational issues and neither spoke out for or against the changes. The table below provides the profile of the sample group.

Table 18 Sample distribution of railway leaders used by Whitmore (2004, p. 94)

LEADER GROUPS	N (SAMPLE SIZE)	FEELINGS TOWARDS CHANGE	QUALIFIED ENGINEERS	SENIOR MANAGEMENT	MIDDLE MANAGEMENT	SUPERVISOR LEVEL
Cosette's	6	negative-	5	4	1	1
Javerts	6	positive	5	3	2	1
Valjeans	3	neutral	2	1	2	0
Total	15		12	8	5	2

The research utilized the three groups to describe the impact of the rail infrastructure business moving from patriarchy to autocratic strategic management. The impact was measured through the element of ‘trust’ and the impact of the change of focus towards the bottom line, *‘we are run by accountants, we’re not being run by engineers and people who know how to run the business. We’re run by people who know how to make profits – or show profits’* Whitmore (2004, p. 148). Whitmore (2004) acknowledged that a number of the Cosette's were ‘letting off steam’ but the research showed that the effectiveness of the leadership can be determined by the level of trust and that qualifications/background of the leader did not correspond to a particular style. Technical and non-technical qualified/background leaders were described in all three description groups.

Other researches such as Seethamraju (1997) and Kniflick (2002) highlight issues for a leader to effective in an engineering dominated culture. They show that a problem exist and is not yet solved hence the purpose of their research was to better understand the issues. Kniflick (2002) confirms that the existence of an engineering culture within a large road infrastructure business and his research focussed on minimising attainment deficit, that is, how the leadership process helps workers to fulfil their expectations of their work potential. The grounded theory research identified the main concerns of the participants in an engineering culture: job security, task orientation, risk aversion and control/compliance. Kniflick (2002, p. 207) pointed towards *‘general leadership theory of altruistic leadership as the method of liberating the worker’*.

Troy (2008) observed that Sydney Water Corporation has a strong engineering culture combined with a strong econometric approach. He noted that the engineering culture would always perceive and favour engineering solutions over market solutions.

Murphy and Hill (2008, p. 1) pointed out that through their research that the *'importance of culture in the management of engineering assets is often referred to, very few authors have taken the time to articulate precisely what an effective culture may entail'*. They suggest that the culture should align with the strategic requirements of the organization – asset safety, reliability and performance.

The pilot study conducted by Murphy (2008) to define the 'best practise' engineering asset culture pointed towards safety, business orientation and quality. Murphy concluded that the pilot study was limited as the participants profile *'equally represented engineers, academics and consultants, future samples should aim for a broader representation of industries and occupations'* Murphy (2008, p. 1159).

This focus upon safety and asset integrity within infrastructure assets is perceived as a critical function for the engineering subculture. They perceive they are the 'stewards of the community' (Yates 2001). Hopkins (2008) goes into some detail regarding stewardship of business and the roles and responsibilities of the Board and executive. Hopkins (2008) raises the issues of technical skills, leadership, culture, decentralisation, reward structures, and cost cutting, which can prevent an organization learning and developing their culture. National Grid (2008), the largest UK electricity/gas infrastructure owner, produces a guide to assist Board directors to demonstrate commitment when competing technical site inspections. But Hopkins (2006b), in his study of organizational cultures and their effect on safety, points towards the need for researchers to immerse themselves in the culture in order to make detailed observations.

While researchers have tried to better understand the culture of infrastructure, the infrastructure companies have identified the need and spent considerable amount of resources and funds to measure the culture and monitor its improvement over time. They often promote this as evidence of their more sustainable approach to governance (SP AusNet 2011). A commercial cultural tool utilized by a number of Australian infrastructure businesses is Organizational Culture Inventory (OCI). They utilise the tool to define an ideal culture (dominated by elements in the blue or constructive styles of the circumplex) and the current profile (dominated in the red/green areas of aggressive/defensive and passive/defensive styles). The tool is used to give routine snap-shots of the organizations culture businesses has introduced management programs in an effort to

measure and improve the culture,(Melbourne Water 2008; Yarra Valley Water 2009; Western Power 2010; SP AusNet 2011). The circumplex which forms the basis of describing the culture using the OCT scoring is shown below.

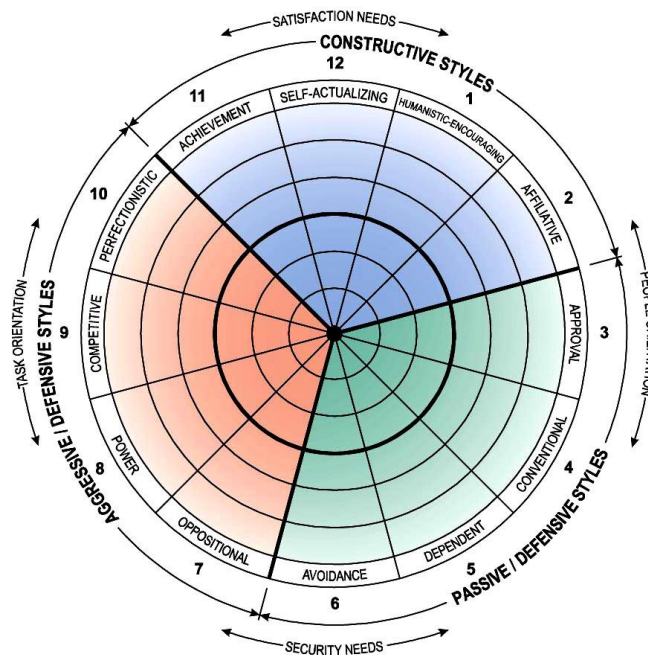


Figure 5 OCI Circumplex and 12 style elements (Yarra Valley Water 2009)

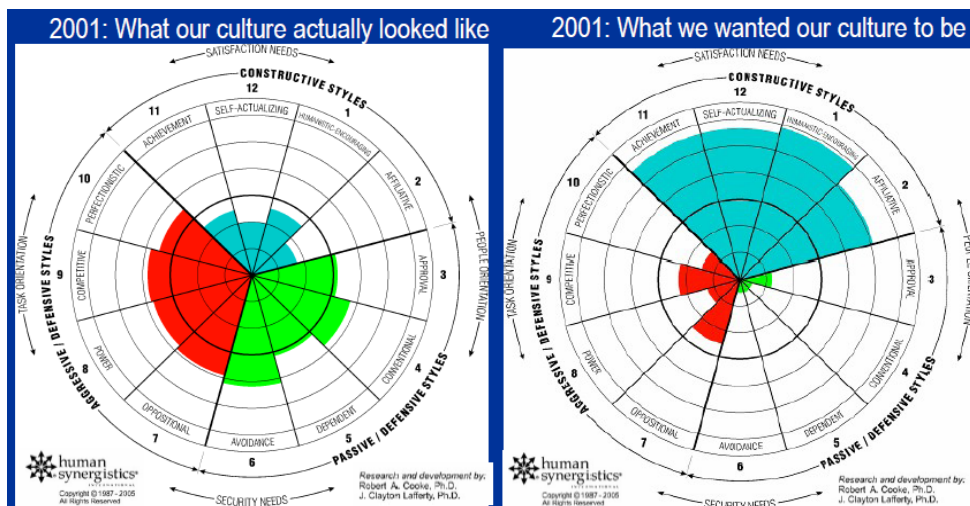


Figure 6 OCI results demonstrating actual culture and an ideal culture for a water infrastructure business. Kelly (2006, p. 15).

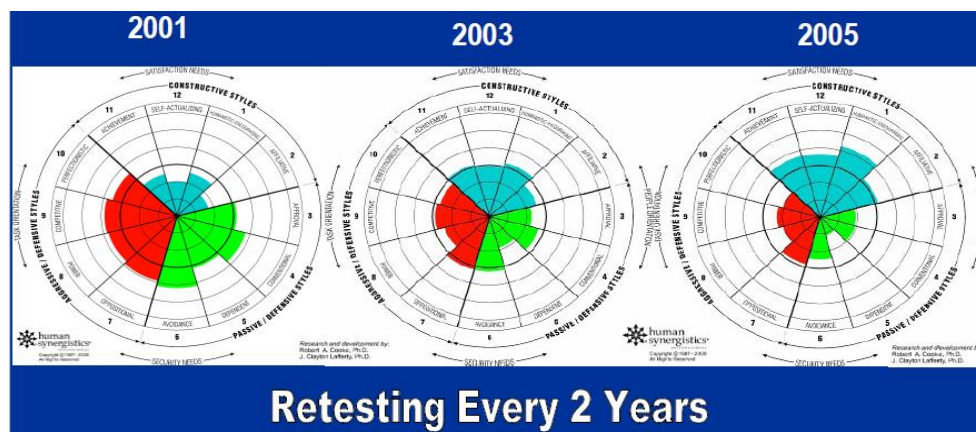


Figure 7 OCI actual results demonstrating improvement across three surveys for water infrastructure business. Kelly (2006, p. 30).

Initial surveys of cultures using the OCI highlight the dominant styles of infrastructure businesses. The table below identifies the dominant style elements of various infrastructure businesses.

Table 19 Ranking of the three dominant styles using the OCI Circumplex for infrastructure businesses (initial actual scores of culture).

DOMINANT STYLES					
Examples of infrastructure businesses	Power	Oppositional	Avoidance	Dependent	Conventional
Yarra Valley Water (Water utility – 579 people) Yarra Valley Water (2009).		2	1		3
Melbourne Water (Water utility – 730 people) Melbourne Water (2008).		1	2		3
Western Power (Electricity utility – 2972 people) Western Power (2010).		2	1		3
AGL (Gas utility – 1500 people)	3	2	1		
SP AusNet (Electricity & Gas utility – 1500 people) SP AusNet (2011).		1	2		3

From these examples the OCI illustrate that the dominant style is 'avoidance' which is a passive/defensive style where, 'people are expected to shift responsibility to others and avoid any possibility for being blamed for mistakes.' The next dominant style is 'oppositional', an aggressive/defensive style where, 'people are expected to be critical, oppose the ideas of others, and make safe (but ineffectual) decisions' (Yarra Valley Water 2009).

Yarra Valley Water (2009) is an example of the cultural improvement journey after almost ten years of investing in leadership development. Culture moved from an avoidance-oppositional style to the positive humanistic-encouraging and achievement style.

These initial culture descriptions, as described using the OCI process, reflect the engineering dominated culture – *'a culture of engineering excellence – top management were engineers, and safety and security of supply were considered primary goals. Financial considerations were purely secondary'*, Conrad (1995, p. 18). Conrad (1995, p. 20) also observed that *'the commercial business culture emerged, during the first five years of privatization'*, primarily with the removal of the replacement of the engineers from top management.

Engineers in executive roles in infrastructure have had negative perceptions regarding their ability to balance technical and financial deliverables (Conrad 1995; Yates 2001). This may originate from the clash between the interface of the Executive culture (financial performance) and engineering culture (technical excellence) (Schein 2004).

Yates (2001, p. 63) notes, *'Many generalist managers consider that engineers are not business focused. This is readily seen in the frequent but incorrect accusation that solutions advocated by engineers are 'gold-plated'. This view is an amalgamation of inaccurate prejudices, including that engineers:*

- (1) Are narrowly focussed on technical issues with no understanding of other issues such as social and environmental impacts;*
- (2) Are determined to get a perfect answer by ignoring the financial and political realities; and*
- (3) Always advocate solutions which are too expensive. This perception undermines all sound engineering arguments'.*

Yates (2001, p. 63) also points out *'another common perception held by generalist managers is that technical issues are easy and consequently non-technical people can competently make technical decisions'*, and this may be supported by the perception that, *'generalist managers regularly change careers and consequently are continually learning new skills, they assume that it is easy to pick up a new skill'*.

The following section concerns development of infrastructure leaders.

3.1.3. Development of infrastructure leaders

The previous two sections highlighted that (1) the industry has acknowledged the need to formalize the skills required for effective performance of infrastructure businesses (IAM 2008a; Too 2010); and (2) that the culture of infrastructure is dominated by the engineering subculture in which engineers are perceived to be the 'problem' not the solution in the new privatized business (Conrad 1995; Yates 2001). The OCI data highlighted the weaknesses of the engineering culture and, by implication, the need for engineers both to develop and learn to lead in an infrastructure business culture that is more 'constructive'. In addition, as Yates (2001) highlights there is also a need to extend the focus to embrace the social, environmental, financial, and political dimensions of the infrastructure.

This section explores the literature on what industry has done in historically to develop those technical leaders who are perceived to be inadequate to lead in this new business environment.

The development of the *'Asset Management strategy is still relatively new. It transcends engineering and accounting...It is corporate in focus'* Lloyd (2010, p. 95) and is the industry's response to better managing the infrastructure class assets. The asset management philosophy originated from the technical industry groups and over time with the application in the broader infrastructure business will begin to gain acceptance for not just being another engineering discipline, (Lloyd 2010). This is an example of how industry has responded to the need to expand the focus of the technical leaders within infrastructure.

Another approach has seen infrastructure owners spend, and continue to spend, considerable funds and resources within the business to influence the leaders and culture to create effective leadership and see improved business performance. Shepherd (2001), an electrical engineer and

chairman of Powerlink (the Queensland State Government electrical transmission provider), highlights the leadership development that she introduced. Seeing the introduction of regulation and the need to reduce charges by 20% she said, *'We know that Powerlink needed to change and so we focussed first on leadership throughout the organization'* Shepherd (2001, p. 35). Shepherd (2001, p. 36) also notes that, *'We had people who had been in the industry a long time: virtually all the staff had never worked anywhere else; 43% of our people were over 45 years old; 50% were engineers or in a related technical discipline'* and *'the remuneration models took people who were very competent technically and forced them to become managers to get rewards, even if they were not good at management'*. As a sign of 'real' leadership, Powerlink adapted the leadership training based on Covey program (Covey 1990) for the business and the first courses were attended by the Board, CEO and senior executive – 'walk the talk'. Shepherd (2001, p.37), notes *'through these programs we have been changing the way engineers view their roles'* and *'no longer do they have to become managers to be rewarded.'* Powerlink was named one of the best 25 employers in Australia in 2001.

Len Bleasel, former CEO of Australia Gas Light (AGL) company introduced Four Quadrant Leadership and has *'given AGL a simple and highly effective process for helping everyone contributes to the success of the company'*, Jarvis (2010, p. 1).

Melbourne Water and Yarra Valley Water have both won culture transformation achievement and sustainability awards using OCI from Human Synergistics (2010). The use of the tool enabled not only delivery of technical results but also reinforced the organizations culture by supporting leaders in being role models of constructive styles.

Stockport (2005) followed the development of Alinta, the Western Australian utility, a A\$5.7 billion energy utility based in Perth that in 2002 which introduced 360 degree feedback process and embarked on a focus on leadership. *'Managers were encouraged to build 'followership' through a 2 step approach which were 'focus on self' and 'focus on others'* Stockport (2005, p. 12). Corrigan (2004) quotes the chairman of Alinta, Tony Howarth *'that financial literacy is critical to strong leadership and effective management, but he places just as much importance on other key attributes needed to succeed in the business world – the ability to invest in people, trust, integrity, common sense and empathy'* and *'It's important to be able to defend your view in a financial sense and also in a strategic sense'* Corrigan (2004, p. 6-7). Howarth explains *'the Chairman and the Board set the values and the type of organisation they want and in doing that they pick the CEO'* and in selecting the CEO they chose someone who *'very well educated, he has technical skills and a human resources background'* Corrigan (2004, p.10).

The recent focus on sustainability reporting by companies has brought to the public domain the areas of focus for infrastructure businesses. SP AusNet (2011) is an example of a privatized infrastructure businesses employing over 1500 direct employees to manage their A\$6.3billion electricity and gas networks which provides services to more than one million customers in Victoria. They focus on a number of initiatives such as (1) cultural improvement using the OCI tool to focus and monitor training needs; (2) company-wide training needs analysis *'to identify core development needs across the business and the strategy to deliver this development'* SP AusNet (2011, p. 12); and (3) up skilling managers to meet the future development of the company – the 'future Leader's' program is to provide leaders with cross-functional experience across the business.

SP AusNet's approach is typical of most infrastructure businesses in developing leaders (Yarra Valley Water 2005; Melbourne Water 2008; Western Power 2009).

The literature on Infrastructure leaders highlighted the issues arising from the privatization or commercialization of infrastructure businesses. Industry responded by developing Asset Management to quantify the competences and skills required for these new businesses who required a balance between the owners investment returns and the communities expectations driven by a more active regulatory framework.

The culture of infrastructure is dominated by the engineering subculture but engineers are perceived as not being suitable leaders in this new commercial world. Infrastructure companies have identified a gap in performance exists and this ineffective leadership has been reflected in their poor OCI survey results. Infrastructure businesses have embarked on leadership development programs to ensure the future of their business performance.

The focus on infrastructure leadership and its effectiveness is limited and appears to be in the early phase of investigations by both practitioners and academics. Current focus within industry is either technical (Deadman 2010; Lloyd 2010) or individual businesses focusing on applying leadership training to their new businesses (Shepherd 2001; Conigan 2004; Stockport 2005).

Infrastructure businesses have responded to the complexity of the competing demands by way of three broad approaches. The first approach was to replace engineers from the executive roles and utilize their technical skills as a function that supports the business rather than lead the business now that financial requirements are so demanding under the investor and regulatory environment. The second approach has the businesses restructuring the business into the three functional

groups of AO, AM, and SP. This approach focusses the subcultures within the group and also provides additional revenue for investors outside the regulatory regime,. The third approach is the businesses focus on leadership style with businesses recognising the gap in the organization and by focussing upon developing the leadership style often via cultural survey tools such as OCI.

The broader infrastructure industry groups such as IAM, CIEAM, and AMC have taken a fourth approach which is different from the three broad approaches of the individual businesses. Their focus has been upon the skills required for this new work environment. In an effort to define this new complex business environment, one that has grown from a traditional engineering background, they have developed the new philosophy of Asset Management. This has been utilized to set the boundaries for the new skills required of the infrastructure business. Individual businesses have focussed upon leader style while the industry profession has focussed upon leader skills to close the gap perceived with engineers in leadership roles of these businesses.

3.2. Engineering leadership

The previous section highlighted that an engineering culture is dominant within infrastructure organizations and how the industry professional groups have focussed upon skills for the leadership to be effective. A broader body of knowledge exists within the general engineering literature which also recognized the need for skills —broader than purely technical ones — if engineers are going to be successful in higher levels of organizations and within the general business community.

Schein (2004) defines the engineering culture as the group concerned about innovation, improvement and redesign of work products and processes. In infrastructure this will be engineers, while the engineering culture for other industries will not be those qualified as engineers per se, for example, *'in a hospital it will be the research physicians as the engineers who are more concerned about their innovations in their speciality rather than daily patient care'* Schein (2004, p.197). The skill for this engineering culture is predominantly technical in nature. Badawy (1982) utilizes a broad definition of the word 'technical', he says: *'Technical skills include the ability of the manager to develop and apply certain methods and techniques*

related to this task. The manager's technical skills also encompass a general familiarity with, understanding of, the technical activities undertaken in his department', Badawy (1982, p.18).

Technical skills for infrastructure are predominately derived from engineering qualification and/or industry experience (Lloyd 2010; Deadman 2010). Engineers Australia, the professional engineering governing body, has recognized the need for engineers to acknowledge the different skills exhibited both by leaders and senior leaders within the broader businesses community. The Centre of Engineering Leadership and Management (CELM) is the Australian group created in 2002 to help engineers meet the challenges of business leadership. Two objectives of CELM are stated as:

- To promote engineering leadership and management by raising awareness and expectation of excellence with individuals, business, government and the wider community.
- To encourage and empower more engineers to build on their professional engineering disciplines for leadership and management roles.

CELM also highlighted the need to develop a clear profile of the skills an engineer should have to be an effective leader as they advance in their career. Engineers and engineering historically have had the following profile as the starting point of their roles in business CELM (2007, p.1):

1. Engineering is ubiquitous, connecting people and places across society using technical infrastructure. In many ways engineers have built the foundation of our society.
2. Engineers create new technical infrastructures to make our lives better.
3. Engineers care for community welfare, health and safety by ensuring the quality and performance of our technical infrastructure assets are of a consistently high standard.

CELM suggested the profile needs to be refined to suit general leadership and within the suggested steps forward proposed *'identifying the engineering and leadership competencies essential to the effective performance of this agreed identity.'* CELM (2007, p. 4). This is a broad definition of engineering executive leadership.

Kaspura (2008) notes that the engineering profession was 250,000 strong based on the 2006 census (this included the trades skills i.e. used the broader definition of technical– pure engineering accounted for 57, 600), a significant industry body requiring leadership and being utilized for leadership roles.

The top eight industries for engineering are listed in the table below:

Table 20 The top eight Australian industries that employ engineers in 2006. (Kaspura 2008)

RANK	PARTICULAR INDUSTRY	% ENGINEERS
1.	Professional & Technical Services	21%
2.	Manufacturing	19%
3.	Public Administration – government	10%
4.	Construction	7%
5.	Transport & Warehousing	6%
6.	Retail Trade	5%
7.	Electricity, Gas & Water	4%
8.	Mining	4%
TOTAL:		76%

Engineers working within the infrastructure business may exist within industries 3, 4, 5 and 7 above i.e. Public Administration, Construction, Transport & Warehousing and Electricity, Gas & Water.

Katz and Allen (1986), in their review of career preferences for engineers show that the pure *technical* orientation was relatively low at around 20% compared to *management* and *project* orientation. Thus from an engineering development point of view most engineers once qualified tend to develop their careers in general management and/or project management. Management is a significant career opportunity for engineers and it is sufficient to note that engineers as a profession acknowledge that a diversity of skills are required for engineers if they are to be effective leaders. (Kelly 2000; Farris & Cordero 2002; Thomas 2005).

3.2.1. Skills mix and balance

The literature provides background of the skills required by engineers if they are going to be effective leaders. Looking outside of Australia, Dudman and Wearne (2003) have done two extensive surveys of examining which skills are required for managerial roles using a sample of chartered Engineers resident in UK in 2002. The sample consisted of chartered members with a minimum of ten years of experience and resulted in over 220 respondents to which 69% were either at Director/Partner level (20%) or Manager/Chief Engineer (49%) level. The research identified the three most difficult or demanding aspects of the leaders job was completing administrative/budgeting control process (26%), People Management (15%) and Business policy/strategy (14%). The skills and expertise required for a technical leader to be effective varied with their level in the organisation. Project Management and Leadership were deemed the highest for all four levels of the organisation but business, personnel and commercial significantly increased at Chief Engineer and Director level and all three skills almost doubled in importance when compared to Professional engineer and Senior Engineer. No skill or expertise decreased when going up the levels of an organization but research supported the view that the skills were cumulative. The table below shows the scores for the nine skill areas and how the scores varied for the description of the engineer at each level of the organisation.

Table 21 The score of importance for each skill (maximum 100) for engineers as they progress up the levels of an organization. (Estimates from Dudman and Wearne (2003 p. 24) graph).

GROUPS OF (%) SKILLS & EXPERTISE REQUIRED COMPARED WITH LEVEL OF RESPONSIBILITY	NUMBER OF LEADERS	TECHNICAL	TRAINING	OPERATIONS	R&D	COMMERCIAL	PERSONNEL	BUSINESS	PROJECTS	LEADERSHIP
Director/Partner	45	29	33	40	43	75	64	82	93	92
Manager/Chief Engineer	111	21	32	32	35	42	59	52	83	90
Senior Engineer	44	18	12	28	37	33	28	34	81	77
Professional Engineer	21	15	32	36	26	33	39	29	78	77

Dudman and Wearne (2003) did not use a measure for leadership style or effectiveness but some of the demographic information highlights the level of post graduate training and base qualification of these senior chartered engineers.

Table 22 The demographic information of leaders from (Dudman & Wearne 2003)

CONTENT OF ROLE	SAMPLE
Predominantly Technical	24%
Predominantly Managerial	36%
Both equal	40%
Branch of engineering	
Mechanical	19%
Civil	18%
Electrical/Electronic	26%
QUALIFICATIONS	
University degree	69%
Higher education qualification	47%
MBA	5%
Higher Engineering Qualification	25%
YEARS IN ORGANISATION	
Greater than 21 years	18%
10-20 years	27%
5-10 years	16%
< 5 years	30%

Dudman and Wearne (2003), in scoring the skills at the upper management levels, highlight the importance of leadership, projects, business, personnel and commercial. Badawy (1978) identified that engineers are *'professionals who demand special treatment and that the engineering environment is characterized by unknowns and uncertainties which initiate close control'* Badawy (1978, p. 37). Badawy goes on to highlight that there are three ways to improve the managerial competency of engineering leaders. They include:

1. Abandon the promotion of the most technically competent to a managerial role just because of their technical ability.
2. Examine psychological characteristics such as will to manage, need for power, and capacity for empathy.
3. Change the current education focus on pure analytical skills and introduce management education.

Badawy (1982) went on to further research why engineers fail as managers. Badawy introduces the managerial skill mix and how for engineers to be successful in their rise through the levels of an organisation they must recognise the importance and how the skill focus can change as they move up. Badawy utilises the three skill approach of Katz (1955). They consist of:

1. Technical Skills – understanding of technical activities undertaken within their department and relative to the company divisions.
2. Administrative Skills – effective management to organize, plan, direct and control a workable group and leading than within a certain direction. Superior skills being cognitive and conceptual skills.
3. Interpersonal skills – ‘*probably the most important*’ Badawy (1982, p. 163), the ability to motivate, influence, communicate both directly to the team and across the organization.

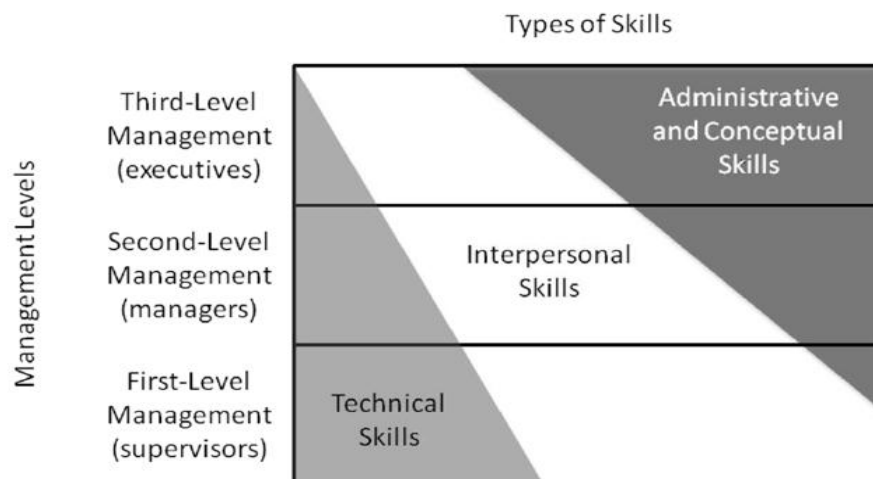


Figure 8 Badawy managerial skill mix (MSM) – Badawy (1982, p. 231)

Badawy (1982, p. 166) highlights, ‘*many technical leaders get fired, not because they lack technical competence, but because they lack managerial competencies (another common practice, sadly, is to transfer incompetent managers back into a heavy technical role!)*. *Management failure can thus result from inadequate management and administrative skills*’ and ‘*The major cause of managerial failure among engineers and scientists is poor interpersonal skills*’. This mix of skills and the variation in the mix of skills at differing levels of management is a critical element of this research.

Lannes (2001) points out that this transition for engineers to management roles is purely time dependent upon the engineers' desired career path. Technical skills are developed during the first five years, followed by twenty years of developing interdisciplinary skills and finally they gain integrative business skills. Lannes does note that *'not all engineers progress through all three stages nor do they progress at the same rate'* Lannes (2001, p. 109).

Clark (2008) notes that in the 1980's, engineers in mining perceived that their roles were 60% technical skills, 20% management skills, 10% financial skills and 10% industrial relations skills. He highlights that in reality, the mix was 10% technical skills, 40% management skills, 20% financial skills and 30% industrial skills. Clark (2008) suggested that engineers needed to rethink what is important if they are to be successful.

Dual ladder organizations attempt to assist technical experts by providing a technical ladder to correct the imbalance of rewards compensation for non-supervisory professionals (Katz and Allen 1986).

Cordero and Farris (1992) highlighted the possible addition of administrative activity as a means of improving the technical leader's skills in order that he/she may take up managerial roles. Farris and Cordero (2002) summarized the recent literature regarding managing engineers based on the initial work of Badawy and highlight that *'If scientists and engineers are provided opportunities to develop both technical and leadership skills and relevant knowledge of the business, we will increase the chances of making full use of what is known about leading scientists and engineers today'* Farris and Cordero (2002, p. 17). They introduce six areas for further research to understand how engineers can lead more effectively: (1) cross-functional teams; (2) leading scientists and engineers; (3) knowledge management; (4) demographic diversity; (5) electronic and other technologies; and (5) outsourcing.

Further, Farris and Cordero highlight that existing leaders of engineers continue to not use the existing knowledge available in that : *'(1) managerial potential is still determined much more by an individual's technical skills than by his or her potential to develop leadership skills and (2) even if some scientists and engineers also have the potential to develop leadership skills, they are often promoted into management before the potential to develop leadership skills and before they have enough opportunity to develop these skills adequately. Leadership skills, business knowledge, and other non-technical skills are increasingly important in today's business'*, Farris

and Cordero (2002, p. 17). Clarke (2002) points out that the failure of leaders to apply past research is due to academics, rather than actual technical managers, being involved in research.

Farris and Cordero (2002) and Clarke (2002) focus on leadership within research and development businesses rather than general leadership.

Cordero, Farris and Di Tomaso (2004) explored the skill mix of the leaders, technical, people and administrative, and observed that the more the leaders possess all three skill sets the more stimulating the work environment. The research was at supervisor level, (level two) and used a seven-point scale on 26 statements for supervisor skills and 13 statements for stimulating work environment. They did highlight that the three skill categories were common and useful for conceptual analysis but the three categories were interlinked. They highlighted positive performance from the three categories but also highlighted an additional component from the research namely: *'always positive, skilled supervisors establish credibility and legitimacy, and gain respect of subordinates'*, Cordero, Farris and Di Tomaso (2004, p. 27).

Khoury (2005) studies the effectiveness of the leader of the knowledge (technical) worker by examining two elements of leadership, credibility and self-efficacy, or belief in oneself as a leader. Khoury (2005, p. 4) works on the assumption that *'leaders motivate others to commit to change, while helping them to overcome obstacles'* and, that *'without self-belief the role and tasks of leadership become overwhelming and conviction for the task diminishes'*. The study was completed at a research laboratory workforce consisting of 8650 individuals of whom 40% were engineers or scientists and 50% had PhD's. Khoury's (2005) conclusion from 118 managers was that technical leadership required effective skills, knowledge and ability plus the leadership 'character' of credibility and self-efficacy. Khoury (2005, p. 134) pointed out that *'knowledge workers want to be encouraged, believed in and lead by those they trust to inspire them to accomplish the goals and objectives of the organization'*.

Visser (2003) examined the difference in leadership styles between experienced engineers in a utility, Eskom in South Africa, and inexperienced post-graduate students at the Rand Afrikaans University. He used the Multifactor Leadership Questionnaire (MLQ) to identify leadership style and focussed on the Transformational /Transactional leadership of Bass & Avolio (1995). The research did acknowledge the engineering culture and identified that more experienced engineers are more transformational than transactional as is the case for inexperienced engineers. The

sample size was 48 engineering managers and 37 post-graduate engineers within one company. Eskom is a significant infrastructure company being the fourth largest power utility in the world which has been chaired and managed by engineers until 1999, (Visser 2003). Visser 's (2003) study does support Badawy's (1995) view for the managerial skill mix and that the skill focus requirement for transition from graduate to senior manager. Visser (2003) does point towards the earlier work of Seethamraju (1997) which examined the transition of engineers into management roles in Australia using a quantitative survey tool that built upon the managerial skill mix (Badawy 1983). Seethamraju (1997) primary focus was on engineering education and what additional training was deemed necessary for engineers to transition for this skills mix. The design tool used an extensive questionnaire sent to almost 10% of the 35,000 registered members of Engineers Australia with the response rate being 27%. A sample size of this magnitude is possible when examining general characteristics such as Seethamraju was exploring.

Another researcher, Bukarica (2009) used an extensive two hour focussed interviews of technical experts who had assumed managerial responsibilities. The experts were not engineers but senior managers. An interesting observation after the research was, *'What was not reported elsewhere in the literature was the overwhelming emphasis on the extent of the technical skill proficiency over other leadership skills as the prerequisite for a leadership position'* and *'this study found that the respondents needed to be seen as leading experts in their field before they assumed managerial responsibilities'*, and *'this study has demonstrated that organizations cannot underestimate or understate the technical component of leadership'* Bukarica (2009, p. 210).

This supports Mole (2004) who pointed out that *'the technical component of leadership...is generally (and often deliberately) underestimated and understated'*, Mole (2004, p. 135). While Maccoby (2000, p. 57) went further and stated that *'employing non-technical manager to manage technical experts could be problematic'*.

Bukarica (2009, p. 39) notes that technical leaders *'may have demanded realisation of tasks and goals that did not make sense to technical experts'*. Both sets of research point to the middle management and supervisory level rather than the executive level but they do acknowledge the need for technical skills as the cornerstone for effective leadership.

Bayne (2010) research focused on leadership within engineering organizations. Results from 381 participants identified that effective leaders need to focus on firstly developing high level of trust, secondly communicate and sell the vision and thirdly to lead by example is essential for leaders to *'truly understand the people they are leading'* Bayne (2010, p. 7).

Yates (2001, p. 71) points out that engineering skilled leader need to highlight and exploit their competitive skill advantage over non-engineering leaders in the areas of:

1. *‘Technical understanding resulting in sound judgements being made on technical matters, an understanding of what is practical and will work, and being able to provide a reality check on proposed solutions.*
2. *Problem-solving ability based on logical, analytical thinking which results in practical solutions.*
3. *Big picture understanding and systems approach, which includes the ability to take a strategic view of the situation and identify causal relationships; and*
4. *Special engineering and management skills, including whole of life, systems engineering, mathematics and contracting skills, and being able to define measureable performance and quality indicators.’*

Industry has begun to highlight more publically the role engineers make as leaders within the broader business community. The Engineers Australia group, CELM, was able to make 2010 the year of engineering leadership (Engineers Australia 2010). Their aim was to promote the following objectives:

1. Leaders of an engineering team provide inspiring, sustainable and innovative solutions to society’s challenges.
2. The community identifies engineering as the desired vocation for those who are or want to become leaders of the future.
3. Engineers Australia is an organization that fosters, supports, and develops engineering leaders through all stages of their careers.
4. Leaders in the engineering team value and are proud to be part of the practise of engineering.

Engineers Australia acknowledges, *‘over time, career options for members of the profession generally become more and more diverse. In broad terms engineers who are approaching mid-career are often increasingly focussed on leadership and management in addition to their technical roles’* CELM (2011, p. 1).

CELM engineering executive is *‘competency based assessment and accreditation framework for engineers with a process professional engineering track record who are interested in pursuing*

management and leadership opportunities in both the private and public sectors' CELM (2011, p. 1).

CELM identifies that for an engineer to be a successful executive they must have the '*ability to perform activities to standards expected and recognized by employers and the community*'

CELM (2011, p. 4). The standard consists of 10 units of competences each with a number of elements for each unit of competency. For these ten units of competency there are a total of 50 elements used to describe in detail what makes up the units of competency. When these 50 elements are categorised using the five skill typography of this research they have the following profile:

1. People skills – 15 elements,
2. Administrative skills – 15 elements,
3. Business skills – 10 elements,
4. Technical skills – 6 elements,
5. Strategic skills - 4 elements.

Comparing the three competency standards being utilised within engineering professional groups (IAM 2008a; AMC 2011a; CELM 2011), at the highest organisational level of competency, they display different profiles of the importance of the skills for effective leadership. This is summarised below.

Table 23 Comparison of the three competency frameworks (at the executive level) from engineering centric industry groups and the distribution of the competency elements across five skill groups.

EXECUTIVE LEADER LEVEL COMPETENCY FRAMEWORK	PEOPLE SKILLS	BUSINESS SKILLS	STRATEGIC SKILLS	TECHNICAL SKILLS	ADMIN. SKILLS
IAM framework. (IAM 2008a)	25%	0%	8%	0%	67%
AMC framework. (AMC 2011a)	8%	8%	0%	68%	16%
CELM framework. (CELM 2011)	30%	20%	8%	12%	30%

This distribution of competency elements points towards the executive leader requiring a balance of skills across these five skill sets. The literature has identified skill groupings (Badawy 1983) and that the skills of engineering qualified leaders needed to be developed. This next section explores if the perception of engineers as leaders is different to that seen within the infrastructure literature.

3.2.2. Engineering culture and perceptions regarding engineers as leaders.

Engineers form a critical part of most organizations especially within infrastructure. With such broad industry base and large numbers it is inevitable that engineers will need leading themselves and will seek leadership roles both within technical industries and outside. (CELM 2011)

CELM provides the focus for these engineers seeking leadership and management roles within Australia's engineering community. A number of articles within the Engineer's Australia's magazine for 2010, (Year of Engineering Leadership) highlighted the practitioners' view of effective leadership and the skills required. Most focus was on the leadership of engineers (Nathan 2010; McNaughton 2010; Bayne 2010) while others explored the elements of general leadership and why engineers make up 14% of the CEO positions of top ASX 100 companies (White 2010) and the third element focussed on the reputation of engineers to hold practical skills and be problem solvers are critical for organizations at the high levels (Evans 2010; Care 2010; Engineers Australia 2010a).

Interviews with six experienced senior leaders having engineering skills answered questions on how engineers can become effective leaders (Engineers Australia 2010a). The table below records one comment from each of six leaders when asked the question, 'Do engineers make good leaders?'

Table 24 Observations of ‘Do engineers make good leaders?’ – (Engineers Australia 2010a)

DO ENGINEERS MAKE GOOD LEADERS?
<i>‘Engineers can and do make great leaders but they need to have a broader base of skills than just their technical qualifications’.</i> - Campbell Newman, Lord Mayor, Brisbane
<i>‘In general, yes, they normally learn how important people skills and communication are early on in their career’.</i> - Geoff Brown, Air Vice-Marshall RAAF
<i>‘No, not all do, but if you are at the top of your game as an engineer, then you have the opportunity to demonstrate great leadership’.</i> - Steve Ludlam, Managing Director of Australian Submarine Corporation
<i>‘Yes. All engineers have the analytical thinking to be able to solve problems, find alternatives and development operation plans or solutions. Those engineers who can combine these skills with personal leadership qualities and organizational implementation skills will potentially be strong leaders’.</i> - Bob Leece, Infrastructure Coordinator General of New South Wales
<i>‘Sometimes, but not always, delegation does not easily come to all engineers as they have a tendency to get too absorbed in the detail, then they meddle with the work their team is trying to do. It is important to be ‘hands on’ but not ‘hands in’.</i> - John Gaskell, CEO of ABB
<i>‘Yes, because early in their careers they realise the value of people skills in getting the job done on time and on budget by a well led group of professionals who understand social and political contexts. These ‘people skills’ have been incubated and cultured over many careers to produce icon engineering leaders.’</i> - Archie Johnston, Dean of Engineering, University of Sydney

Summarising the above table, these professionals believe that engineers need a broader base of skills rather than merely their technical skills. Skills such as people skills, communication skills, personal leadership qualities, organizational implementation skills, delegation, and, understanding social and political contexts are required.

Executive leaders embed their beliefs, values and assumptions into the culture through the ‘DNA’ of the culture. If they are to be effective as leaders and hence have an effective culture within the organization they need to be aware of the two mechanisms defined by Schein (2004, p. 246) i.e. the primary embedding mechanism and the secondary mechanism of articulation and reinforcement.

Table 25 How leaders embed their beliefs, values and assumptions within the organization's culture Schein (2004, p. 246).

PRIMARY EMBEDDING MECHANISMS	SECONDARY ARTICULATION AND REINFORCEMENT
What leaders pay attention to, measure and control on a regular basis.	Organisational change and structure.
How leaders react to critical incidents and organisational crises.	Organisational systems and procedures.
How leaders allocate resources.	Rites and Rituals of the organisation.
Deliberate role modelling, teaching and coaching.	Design of physical space and buildings.
How leaders allocate rewards and status.	Stories of important events and people.
How leaders recruit, select, promote and excommunicate.	Formal statements of organisational philosophy, creeds and charters.

Engineers have such a distinct set of skills and impact that Schein (2004) identifies one of the three subcultures of an organisation as being an engineering subculture. It may or may not contain actually tertiary qualified engineers per se but the technical groups of an organisation.

Engineering culture is a subculture defined by Schein as having distinct differences to the other two subcultures i.e. operator and executive.

Table 26 Summary of three subcultures of an organization and their specific focusses, (Schein (2004, p. 198).

Elements of focus:	THE THREE CULTURES OF MANAGEMENT		
	Operator Subculture	Engineering subculture	CEO Subculture
Colloquialisms	The line, middle managers, management, or the boss	Experts, geeks, technocrats, or analysts	Executives, top leaders, Mahogany Row, or the big boss
Scope	Local	Global	Global
Orientation	Making the system work, people, local community, based on core technology.	Technological elegance of design, abstract and efficient solutions, people are a source of noise.	Financial growth and viability, people are a cost to be managed, managed through impersonal systems and routines.
Examples of Basic Assumptions	<p>Success of enterprise depends upon people's knowledge, skills, learning abilities, and commitment.</p> <p>Required knowledge and skills are 'local' and based on the organization's core technology.</p> <p>Operators need to learn and deal with surprises in the production process.</p> <p>Operators must be part of a collaborative team in which communication, openness, mutual trust, and commitment are valued.</p>	<p>We are proactive and optimistic; our ideal is mastering nature' We are stimulated by puzzles and problems.</p> <p>We are pragmatic perfectionists who prefer solutions independent of fickle people.</p> <p>An ideal world is made up of elegant machines and processes that work with precision and do not need human intervention.</p> <p>We are oriented toward safety over design.</p> <p>We prefer linear, simple cause-and-effect, quantitative thinking.</p>	<p>Financial survival and growth must be our focus.</p> <p>We are in a perpetually competitive and hostile environment.</p> <p>We need to appear in control and be indispensable.</p> <p>We must rely on our own judgment because subordinates do not give reliable data.</p> <p>Hierarchy helps to maintain control We take risks only in ways that maintain control.</p> <p>Large organizations require rules, routines, and rituals.</p> <p>Challenge and achievement, not relationships define success.</p>

Any change required within an organization will required the culture of the organization and subsequent three subcultures to become aligned to the organization. A subculture can become aligned when the change is firstly accepted by the leadership. But as Schein (2004, p. 23) highlights, *'the bottom line for leaders is that if they do not become conscious of the cultures in which they are embedded (i.e. such as engineering culture), those cultures will manage them'*.

Yates (2001) points out that if the engineering leaders are going to accept the change to privatization and business focus they must change the perception of engineers which is seen as: *'small picture people, focussed on narrow technical views; and seeking impractical, gold plated solutions; having poor people and management skills; and seen as a necessary evil and often resented'*, Yates (2001, p. 72).

The next section explores the literature and what has been done to better prepare engineers for leadership and the executive roles that many appear to develop into as they advance in their careers.

3.2.3. Development of engineers into leaders

The previous two sections have identified that engineers do advance into management roles (Badawy 1982; Dudman & Wearne 2003; Cordero, Farris & Di Tomaso 2004) but their effectiveness as leaders is questioned by various groups (Yates 2001; Visser 2003; Khoury 2005). CELM (2011) has developed a competency framework for executive engineers who are in the public or private sector who are no longer doing specifically technical work.

The literature in engineering identifies a number of approaches for developing engineers into leaders and further developing those already in leadership roles. A master's program that was initiated to support *'engineers (that were) unable to rise through the ranks because of a lack of leadership skills'*, D'Angelo Fisher (2007, p. 54) and also notes that in the late 1980's companies were *'de-engineering'* and *'many of the senior positions conventionally occuppies by engineers were now being occupied by non-engineers'* and *'there were even examples of chief engineer's positions being filled by accountants. We were concerned about this and wanted to give engineers the skills that employees were looking for'* D'Angelo Fisher (2007, p. 54).

The Association of Professional Engineers, Scientists and Managers Australia (APESMA) developed an MBA in 1992 and has produced 8000 graduates to date. The MBA has a strong engineering and technical focus – enrolments are 52% engineering, 20% IT and 12% Science (D’Angelo Fisher 2007). The MBA has been a traditional method for engineers to obtain their ‘non engineering’ skills – as an example one of Australia’s business focused MBA programs the program is dominated by students of whom (MSGM 2011):

- 73.7% holding middle management or above positions
- 5.6% have an engineering job function, largest group is sales/marketing/PR – 30.6%
- 9.5% are employed in engineering/construct or utilities, largest group is finance/banking/insurance – 16.4%
- 79.2% have less than 10 years of management experience.

Formal qualifications are important. Goh and Bullen (2009) note that of the leaders of the ASX 100, 93% have tertiary qualifications (31% being engineering/science) and at post graduate level 25% have an MBA. Dent (2009) notes that there are two types of managers at these levels — those who are outstanding people-people and those who are risk managers.

Goh, Coaker and Thorpe (2008), in their review of how engineers can become CEO’s, note that a new type of MBA may be required as most universities do not cover some highly desirable skill sets and attributes. The skills/attributes with highest importance with training required are: (1) leadership, (2) communication ability; (3) business acumen; (4) strategic planning; and (5) financial management.

Formal education and other development opportunities are not distinctive to engineers and the next section examines the vast bank of literature that has been written and researched on what defines effective leadership especially at the executive level, what are the skills for effective leadership, and how leadership is measured and developed.

The literature of engineering leadership highlights that the perception of engineers as poor leaders is not a new problem and the profession has worked hard to change this perception. CELM is one example. Like the professional bodies of infrastructure, the engineering professional groups have focussed upon leader skill as the approach to developing engineers into more effective leaders of business. It is acknowledged that engineers need additional skills if they are to expunge their poor business image and advance into managerial roles.

3.3. General leadership

The previous two sections of the chapter explored the focus of leadership within infrastructure business and the broader engineering profession. Both the businesses and the profession recognize that engineers can be effective leaders but they need to be developed if they are to remain, or become, effective in the executive levels of an organization. Infrastructure business focus was upon leader style while the professional bodies of infrastructure and engineering focussed upon leader skill rather than leader style. The chapter outlines the general literature on leadership style and leadership skills and how they have been studied.

The area of leadership is one of the most observed subjects but, at the same time, one of the least understood. Burns (1978) and Stoddill (1974) highlight that this endless gathering of empirical data is yet to produce an integrated leadership framework. Bass (2008) and Yukl (2009) provide a more than adequate critique of both the theories and the strength of the research approaches. This research is not about reviewing the vast amount of literature/research that has gone before.

The 2006 report for Boston Consulting Group (BCG) builds upon the attributes and skills identified by Karpin (1995) in the Australian government's industry task force on leadership and management skills. BCG (2006) note that a return to expert leadership is occurring, *'in recent times, the premium of generalist management skills has begun to decline. In education, demand for specialist management courses has grown much faster than the demand for generalist courses, such as MBA's. As generalist management skills become more readily available in the workforce, depth of expertise has become more defining requirement for senior executives'* and, further, *'executive searches increasingly specify deep expertise in an industry or functional area. The 21st Century manager is expected to possess this expertise, along with advanced communication and team building skills...it is no longer sufficient for executives to play co-ordinator and goal setting roles. They must also be expert in subject matter at hand or bring deep experience to the issues being addressed. These trends suggest the age of the generalist manager is coming to an end'* BCG (2006, p. 21).

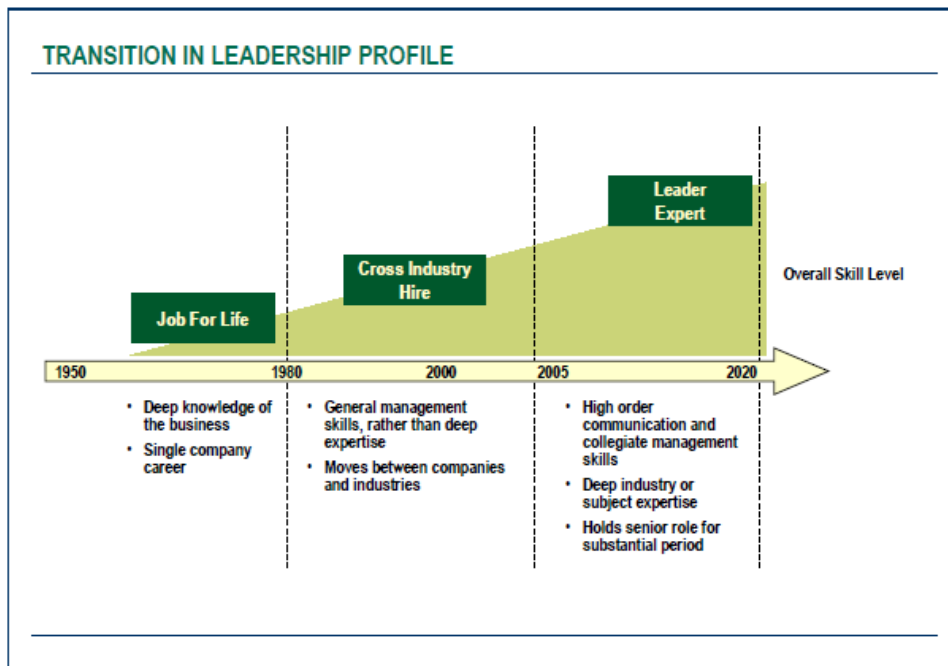


Figure 9 Transition from generalist manager to leader expert, BCG (2006, p. 22).

This move from technical to general to expert leadership has been reflected within the infrastructure class of assets (Gowland & Aiken 2005). The leader expert is slowly being recognised as a critical element and this is being reflected in the developing field of asset management which brings together those distinctive skills required in a complex asset intensive business (Lloyd 2010; Deadman 2010).

Covey (1990) through to Collins (2001) identify that the great enabler of business performance is leadership. Schein (2004, p. x) states that *'we are in an age which leadership is touted over and over again as a critical variable in defining the success or failure of organisations, it becomes all the more important to look at the other side of the leadership coin – how leaders create culture and how culture defines and creates leaders.'* Schein (2004) goes on to clearly demonstrate that leaders create the culture. Schein identifies that leadership impacts the culture either positively or negatively via two broad groups: Primary Embedding Mechanics or Secondary Articulation and Reinforcement.

Definitions of leadership are as equally disputed as leadership theories. Yukl (2006) provides a summary of multiple definitions and the continuing controversy about the difference between

leadership and management plus the degree of overlap. Kotter (1990) provides an example of the leadership versus management debate.

Table 27 Example of the leadership verse management debate (Kotter 1990)

LEADERSHIP –SEEKS TO PRODUCE ORGANIZATIONAL CHANGE	MANAGEMENT – SEEKS TO PRODUCE ORDER AND PREDICTABILITY
Developing a vision and making changes	Setting organizational goals, establish action plans with timelines and allocating resources
Communicating and expanding the vision	Organizing and staffing
Motivating and inspiring people to deliver the vision	Monitoring results and solving problems

At the executive level it is more appropriate to recognise that the executive leader needs both definitions and they are utilised inter-changeably (Jaques & Clement 1991).

3.3.1. Executive leadership

The general leadership literature has been traditionally concerned with supervisors and middle management (Yukl 2008). Significant focus has recently been focussed on the senior leaders at the executive leadership level and has been termed as strategic leadership (Hitt & Ireland 2002; Yukl & Lepsinger 2004). Yukl (2008, p. 708) goes so far to say that *‘During the past too much of the empirical research on leadership style was guided by the theories of transformational and charismatic leadership’* and *‘these leadership theories are too narrowly focussed to explain how top executives influence the financial performance of a large corporation’*.

Yukl (2008) points towards ‘flexible leadership theory’ (FLT) which is intended to bridge the gap between ‘leadership and management literature’ and provide a broader focus to explain how executive leaders influence. Yukl identifies four sets of variables which impact performance: (1) organizational effectiveness; (2) performance determinants; (3) situational variables; and (4) leadership. Yukl (2008) then highlights the drivers of performance determinants for which the executives have the ability to impact directly:

- (1) Leadership behaviour (task-relations-change) with peers, subordinates and outsiders.

- (2) Management of processes, systems and organizational structures that ensure efficiency and process reliability.
- (3) Decisions about competitive strategy to meet external environment.
- (4) Much of the literature points towards a single 'heroic' leader such as the CEO but a larger group point towards distributed leadership at the executive level as being more important (Yukl 2008; Yukl 2009; Collins 2001; Jaques & Clement 1991).

Other researchers focus on the executives other attributes: cognitive/systems thinking (Senge 1990; Jaques & Clement 1991) and social intelligence often political skills (Brandon & Seldman 2004).

The leader or leaders as in the executive team, impact the effectiveness of the organization by their (1) style with the team, peers, Board and external stakeholders; and their ability to (2) influence systems/processes/organizational structure and the competitive strategy (Collins 2001; Yukl 2008b). A key measure of the organizational effectiveness is the leader's effectiveness as measured by their style and ability to influence.

The effectiveness of the organization and the priority of actions between efficiency and process reliability; human capital; and adaption to the external environment will vary depending on: (1) the type of organization; (2) turbulence in the external environment; and (3) constraints on executives actions especially from external parties such as governments, creditors, banks. (Yukl 2008).

The executive team members provide additional skills that the CEO may lack; hence having an executive team will not only provide a balance of skills but culturally represent the diverse interests of the subcultures (Schein 2001). *'One characteristic that appears to be important is the functional background or specialized field of the team members. Executives with different functional backgrounds usually develop different values and attitudes that affect their interpretation of the environment, preference for particular types of strategy, and capacity to generate innovative solutions to problems'* Yukl (2009, p. 411).

Two core responsibilities of strategic leadership is monitoring the external environment and developing a competitive strategy which contributes to the organizations' performance, (Miller &

Cardinal 1994; Collins 2001; Yukl 2009). In a more complex changing environment with organizations of highly interdependent business units, the role of the executive team becomes critical and their effectiveness as a team will often be supported or hindered by the style of the CEO. Diversity of skills, experience, backgrounds improves quality of strategies but also creates difficulty in consensus hence there is a greater need for effective leadership in this often changing environment (Yukl 2009).

McCall and Lombardo (1983), through the Centre for Creative Leadership (CCL), have researched the traits and styles which are associated with the success or failure of executives. This failure rate is relatively high in executive levels ranging from 40% to 67%, (Fernandez-Araoz 1999; Smart 1999; Lombardo & Eichinger 1999; Hogan & Hogan 2001; Charan 2005), and this failure is often termed 'derailment'. *'Derailment is involuntary, in contrast to a conscious choice to pass up a promotion for personal reasons, or a necessary layoff due to downsizing, mergers or acquisitions. It reflects an inability to live up to expectations, and therefore represents failure'*, Prince (2005, p.1).

Based on Bentz (1990), thirty year study of failed retail managers, McCall and Lombardo (1983) interviewed twenty senior executives from three organizations. Each executive in their interview reflected upon a 'successful' executive and a 'derailed' executive. The definition of derailed being *'...people who were very successful in their careers (spanning 20-30 years and reaching very high levels) but who, in the eyes of the organization, did not live up to their full potential'* McCall and Lombardo (1983, p. 1).

They showed that at these senior levels:

- a. Successful managers were similar to derailed managers.
- b. They were all initially successful to get to this level.
- c. Every manager had strengths and weaknesses.
- d. Success sometimes depended on the situations often outside the manager's control.

McCall and Lombardo (1983, p. 6) pointed out that the *'most frequent cause for derailment was insensitivity to others. Under stress, the derailed managers became abusive and intimidating.'*

They highlighted five specific traits and skills that either advanced or derailed the manager, namely:

- 1) Emotional stability
- 2) Defensiveness
- 3) Integrity
- 4) Interpersonal skills
- 5) Technical and cognitive skills.

Derailment is an *antitype* of effective leadership. Executive leaders are effective by the fact that they have progressed to these executive roles. Measurement of effective leadership can be measured derailment and McCall and Lombardo (1983) identified ten reasons for derailment. Morrison, White and Van Velsion (1987), using the same derailment measure but with women rather than men, confirmed similar ten reasons for derailment and an additional reason which appeared, namely, gender bias against the female leader, or, having a poor image. Van Velsion and Leslie (1995) explored the same measure outside the United States and examined 42 executives across United Kingdom and Europe and found similar results as to McCall and Lombardo.

The Centre for Leadership Development (2010) best summarizes the thirty years of research on executive derailment. Four key dynamics lead to derailment:

- (1) An early strength becomes a weakness. The same skills, characteristics and qualities that enabled the executive to be successful may become liabilities if they fail to learn new skills and over-rely on past styles.
- (2) A flaw eventually matters. All leaders have flaws and if not managed or changed can become unacceptable in times of stress, rapid change or even prolonged interaction with individuals.
- (3) Extreme or unexpected challenges. Changes or challenges within the organization which are beyond the leader's direct control may cause their skills or flaws to surface.
- (4) Victims of their own success. Leaders who enjoy great success early and easily may develop a sense of superiority which affects their judgement.

They also highlighted that situation dynamics can directly impact individual factors. Organizational dynamics or culture set the context for success and define what qualities are considered strengths and weaknesses. Job dynamics through the level of organization set the requirements of the role and those that do not possess the *'necessary business/conceptual (intellectual) skills, the interpersonal skills, or the intrapersonal skills necessary for dealing with the complexity of the job are at the greatest risk of derailment'*, Centre for Leadership Development (2010, p. 3).

Derailment research provides an additional 'measure' which enable a clearer view of what drives the leaders' career success at executive levels after an often long period of success. Denton and Van Lill (2006) explored the derailment process from effective leadership towards ineffective leadership (ultimately derailment) and highlighted how strengths in results-oriented and technical skills early on in one's career can lead to the executive leader not being able to learn new skills and adapt to a more strategic and complex role. They reviewed 193 leaders, building on the work by McCall and Lombardo (1983) suggested 33 elements for derailment which they then reduced to six dominant 'flaws': (1) interpersonal problems; (2) difficulty in moulding staff; (3) difficulty in making strategic transitions; (4) lack of follow-through; (5) over dependence; and (6) strategic differences with management.

Their research was able to rank which of these flaws posed the greatest threat to the success of the leader and that the ranking varied across organization types, which highlighted the significance of the complexity of the leader's operating environment can contribute to the individual leader's derailment or progression.

Benson and Campbell (2007) point towards the inverted U-shape graph on matrix of performance versus style where the top of the U-shape is the turning point at which point the once successful style becomes a liability. A common example is the change from task-focus to people-focus and how at different times of one's career they may be helpful or a hindrance to the success of the executive.

Hogan and Hogan (2001) explore the personality issues that arise before derailment and how the situation can make these flaws a critical contributor to derailment. While other researchers

(McNally & Perry 2002; Prince 2005; Webb 2006) point out the availability of appropriate coaching for executives who want to avoid derailment.

Gentry, Hannum, Ekelund and De Jong (2007) highlight the importance of multisource instruments (i.e. 360 degree) to help executives identify derailment behaviours. The survey of 1742 European managers using the CCL tool called Benchmarks® identified a discrepancy between self and observer ratings with the discrepancies widening as the managerial level increased.

Jaques and Clement (1991) point to effective executive leadership in that they must manage complexity – the higher the level in the organization the greater the complexity and the greater ‘time span’ they have to deliver work across. *‘Effective leadership depends first and foremost upon competence in role’* Jaques and Clement (1991, p. 35) and *‘effective leadership demands four straightforward and basic conditions. First the necessary competence to carry out the particular role, including strongly valuing it. Second, that person must be free from any severely debilitating psychological characteristics that interfere with interpersonal relationships. Third, the organizational conditions must be requisite, ... Fourth, each person must be encourage to use his or her own natural style’*, Jaques and Clement (1991,p. 47).

Millett, Mattsson and Johnston (2005, p. 615) identified, *‘four distinct types of executive learning: assumption learning, adaptive learning, development learning and maintenance learning’* depending on the organizational conditions (established or new relationships) and the executive’s competence (established or new competence).

Kaplan and Kaiser (2003) point out that it is not just developing and applying competence it also is critical to balancing skills especially when they can appear opposite such as task-orientation and people-orientation leadership. They point out that, *‘developmental efforts should be allocated to both sides’*, Kaplan and Kaiser (2003, p. 23).

Ingerick et al (2008) completed their best practice review of executives and senior leader development and identified the major kinds of approaches and the frequency of organizations utilizing the approach:

- 360-degree feedback – 79%
- Executive coaching – 76%
- Formal training program (Classroom learning) – 72%

- Action learning (project-based opportunities) – 22%
- Formal mentoring – 13%
- Job assignments (stretch assignments) – 0%

Although the executive leadership has some distinctive issues such as derailment, complexity, time horizon of work delivery, they are still individuals who must be effective. The following section explores the effective leader literature.

3.3.2. Effective leadership

The previous section discussed the literature around effective leaders who had been promoted to the executive levels of an organization. Although initially effective the leaders needed to be aware of the potential to derail and what they need to do to remain effective. This section explores the vast amount of literature on what makes a leader effective and how researchers have described these effective leaders.

Connell, Cross and Parry (2002, p. 139) note that, *‘Despite the depth and breadth of debate concerning leadership effectiveness, it remains an elusive construct...research has covered a broad spectrum from trait models,...to behavioural perspectives...to contingency theories...and more recently, the transition versus transformational leadership models’*. Yukl (2005, p. 12) raises the concern that, *‘most leadership theories emphasise one category more than the others as the primary basis’* which can limit the understanding and how the approaches may be connected or dependent. The table below summarizes the 5 major leadership approaches as adapted from Yukl (2009):

Table 28 Five major leadership approaches (Yukl 2009)

LINE OF RESEARCH	ESSENTIAL FOCUS	MAJOR STUDIES
<i>Trait and skill approach</i>	Traits such as Personality Motives Values Skills	(McClelland 1965) (Miner 1965)
<i>Behaviour approach</i>	Behaviour often divided between task focus and people orientation	Ohio State Leadership Studies Michigan Leadership Studies (MCDQ) - Managerial Grid (Blake & Moulton 1964)
<i>Power-Influence approach</i>	Motivation/influence processes	(French & Raven 1959) Social exchange theory Leader member Exchange theory (LMX) IBQ - (Yukl 2002)
<i>Situational approach</i>	Contextual factors	Situational Leadership Theory (Hersey & Blanchard 1977)
<i>Integrating approach</i>	More than one type of leadership variable	Charismatic & Transformational (Bass 1985)

Studies under each approach have been utilized within industry, some extensively (Yukl 2006; Bass 2008; Northouse 2010) but, between and within approaches, academic debate occurs around the uniqueness of the approaches and their interrelationships (Blake & Mouton 1981; Hersey & Blanchard 1982; Blake & Mouton 1982; Molloy 1998).

To better explore the interrelationships between the leadership approaches – a number of authors, such as Hay (1999), Yukl (2006), and Hughes, Ginnett and Curphy (2006), have developed conceptual frameworks to better explain the interrelationships.

Yukl's (2006) integrated conceptual framework draws together the leadership approaches. This framework provides an alternate view from the traditionally: '*narrow focus, and there has been little integration of the findings from the different approaches*' and '*is based on the assumption that a core set of intervening variables determines performance for individuals, groups, and the overall organization*' Yukl (2006, p. 445).

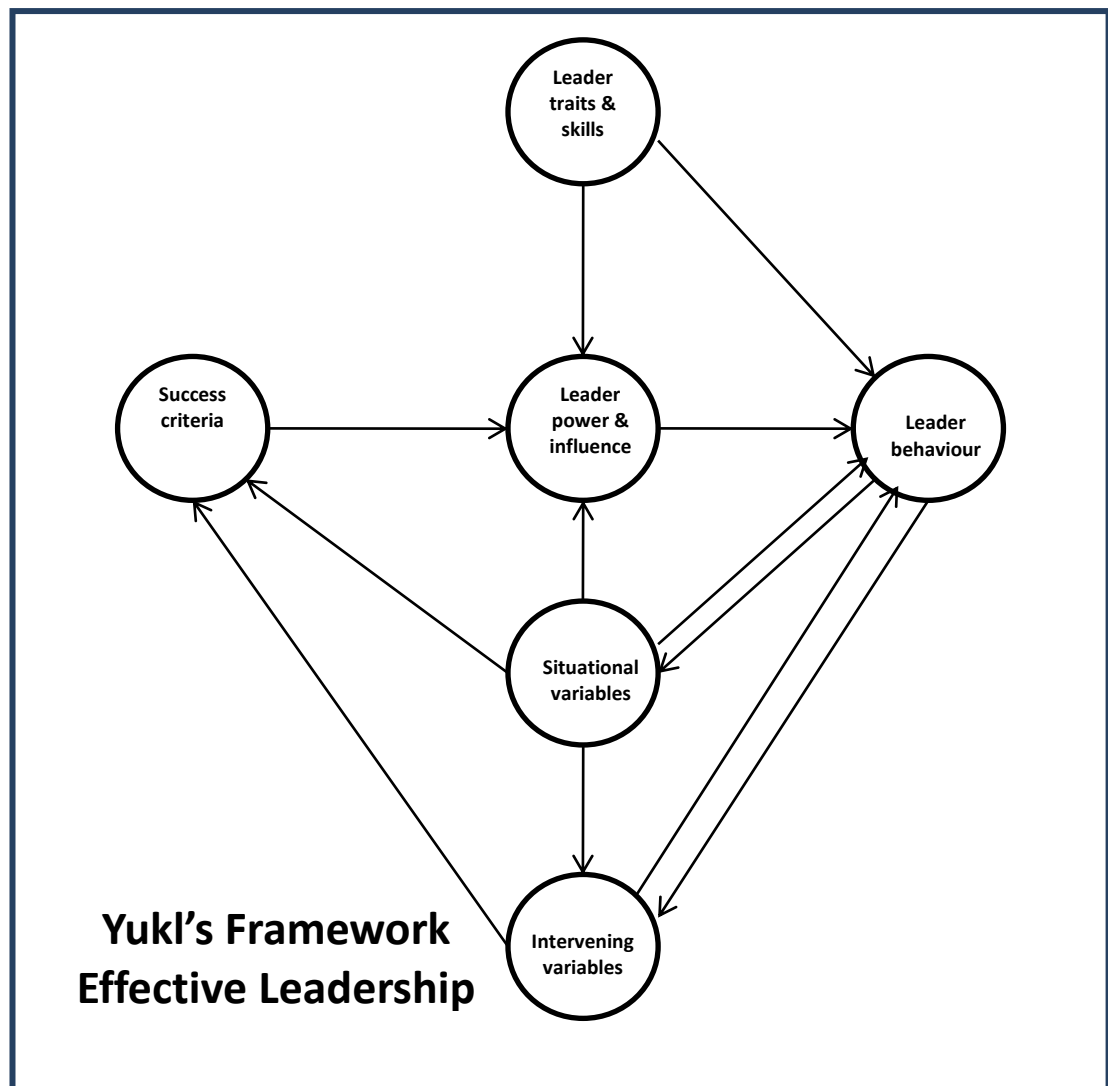


Figure 10 An integrating conceptual framework for understanding the leadership process. Yukl (2006 p. 447).

This framework links the three core approaches of effective leadership: (1) leader traits and skills; (2) leader power and influence; and (3) leader behaviour with the situational and intervening variable plus success criteria.

A number of frameworks exist to explain the interactions between leadership approaches, Bolden, Gosling, Marturano & Dennison (2003) reviewed seven private sector, nine public sector and eight generic frameworks and agreed that yet another framework should be developed. Like leadership research, the search for a universal framework also appears endless.

A number of researchers, Norga (2005), Taylor (2008) and Chathury (2008) have found Yukl's integrating conceptual framework assists: *'greatly in understanding the leadership process'* Chathury (2008, p.19) and also provides: *'a better perspective of the process and its interactions with other processes'* Chathury (2008, p. 21).

Table 29 Examples of researchers utilising Yukl's integrating conceptual framework and the findings of using the framework.

AUTHOR	SITUATION	OUTCOMES
Norga (2005)	Develop leadership tool for Belgian Defence Force.	Incorporated a values model and Quality Management Excellence model into the general framework (p. 167)
Chathury (2008)	Leadership in large Petrochemical company.	Investigate the linkage between servant leadership and effective leadership as defined by Yukl using Bass's MLQ measure.
Taylor (2008)	Investigate the nature of emergent leaders (champions) and foster development at executives' level of Australia urban Water Companies.	Framework was used to create a path for new change champions (p. 6-7)

Yukl's (2006, p.448) framework *'applies to any level of management in a large organization, but the intervening variables and situation variables change from level to level,'*. Yukl (2006) highlights the limitations of assumptions regarding research into effective executive leadership such as (a) heroic individuals versus shared leadership; (b) didactic versus collective focus; and (c) importance of explanatory processes to better understand the relationships and why they occur. Gordon and Yukl (2004) discussed these biases and how they have prevented a complete understanding of effective leadership but called on researchers to ensure they respond to the changing nature of work and better understand the dynamic qualities. Yukl's framework attempts to ensure these three areas of influence are incorporated into a conceptualized view. From the model, leader skills, which are incorporated within the variable leader traits, are the cornerstone for effective leadership. Leader traits and skills impact two other variables: leader power and influence and leader behaviour, with leader behaviour also being impacted by leader power and influence.

Other researchers have developed approaches to describe more than one variable, a fifth approach (Yukl 2006) is the Transactional and Transformational leadership (TTL) approach built upon the work of Weber (1947) and the story of the charismatic leaders who transform and change the world prior to being overcome by the bureaucratic or traditional authority type leaders. TTL is, in effect, a continuum between the bureaucratic or transactional behaviour through to the charismatic or transformational behaviour. TTL has been popularised by Burns (1978) and further developed by Bass (1985). A full range leadership model has been developed to articulate this continuum.

The transformational leaders exhibit one or all the 'Four I's' as listed below:

1. Idealised influence – role models for followers
2. Inspirational motivation – motivate and inspire those around them
3. Intellectual stimulation – stimulate innovation and creativity
4. Individual stimulation – pay specific attention to individuals needs for growth and achievement

Transactional leadership has the leader rewarding or punishing depending on the follower's ability to perform. They are grouped into four elements as outlined below:

1. Contingent reward (CR) – results occur because of rewards
2. Management-by-exception active (MBE-A) – leader monitors deviation and takes corrective action
3. Management-by-exception passive (MBE-P) – leader waits for mistakes and takes corrective action
4. Laissez-faire (LF) – avoidance or absence of leadership

Yukl (1999) has criticized the leader-centred assumptions around the transformational model and charismatic leadership and has called for more focus on the situation and the impact on the leadership from followers. Unfortunately, Yukl's framework lacks a complete measure, (Yukl 2009), whereas TTL has been extensively tested using the Multifactor Leadership Questionnaire (MLQ) originated by Bass (1985) and further revised by Bass and Avolio (1997). Both models provide a conceptual framework but Yukl's framework allows the integration of proven measures from the three leadership approaches of traits, power and behaviour thus allowing significant granularity for further research.

Yukl (2006, p. 456) identifies the essence of effective leadership as shown in the table below.

Table 30 Ten Elements of effective leadership. Yukl (2006, p. 456).

1. Help interpret the meaning of events.
2. Create alignment on objectives and strategies.
3. Build task commitment and optimism.
4. Build mutual trust and cooperation.
5. Strengthen collective identity.
6. Organize and coordinate activities.
7. Encourage and facilitate collective learning.
8. Develop and empower people
9. Develop and empower people
10. Promote social justice and morality.

These ten elements provide the behaviours that should be being seen from an effective leader. Yukl's framework illustrates the connections between the variables leader trait, leader power to leader behaviour to demonstrate these elements of effective leadership. Historically, these three variables of: leader traits, leader power, and leader behaviour of the model have been used extensively in stand-alone research. The following section explores how the constructs of these historical measures have been used to describe effective leadership.

3.3.3. Measurement of effective leadership

Yukl (2009) suggests that clarity around the leaders' effectiveness can be measured by any four indicators, namely: (a) how an organizations performs its tasks successfully; (2) attitude of followers towards the leader; (3) the leader's contribution to the group's processes as seen by external stakeholders; and, (4) the extent to which a person has a successful career as a leader. The literature suggests that both indicators (1) and (3) are difficult to link directly to the role of an individual, or 'hero leader', especially with large companies where organizational success is very much a team result. Historical measures tend to focus on indicator (3), whilst a number of researchers suggest that the number of variables influencing an effective leader is great and

which of these has priority within a given situation is very difficult to isolate. The table below summarizes the three historical leader approaches from Yukl's Integrating conceptual framework: (1) leader trait and skills; (2) leader power and influence; and (3) leader behaviour.

Table 31 Summary of the key concepts of the three leader variables of Yukl's framework. (Yukl 2009).


KEY CONCEPTS FROM RESEARCH	
Leader Trait and Skill	<p>Personality traits seem less important than skills for effective leadership. Yukl (2006, p. 4440)</p> <p>Importance of different skills varies with situation but some skills are useful in all leadership positions.</p> <p>Skills are three-factor taxonomy of technical, interpersonal and conceptual skills. (Katz 1955; Mann 1965).</p> <p>Skills will vary depending on level of management. (Katz 1955; Mann 1965; McCall & Lombardo 1983; Jaques 1989).</p>
Leader Power and Influence	<p>Power is defined as position power and personal power.</p> <p>Focus in research moved away from power and studied the behaviour of power – influence tactic – 11 proactive tactics – (Yukl & Serfert 2002).</p> <p>Rational persuasion; inspirational appeal; consultation; collaboration; apprising; ingratiation; exchange; personal appeal; coalition tactic; legitimating tactic; and pressure.</p> <p>Influence is the essence of leadership. (Yukl 2006)</p>
Leader Behaviour	<p>Three types of behaviour differentiate leaders; task-oriented behaviour, relations-oriented behaviour and participative leadership (Michigan Leadership Studies) MLQ</p> <p>High-high leader – task and relationship organization. (Blake & Mouton 1964) - Grid® - issues around impact of situation.</p> <p>Multidimensional model more useful, task, relations and change-oriented Behaviour. (Yukl, Gordon & Taber 2002).</p> <p>In exploring the lack of agreement around the behaviour categories of effective leadership.</p> <p>Yukl, Gordon and Taber (2002) and Yukl (2006) propose the historical two general categories of relation-oriented behaviour and task-oriented behaviour of Blake & Mouton (1982) is inadequate. A third 'meta category' is required called change-oriented behaviour.</p> <p>Others highlighted that change is a function already within the proven two meta category model and see no need to have a third. (Nadler & Tushman 1999; Indge, Piccolo & Ilies 2004; Keller 2006; Battilana et al 2010).</p>

Leader skill assessments will be discussed in detail in the next section exploring skill mix and skill balance. This section describes the literature around the other two measures, leader power and influence; and leader behaviour.

The leader power variable within Yukl's integrating conceptual framework is influenced by leader traits, success criteria, and situational variables and the output directly impacts the variable leader style. Yukl (2006, p.442) states, *'influence is the essence of leadership, and much of the activity of formal leaders involves attempts to influence the attitudes and behaviour of people'*. Power is the capacity to influence and Yukl (2006) recommends that rather than focussing directly on power as such, or the type of power, it is more appropriate to focus on the outcome of power and again, *'for the past two decades, rather than focussing exclusively on power as a source of potential influence, researchers have begun to examine the specific types of behaviour used to exercise influence'* Yukl (2006, p. 164).

A number of measures exist for leader influence. Yukl and his colleagues developed the Influence Behaviour Questionnaire (IBQ), (Yukl, Lepsinger & Lucia 1992) which identified nine distinct influence tactics. A further two tactics were later identified, (Yukl & Seifert 2002). An effective or good leader would use more highly effective tactics, while an ineffective or poor leader will tend to utilize those influence tactics with low effectiveness (Yukl 2006).

Table 32 The 11 influence tactics categorized as effective or ineffective for leaders. Yukl (2006, p. 172)

INFLUENCE TACTIC		
High effectiveness	Moderate effectiveness	Low effectiveness
Rational persuasion	Apprising	Coalition tactic
Inspirational appeal	Ingratiation	Legitimizing tactics
Consultation	Exchange	Pressure
Collaboration	Personal appeal	
		
Effective leadership		Ineffective leadership
Good leader		Poor leader

A number of other researchers have utilized Yukl's influence tactics to describe effective leadership. Hysong (2008), using technical supervisors, and Taylor (2008) both utilized Yukl's integrating conceptual framework and IBQ to better understand how influence factors led to

effective leadership within water infrastructure. Both researchers highlight the strong relationships between influence tactic used and the effectiveness or ineffectiveness of the leader.

The leader behaviour variable is the output from Yukl's integrating conceptual framework and these research measures are the most numerous, (Yukl 2006). The cornerstone of leader behaviour measure is the people/task measure of people issues and task issues (Kaplan & Kaiser 2003). This issue of balance between these two factors is one of the most critical areas identified as the reason engineers fail to become effective leaders, (Badawy 1983; Schein 2004).

Schein (2004) highlights that in an engineering culture the leaders tended to be task focussed whereas in an operational culture the leaders tended to be people focussed.

Researchers debate the adequacy of the historical two element model, task/relationships, to describe leader behaviour. Yukl (2006, p. 64), while acknowledging the effectiveness of the historical task-orientated and relations-oriented leadership behaviour focus, believes that a third element is required i.e. a change-oriented behaviour. Yukl, Gordon and Taber (2002) supported this three element approach but others point out that change-oriented behaviour can be adequately reflected with the historical simpler two taxonomy model of task and relationships (Nadler & Tuchman 1999; Judge, Piccolo & Ilies 2004; Keller 2006; Baltilana et al 2010). *'Most theorists agree that task and relations behaviour are both important for effective leadership.'* Yukl (2006, p. 59).

Blake and Moulton (1964) model is a practical model for training leaders; it has strengths and weaknesses (Yukl 2006). Northouse (2010, p. 87) summarises the two taxonomy model by stating, *'Not a refined theory...the style provides a valuable framework for assessing leadership in a broad way as assessing behaviour with task and relationship dimensions'*.

The third element of Yukl's model, leader traits and skills, is the starting point for leader effectiveness and is discussed in the following section.

3.3.4. Skill mix and skill balance

The previous section highlighted that leader traits and skills, leader power and influence and leader behaviour are critical for effective leadership. The amount of research is vast and a number of models have been proposed to better describe the connections between the leadership

approaches and the situation variables that impact effectiveness. The literature also highlighted that these same approaches are also relevant at a more strategic leadership level. (Yukl 2009)

A number of authors have attempted to develop a universal view of how skills can be not only valued but, also, prioritized. Loubser and De Jager (1995) researched 78 generic dimensions of skills required for management success at senior, middle and junior levels of management. They extrapolated these elements from the three traditional dimensions of technical, interpersonal and conceptual skills of Katz (1955). Results from 241 managers from a large South African media company of 6000 employees enabled the 78 dimensions to be grouped into nine factors which varied depending on the level of the leader.

Table 33 Mean factor scores per level of Management. [Adapted from Loubser & De Jager (1995, p. 5)]

DIMENSION	FIVE GENERIC SKILL DESCRIPTION	SENIOR LEVEL	MIDDLE LEVEL	JUNIOR LEVEL
Financial & Business Management	Business	0.65	0.17	-0.27
Management of People	People	0.25	0.01	-0.07
Self-Management	People	-0.25	0.00	0.06
Environmental Management	Technical	0.34	-0.03	-0.05
Communication	People	-0.35	-0.14	0.18
Information Management	Technical	0.12	0.07	-0.08
Managerial Sensitivity	People	0.24	-0.09	0.01
Operational Management	Administrative	-0.72	-0.07	0.21
Managerial Temperament	People	0.40	-0.05	-0.05

The results revealed that business skills are more important at the senior and middle while operational skills more important at the junior levels. Loubser & De Jager's (1995) description of these skills dimensions can be grouped into three generic skill dimensions but which show, at different levels of an organization different skills are required for the leader to be effective. The research failed to link the skills with the effectiveness of the leader at each level.

McLennan (1967) also highlighted that skill requirements will vary depending on the organizational characteristics such as structure, size, type and degree of central authority.

Technical skills are more important for top executives who are functionally specialized or where operating decisions are highly centralized. Jaques' (1989) research found that an organization has five levels from operator, first line manager, senior manager, general manager to managing directors, with strategic planning (time frame of which activity is planned and scheduled) varying from level 1 being 0-3 months to managing director at level 5 being 5-10 years.

Jaques and Clement (1991) explore getting the right balance and link leadership competence as a function of role competence. They create an equation to define actual capacity of executive leader:

$$\text{Current Actual Capacity (CAC)} = \text{Cognitive Power (CP)} + \text{Values (V)} + \text{Knowledge/Skills (K/S)} + \text{Wisdom (Wi)} + \text{'Minus T' (-T)}$$

where:

- CP = the ability to handle complexity, or mental ability to strategically group information
- V = interests, priorities
- K/S = skilled use of relevant task knowledge
- Wi = application of K/S to work with people and tasks
- (-T) = the absence of serious personality traits

For the correct mix of knowledge and skills, Yukl (2005, p. 444) notes *'Technical skills are needed to understand operational processes..... The relative importance of skills varies greatly from situation to situation, but some specific skills are probably useful in all leadership positions.'* This skills mix was previously seen in the engineering research (Badawy 1983).

The Hay group (1999) executive survey of leadership effectiveness identified that organizational performance begins with leader competences, leader's style and application to work situation which all impact positively on an organization's culture.

Hodgson and Binney (2007) state that being a professional, such as an engineer, and being a leader are not the same. They represent 'countries' with two sets of norms and beliefs and that you need to develop a 'passport' to be understood in the two countries to be effective. Mann (1983) states that technical people are inherently different and require technically competent

leadership. (Jaques 1989; Mant 1999; Menkes 2005) all point out that technical skills within the leader are a prerequisite to effective leadership.

Most literature on leader skills is built upon the work of Katz (1955) who first called attention to skills and their impact upon effective leadership (Peterson & Van Fleet 2004). Skills are interrelated with traits but 'there is real merit in examining each one separately' Katz (1974, p. 34). These 'skills' are demonstrable, developable, observable, and focussed on what the leaders '*real concern should be for what a leader can do rather than what they are*' Katz (1974, p. 33).

'A skill is the ability to perform some specific behavioural task or the ability to perform some specific cognitive process that is related to some particular task..., a skill is conceived as comprising three components:

- 1) The existence of a domain specific knowledge base;*
- 2) A method for accessing this knowledge base; and*
- 3) The ability to enact a set of behaviours or cognitions using the retrieved knowledge to perform the given task.*

...The third component was what people can observe and label as a skill.' Peterson and Van Fleet (2004, p. 1298).

Katz (1955) proposed three categories of skills, while Peterson and Van Fleet (2004) summarized the new skill categories which researchers have attempted to develop distinct categories. They summarize them as ten core skills which are really subsets of Katz's original three (Peterson & Van Fleet 2004).

Yukl (2006) also defines the skills into a three-factor taxonomy but does acknowledge that '*some writers differentiate a fourth category of skills (called administrative skills) that are defined in terms of the ability to perform a particular type of managerial function or behaviour*' Yukl (2006, p. 181).

'Technical skill provides incremental value over managerial skill in managerial performance for first-tier managers' but 'technical skill is valuable to managers as a source of credibility and a means to identifying with subordinates. Technical skill should not, therefore, be the most important criteria in selecting technical managers' Hysong (2008, p. 275).

But technical skills are often the skill which identifies a leader and enables promotion. (Kaiser & Craig 2004). At the senior executive level, Hunt (2006, p. 128) notes, *'they (Australian senior executives) have a high achievement orientation, and place a premium upon conceptual and interpersonal skills, they regard knowledge of human resources management to be more important than a knowledge of any other discipline, they have a moderate entrepreneurial orientation, they do not regard administrative skills as particularly important...'*

'Technical skills' is a broad term also used in a university setting, where, 'technical skills' refers to academic skills. Goodall (2009,) in her research on heads of universities, was able to state *'better scholars make better leaders' and challenged the 'assertion that academics do not make good managers or leaders'* Goodall (2009, p. xii). She researched 26 heads of university and identified four reasons why these heads should be scholars, and not come from outside academia with general management or 'non-technical' skills. These four reasons are:

- a) Scholars are more credible leaders.
- b) Being top scholars provide a leader with a deep understanding or expert knowledge about core business of universities.
- c) The President sets the quality threshold and is therefore the standard bearer.
- d) A President who is a scholar sends a signal to the university that the leader shares their scholarly values.

'My central argument is that where expert knowledge is the key factor that characterizes an organization, it is expert knowledge that should also be key in selection of its leader,' says Goodall (2009, p. 8).

Goodall (2009) challenges the shift to 'managerialism' in a university where there is a greater emphasis for university presidents to have management skills rather than technical ability. Success in the universities' world ranking is measured using a standard industry index. The link to performance reflects the 'hero' leader theory however her research fails to examine the effectiveness of the leadership style at either president/head or executive team member level.

From the first-tier managers in Hysong (2008) research to the senior executive of Hunt (2006) there appears a transition of skills. Kaiser and Craig (2004) note the change of the primary skill at

supervising (bottom level) to be technical which changes to interpersonal at middle management and then to conceptual (strategic thinking) at the top executive level.

Mumford, Campion and Morgeson (2007) note the skills as being layered (strata) and segmented (plex) to create the term 'strataplex'. They studied four skills across levels: cognitive skills, interpersonal skills, business skills and strategic skills. They determined that *'cognitive skill requirements are important across organization levels, certain strategic skills only fully emerge at the higher levels of the organization'* Mumford, Campion and Morgeson (2007, p. 154). They summarized the ranking of skills as, *'cognitive skills were needed to the greatest degree. Similarly, interpersonal skills were required to a greater degree than business and strategic'* Mumford, Campion and Morgeson (2007, p. 163).

But Peterson and Van Fleet (2004, p. 1298) argue that skills, *'are all cognitive processes'* and as such should not be considered separately. They point to Katz's (1955) definition of skill having: (1) specific knowledge base, (2) method for accessing knowledge base; and (3) ability to enact a set of behaviours or cognition using the retrieved knowledge to perform the given task. Jaques and Clement (1991) use the term 'wisdom', the application of skill (knowledge) with experience.

Thus skills may vary in importance as a leader progresses up the levels of an organization. Kaplan and Kaiser (2003) suggest that, *'leadership consists of opposing (skill) strengths and most leaders have a natural tendency to overdevelop one at the expense of its counterpart. The resulting imbalance diminishes effectiveness. But leaders who work to guard against such lopsidedness can increase their versatility and their impact'* Kaplan and Kaiser (2003, p. 19).

They note that leaders in general then to 'polarize' or place a high value on a skill or approach that they have traditionally found effective. A typical polarized approach is the people skills versus task skills which they term 'enabling leadership' versus 'forceful leadership' which has been the 'focus of their work' (Kaplan & Kaiser 2003). They point to secondary skills that required balance 'strategic leadership versus operational leadership' and 'general management skills versus technical/function skills'. An effective or 'versatile' leader is one who has the balance of using these skills – *'the right approach and the right degree, for the circumstances at hand'* Kaplan and Kaiser (2003, p. 22).

Kaplan and Kaiser (2003) point to five root causes of the skill imbalance' which creates this ineffective leader: (1) uneven skill development; (2) skewed mental models of cultural assumptions, beliefs, and values; (3) one-sided values due to placing a premium on one skills; (4)

fear of inadequacy when a leader advances and no longer the 'comfortable' in the new work environment (i.e. executive); and (5) tendency to polarize – *'as human beings we have an inherent tendency to see our choices as either/or scenarios'* Kaplan and Kaiser (2003, p. 24).

Kaplan and Kaiser (2003) point out that leaders can strengthen their effectiveness by: (1) strengthening their weaker skills; and (2) moderating the overused skill (Lindberg & Kaiser 2004). Black (2005) supports that *'for managers, such as mastering manager skills included not only knowing what to do, why to do it, and how to do it, but also knowing when to do it'* Black (2005, p. 81).

Lombardo and Eichinger (2000) approach is to use the "10:20:70" rule for leader development – 10% is by structured training; 20% is from feedback from others; and 70% is on-the-job experience.

3.4. Conclusions

The chapter has summarized the literature and research around effective leadership within infrastructure businesses, engineering industry group and the broad general leadership. The focus has been upon executive technical leaders, those with an engineering qualification and/or technical background, whose leadership has been challenged or, in some cases, they have been replaced as part of infrastructure businesses being made more commercial.

In the review of the literature the existing infrastructure leadership was examined. It notes that the business focus has been upon leader style. Style has been used as a key measure of leader performance and as the focus of processes to further develop leaders. The dominant focus of the professional and the industry groups has been upon leader skills rather than leader style. Both groups acknowledge that infrastructure businesses are complex and atypical. They note that leaders with technical skills require development if they are to be effective at the executive levels. The approaches of development were identified in the literature and a number of examples, such as D'Angelo Fisher (2007); Goh, Coaker and Thorpe (2008); Dent (2009) were discussed.

The review of the literature also examined the approaches taken by the engineering profession to ensure that firstly, engineers are recognized as effective leaders and, secondly, that engineers obtain the required competences if they are to be promoted into executive roles. The literature review identified that the dominant focus has been upon leader skills and not leader style. Within

the broader engineering profession engineers hold senior executive roles within business but it is recognised that engineers need additional skills to be considered for these roles.

The review of literature also examined the broader literature of effective leadership measurement. The literature of infrastructure and engineering leadership identified two approaches, leader style and leader skills. Examination of the literature identified an integrated conceptual framework that consolidated the multidimensional nature of effective leadership approaches including leader style and leader skills.

Further examination of the literature identified historical measures of leader style and leader skills. The following chapter presents the methodology used in the research in order to examine leader style and leader skill as potential key factors in effective and ineffective infrastructure leadership.

4. Methodology

The previous chapter provided the background for this research highlighting the infrastructure industry and the changes that have occurred due to privatization and their impact upon the leadership and their perceived effectiveness within an engineering dominated culture. The literature regarding leadership in general highlighted a vast breadth of theory and delineates a number of measures that have historically been used to quantify the attributes of effective leadership.

This chapter provides detailed information regarding the methodology used, namely: (1) the rationale for the methodology; (2) the conceptual framework for the methodology using mixed methods; (3) describes the sample of reviewers and their exemplars of good and poor leadership; (4) defines the meanings of the constructs used by the reviewers to describe their chosen exemplars; (5) describes the measures and response scales and desired scores used in the structured part of the interview; (6) outlines the areas of focus within the structured and semi-structured interview; (7) describes the limitations for this research; (8) outlines the ethics involved in conducting the research; and (9) a gives a summary of the methodology using mixed methods with structured and semi-structured interview.

4.1. Introduction

The literature regarding infrastructure industry and its privatization supported the observation that the traditional leaders of these industries who had an engineering or technical skilled background were deemed to be unsuitable by the investors of the newly privatised businesses. They were demanding a business focus rather than a technical focus (Conrad 1995; Whitmore 2004). The new business leaders who were replacing the traditional technically qualified leaders such as engineers were more likely to have ‘non-technical’ skills such as finance, business or law. They were viewed negatively by the existing leadership and culture because of their lack of technical skills and heritage, (Whitmore 2004; Wolmar 2005). The broader literature on leadership explored the general population, (Yukl 2005) and impact of technical skills on leaders and their effectiveness (Badawy 1978; Cordero & Farris 1992; Seethamraju 1997; Visser 2003).

Leaders require skills to be effective, (Katz 1955; Peterson & Van Fleet 2004), but there is no consensus that leaders are effective with or without technical skills (Badawy 1982; Lombardo & McCawley 1988; Hysong 2008).

Some consensus exists around the fact that the skills mix changes across the levels of organizations (Badawy 1978; Jaques 1989; Mumford, Campion & Morgeson 2007; Dai, Yii Tang & De Meuse 2011; De Meuse, Dai & Wu 2011) while further consensus points towards the need for balance between skills (Kaplan & Kaiser 2003; Yukl & Lepsinger 2004). But there is no consensus as to the effective mix of skills for leaders at the executive level and the requisite skills for effective leadership in a complex business such as infrastructure.

This research methodology required a design that could explore the range of characteristics for success as an executive leader in infrastructure management. To do so it was anticipated that it would be practicable to recruit for participation in the research about 40 senior executives currently working at Board or executive level in the infrastructure industry sector. It was also anticipated that these ‘experts’ would include subgroups: those with a primary technical/engineering skill background and those with a primary business skill background. Each member of the expert group, it was anticipated, could reasonably be expected to give about one hour to the research. Within these constraints it was determined to adopt a mixed method approach methodology using a structured and semi-structured interview.

The structured interview had two key components. First, each expert was asked to identify an example of an executive level leader who they deemed to be good and an example of one they deemed to be poor. This focus on actual leaders known to the experts i.e. those leaders they had worked with, was used to encourage specificity. Second, using a detailed descriptive framework specified by the researcher each expert was asked to describe and rate each of the example leaders they had chosen. The use of a detailed and standardised framework was used to enable the results from all experts to be pooled so that an analysis of the pooled data set could be undertaken to identify the key characteristics of good and poor infrastructure leaders. The detailed descriptive framework covered 5 skill domains widely canvassed in the leadership literature: people, business, technical, administrative, and strategic skills.

The theoretical background of the construct base of the descriptive framework on which the quantitative descriptive assessment was framed is further discussed in section 4.3. Each construct used in the assessment is described in section 4.3.1 and the descriptive assessment scales completed as part of the structured interview procedure are described in section 4.4. The semi-structured section of the interview focuses discussion around the expert’s perceptions regarding the additional observation of effective leadership within infrastructure and the general frame of infrastructure poor leadership.

The following section provides detail regarding the methodology and what was required to capture the knowledge of the Board or executive level reviewers.

4.2. *Rationale for the methodology*

The sample chosen for this research came from Board members and executives of infrastructure business. Yukl (2009) summarizes the difficulties researching at this level of an organization and how much of the research in leadership has focussed on the more readily available direct supervisors and middle management levels.

To identify key characteristics of infrastructure leadership required a larger sample of participants than is typically used in less structured case study research (Whitmore, 2004) and assessment of a wider breadth of characteristics than is typically used in survey-based research (Seethamraju 1997; Dudman & Wearne 2003).

The rationale underpinning the choice of a structured interview was to use a methodology that made the best use of “experts” whose time availability was limited and who had some experience of operating within the framework of structured recruitment interviews. Like all methodological choices this choice involves a number of compromises. In this case the main methodological compromises are:

- (a) The sample size from which the characteristics of good and poor leadership can be inferred: 40 “experts” each describing an example of a good and poor leader.
- (b) A standardised descriptive framework that enabled assessment of skill constructs at a high conceptual level rather than at a detailed operational level of measurement. The framework therefore did not use standard measures of variables such as IBQ nor did it involve assessment of leadership skills from a 360 degree perspective.
- (c) The methodology relies on each “expert” to describe from memory an example of a good and of a poor leader. There’s no independent validation to confirm the judgement of the “expert” that the leaders described were actually good or poor.
- (d) The research is essentially cross-sectional rather than longitudinal and therefore is focussed on infrastructure leadership in the current privatised environment.

The rationale for the inclusion of an unstructured conclusion to the interview was primarily to enable the “experts” to identify any clear shortcomings of the skill domains chosen by the researcher – in particular to add and address any missing domains that the “expert” considered pertinent to good and poor infrastructure leadership.

The strengths of the methodology are:

- (a) It supports access to a relatively large sample of board members and senior executives in the field of infrastructure.
- (b) It provides “experts” from different primary skill backgrounds with a common framework for describing good and poor infrastructure leaders.
- (c) It uses a mixed-methods structured interview which other researchers (Hussey & Hussey 1997; Lombardo & McCauley 1988; Tashakkori & Teddlie 2003; Brannen 2005) recommend as particularly appropriate for exploratory research.
- (d) It capitalises on the rare opportunity (given by the researcher’s professional role as an infrastructure board member and senior executive) to draw on the knowledge and experience based opinion (Yukl, 2009) about good and poor infrastructure leadership.

4.3. Conceptual framework of the Methodology (Mixed method)

The rationale for the methodology identified the boundaries within which the methodology needs to operate to be effective. This study utilised a mixed method design. It is this combining of two traditional paradigms – quantitative and qualitative methods - during the research process in to a single study that enables the research problem to be examined more completely (Creswell 2002). The idea behind mixing methods is based on the belief that neither quantitative nor qualitative methods would be sufficient in themselves to capture sufficient data for analysis in complex situations such as identified in the prior section. Hussey and Hussey (1997) note that it is not unusual in business research to take a mixture of approaches in collecting and analysing data.

This research accessed a large sample of high ranking experts known as ‘reviewers’ which required a quality framework to draw out quality responses that could be analysed. The mixed methods quality framework for this research used structured and semi-structured interview approach. The time constraints of the interviews with the expert group drove the need to develop a robust structured interview that would draw out adequate data for analysis. With this in mind the interview was broken into four phases, 3 of which were structured and quantitative and the fourth which was semi-structured and qualitative. The framework used is shown in the table below and highlights the phases which were quantitative and which were qualitative.

Table 34– The links between the mixed methods, interview sections and the four phases within the two interview approaches.

DATA COLLECTION	INTERVIEW MODE	PHASE OF INTERVIEW – DATA COLLECTED
Quantitative (Qt)	Structured	A. Demographics of reviewers and their exemplars
		B. Constructs of Measures of Leadership of the good and poor exemplars
		C. Assessment of leader skills of the good, poor and ideal exemplars
Qualitative (Ql)	Semi-structured	D. Observations of effective leadership in Infrastructure businesses and appropriateness of the research descriptive framework.

A quality framework was essential in order to draw out the information from this expert group about effective leadership of Infrastructure businesses. The Qt phase, which equates to the structured interview element of the interview, was built around leadership literature and this would enable the experts, who may or may not be familiar with the vast literature base, to still able to describe their exemplars within a framework built upon current literature and sound research. The Qt element of the methodology has three of the four phases:

- Phase A was to gather demographic information regarding the expert reviewers themselves and that of the two exemplars (one good and one poor) they had identified.
- Phase B was to allow the expert reviewers to describe the two exemplars using a framework developed from the literature. This would enable comparisons to be made

between the descriptions about the exemplars and the general literature in order to confirm whether or not the exemplars of infrastructure given accurately reflect good and poor descriptors of leadership from the literature.

- Phase C captures the expert reviewers description of the five skills utilized by their good and poor exemplars and also their description of an ideal leader for each exemplar.
- Phase D is encapsulated within the QI element of the mixed method. This phase captures the expert reviewers' thoughts and views regarding effective leadership of infrastructure assest/businesses, the impact of the level in the organisation, the business context and what engineering skilled leaders need to change to be effective. These descriptions were captured outside the literature framework to allow for further thoughts and descriptions to be explored in a way that may not have been captured within the structured element of the interview. Any observations on the appropriateness of the research framework were noted through both phases as a qualitative measure of the practicality of the methodology with this research group.

The following table below best explains the methodology and the various strengths and weaknesses at each stage of the research.

Table 35 Details of the strengths and weaknesses of the methodology for this research.

	PHASE		PROCEDURE	OUTCOME	STRENGTHS	WEAKNESSES
Structured Interview section (Quantitative (Qt) Phase)	A Qt	<u>Demographics</u> Record demographics of expert reviewers Record demographics of both good and poor exemplars of leadership	1. Record demographic information about reviewers (n=46) and exemplars of good & poor leaders (n = 91). 2. Record foundation qualifications - technical and non-technical. 3. Ranking of exemplars between score of 1 (worst) and 10 (best)	Confirm reviewers and exemplars are at the adequate level in the organisation Experience of reviewers Qualifications for reviewers and exemplars – technical and non-technical Exemplar rated from 1 to 10.	Reliable source of quality quantitative data Expert reviews of exemplars are quality observations because they are based on experience developing/rewarding this type of leadership. 3 rd person view of performance – closer to reality. Large expert population much better than traditional case study sample size and enables statistical analysis. Balance of technical and non-technical reviewers.	Exemplars are not identified therefore some may be a ‘double up’ but exemplars are an aid only in extracting features of good/poor leadership. Ranking of exemplar is quantitative, judgement from expert reviewers based on their extensive experience of good and poor leaders, rather than an agreed scale from literature (which does not exist).
		<u>Effective leadership measure</u> For good and poor exemplars score effectiveness using: Leadership derailment (LD) Leader influence (LI) Leader behaviour (LB)	4. For each exemplar score the performance using a ‘construct ‘built from a proven measure from literature (3 off – LD, LI and LB)) Score the constructs utilising a simplified scale – ‘top 3’ observations rather than using traditional Likert scale – time constraint	Output from constructs is similar to standard proven measures but using modified scale which enables simple stat analysis and t-test for significance. Compare scores from constructs to existing literature on standard measure thus confirming: Good & poor leader exemplars in infrastructure have similar characteristics to general literature Scoring scale will reflect literature	Use of three constructs to cover the broadest range of theories in leadership effectiveness literature. Simplified constructs and scales enable three measures of effectiveness to be explored for two exemplars within the time available with the reviewer. Utilized constructs from proven measures from literature and the framework provides quality rich data from reviewers more experienced with operations rather than leadership theories in literature. Balance of exemplars being good and poor plus technical and non-technical.	Only using the constructs of proven measures thus removing the ability to validate the measures from first principles and reduces the amount of statistical analysis on the exemplars to means and T tests. Selection of measures may be biased and is only an element of the literature. Simplified scales of the constructs may not enable the results of leadership effectiveness to align with literature. Top down scale rather than traditional bottom up approach with multiple questions and likert scale.

	PHASE		PROCEDURE	OUTCOME	STRENGTHS	WEAKNESSES
					Reviewers endorsed the process by completing the process and highlighted that it was an enjoyable process to complete – less detail than normal surveys.	
	C Qt	<u>Leader skills assessment.</u> For good, poor and ideal exemplars score: Skill rank Skill weighting	5. For each good & poor exemplar, rank from (1 to 5, 1 being most important and 5 the least) and weight the time (portion out of 100% time spent of their role) doing each of the five skills. 6. For each good and poor exemplar rank and weight the five skills for an ideal exemplar in that role.	Exemplars (n = 91) of good & poor leadership scoring both rank and weighting of five skills. Exemplars (n =91) of ideal leader to each of the good & poor exemplars scoring rank and weighting for five skills. Simple stat analysis and t-test for significance between technical, non-technical, good, poor and ideal leader combinations.	Selection of the five skills groupings well supported in literature. Interview process enabled more detailed explanation of the classification of the skills and scoring thus removing any significant misinterpretation. Reviewers endorsed the process by completing the process and highlighted that it was an enjoyable process to complete – less detail than normal surveys.	Structured interview section – parts A,B and C being quantitative (Qt) in nature may have missed additional information from reviewers which is outside current literature hence the qualitative (Ql) phase in part D following.

	PHASE		PROCEDURE	OUTCOME	STRENGTHS	WEAKNESSES
Semi-structured interview section Qualitative (QI) Phase	D	<u>Observations of effective leadership</u> Describe effective leadership in the infrastructure environment	7. As time permitted explore with reviewer five open questions to draw out from the reviewer's experience base 'top of mind' views regarding effective leadership and some of the specific issues around infrastructure and how it operates with dominant engineering culture.	General observations recorded that are free flowing thoughts and ideas derived from the reviewer's experience rather than literature/research. Ideas for additional research and investigation.	Allows the Qt data to be locked away before more general discussion on infrastructure leadership. Qt phase does set the scene for the QI phase. Allows for additional views and observations from a large expert sample which may be outside the literature and specific to infrastructure. Semi –structured open questions enable considered responses based upon experience. Reviewers were able to 'relax' after the structured part and share the wisdom. (Reverse sequence would have been difficult to manage and meet the time constraints). An area of passion for Board/executives – real issues faced daily in their roles – i.e., not theoretical.	Interview time constraints restricted the amount of reflection time to the open-ended questions. This shortened the responses and enabled limited exploration of any distinctive observations. Limited response and structure removed ability to do any further statistical analysis after the Qt phase such as statistical analysis of key words or statements.

4.3.1. Phase A – Demographics

The demographic information captured within this phase is of the reviewers and the exemplars of good and poor leaders within infrastructure. The critical demographics included:

- Level within the organisation to demonstrate that the reviewers and exemplars are representative of the executive levels within infrastructure organisations. The scale utilised is that of the five levels of an organisation as describe by Jaques (1989). See table 36 below.

Table 36 Scale used to identify the level in the organisation for the expert reviewers and their exemplars.

LEVEL	DESCRIPTION OF POSITION IN ORGANISATION
5	Board member or Managing Director of the company
4	CEO or part of the executive team reporting to the CEO.
3	Middle management roles reporting to the executive team.
2	Supervisory level managing the activities in level 1.
1	Operations/engineering level

- Years both reviewers and exemplars have had in the industry to demonstrate experience
- Infrastructure industry background:
 - industry type
 - organisational numbers of employees to describe magnitude of business
 - team size of exemplars and percentage of technical followers to demonstrate the materiality of the engineering subculture.
- Education qualifications of both the reviewers and exemplars to quantify those that had technical and non-technical foundation qualifications.
- Years that the reviewer has known/worked with the exemplar to demonstrate the strength of the descriptions about the exemplars.
- General demographics such as gender, years in industry and additional qualifications which provide further description about the reviewers and exemplar.

- Scale for describing the effectiveness of exemplars set by the expert reviewers. Scale was from 1 to 10 with 1 being for the ‘worst’ and 10 being for the ‘best’ exemplar of effective leadership. A subjective scale accessing the expert reviewers’ experience with a large number of exemplars to compare the exemplars they have chosen.

The demographic data collected in this phase sets the background of the reviewers and their exemplars. Section 5.1 explores in detail the expert reviewers and the strength of their expert opinions by further describing the demographic data collection process which enables the two sets of reviewers (technical and non-technical) to be accepted as a quality expert sample.

4.3.2. Phase B – Framework to measure effective leadership

This phase of the methodology is required to enable reviewers, who may or may not be familiar with the broad literature and research in effective leadership, to be able to accurately describe effective leadership in a quality framework that would enable the descriptions to be drawn together for analysis.

Yukl (2006) and Bass (2008) highlight the enormous quantity of research and measures utilized to describe leadership and in particular effective leadership. Yukl (2006) highlighted the five major research approaches and attested that using more than one approach at one time was becoming common but it was *‘rare to see all five utilized’* Yukl (2006, p. 15).

A number of researchers, (Norga 2005; Taylor 2008; Chathurri 2008), have found Yukl’s integrating conceptual framework (ICF) of benefit in incorporating a number of leadership research approaches. In addition to the integrating conceptual framework, Yukl (2009) identified four approaches for measuring effective leadership, namely, (1) organizational performance - meeting goals and objectives; (2) attitude of the followers towards the leader; (3) leader’s contribution to the business processes; and, (4) the extent that the leader has a successful career.

An ideal research approach to effective leadership would be to use the integrating conceptual framework while incorporating all five major research approaches and use all four measures of effective leadership. This would be an ideal research approach. But this research required a

methodology in phase B that would describe the exemplars chosen by the expert reviewers in descriptions similar to those described in the literature.

This research focuses upon the three foundation variables of Yukl's framework: leader skill; leader behaviour; and leader power. In addition to Yukl's framework an output variable, leader performance is incorporated. The variable selected here is an antitype of the traditional leader performance, called leader derailment i.e. why leaders fail after initially being successful and rising to the executive levels of an organization.

It was necessary to select constructs of measures for each of the variables of Yukl's framework from the leadership approaches that embody leadership characteristics widely known in the infrastructure sector and which fitted the focus of the research. For example, whilst the work of theorists such as Hersey and Blanchard (1977) are widely known, their dual focus on both follower maturity (i.e. competence and motivation) and the leader's ability to adapt his or her leadership style to the follower's level of maturity did not readily adapt to the structured ratings required to develop a framework for describing leadership characteristics of senior executive leaders to be used by the expert reviewers.

Figure 11 below diagrammatically shows Yukl's (2006) framework and the elements used as part of this methodology.

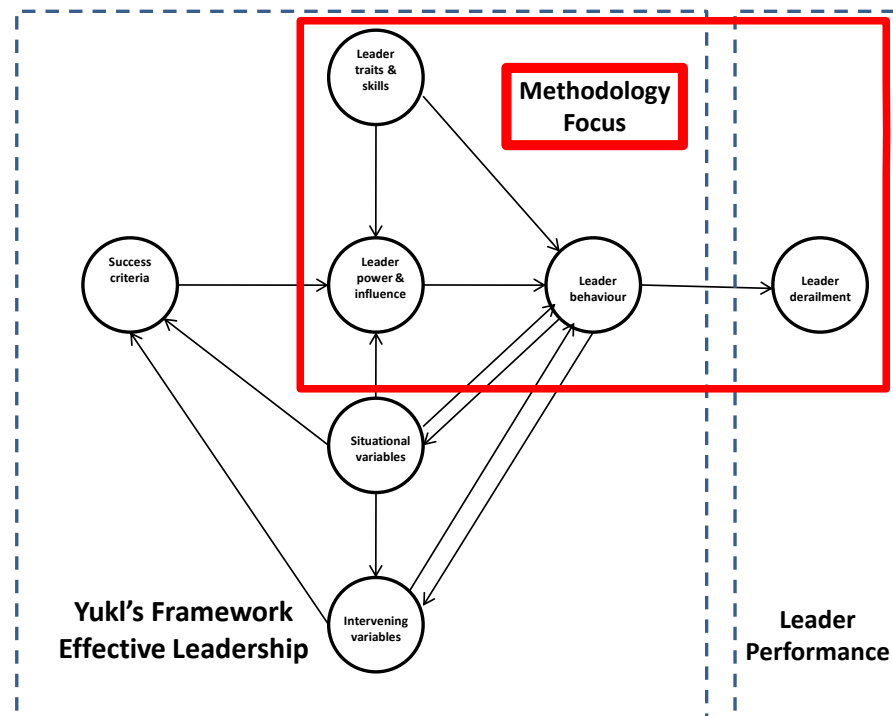


Figure 11 Focus of the methodology in reference to Yukl's framework (Yukl 2006).

The elements within the methodology focus, which is a subset of Yukl's framework, consist of constructs that have been widely researched using quantitative measures with established reliability and validity.

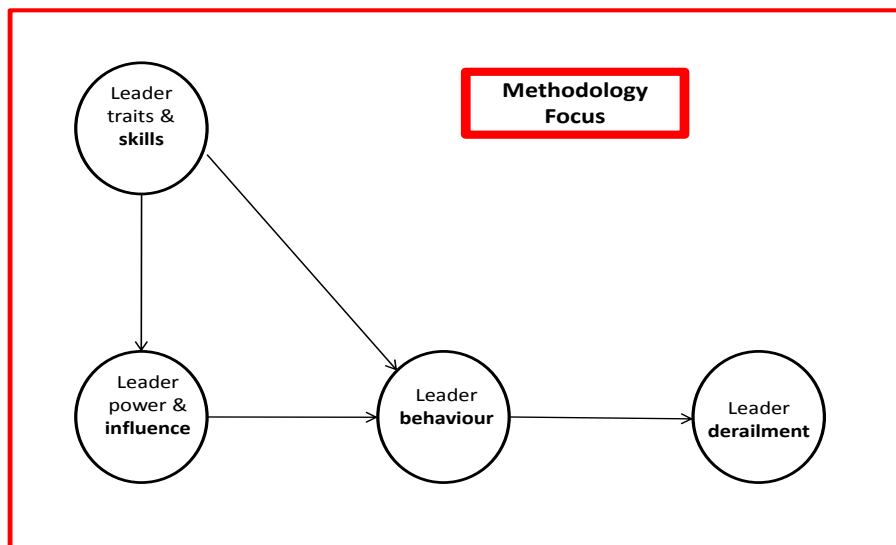


Figure 12 Subset of variables from Yukl’s framework under consideration in this research.

The figure above shows the subset of variables from Yukl’s integrating conceptual framework and one variable for measuring leader performance (leader derailment) that is to be studied in this research. The table below provides a more detailed description about the variables and their application in the phases of the methodology.

Table 37 Variable descriptions for phases in the methodology.

VARIABLE	DESCRIPTION	YUKL’S ICF DESCRIPTION (2006 P 447)	PHASE OF METHODOLOGY	DETAILED DESCRIPTION IN SECTION #
LS	Leader skill	Leader traits and skills	C	4.3.3
LI	Leader influence	Leader power and influence	B	4.3.2.1
LB	Leader behaviour	Leader behaviour	B	4.3.2.2
LD	Leader derailment	Not a variable of Yukl’s ICF	B	4.3.2.3

Leader Influence (LI), leader behaviour (LB) and leader derailment (LD) are the three variables utilized in phase B. LI and LB to describe effective leadership and LD as an ‘antitype’ measure of effective leadership performance. These three variables are now discussed in the following subsections. Leader skill (LS), while the first variable of Yukl’s model, is discussed in detail in phase C of the methodology in section 4.3.3.

The measures utilized in phase B and the original historical measures share a common concept base. The interview time constraint has necessitated the outputs of the measures to be utilized rather than the traditional questionnaire items. The questionnaire items of a measure which can be 40 or so questions, focus on observed behaviours (to what extent does this leader do this?) from which leadership output statements are collated.

Because the measures of phase B ask the reviewer to describe the leader using the constructs from the historical measure it is theoretically a quantitative descriptive assessment. This assists the reviewer to make best use of the interview time available and still provide the researcher with a categorical set of data that can be subject to statistical analysis. This phase provides the expert reviewer with a set of quantitative descriptive assessment tools.

4.3.2.1. Leader Influence (LI) Variable

The leader power variable within Yukl’s integrating conceptual framework is influenced by leader traits, success criteria, and situational variables and the output directly impacts the variable leader behaviour. Yukl (2006, p. 442) states, *‘influence is the essence of leadership, and much of the activity of formal leaders involves attempts to influence the attitudes and behaviour of people’*. Power is the capacity to influence and Yukl (2006) recommends that rather than focussing directly on power, or influence, it is more appropriate to focus on the outcome of power rather than the type of power and again, *‘for the past two decades, rather than focussing exclusively on power as a source of potential influence, researchers have begun to examine the specific types of behaviour used to exercise influence’* Yukl (2006, p. 164).

A number of measures exist for leader influence. Yukl and his colleagues developed the Influence Behaviour Questionnaire (IBQ), (Yukl, Lepsinger & Lucia 1992) which identified nine distinct influence tactics. A further two tactics were later identified, (Yukl & Seifert 2002). The


eleven proactive influence tactics Yukl (2006, p. 166) are shown below in table 38. Their extensive research has identified the tactics which are effective and those that are not. An effective or good leader would use more highly effective tactics, while an ineffective or poor leader will tend to utilize those influence tactics with low effectiveness (Yukl 2006).

Table 38 Description of the 11 influence tactics (Yukl 2009).

PROACTIVE INFLUENCE TACTICS	
Tactic type	The leader :
<i>Rational Persuasion</i>	Uses <u>logical</u> arguments and factual evidence to carry out the request
<i>Apprising</i>	This will <u>benefit</u> you personally or your career if you carry out the request
<i>Inspirational Appeals</i>	<u>Appeals</u> to your values and ideals, emotions to carry out the request
<i>Consultation</i>	Asks for <u>suggestions</u> to improve the proposal if you carry out the request
<i>Collaboration</i>	Will provide the <u>resources</u> and assistance if you carry out request
<i>Ingratiation</i>	Uses <u>praise</u> and flattery and confidence in your ability
<i>Personal Appeals</i>	Asks for support out of <u>friendship</u> and as personal favour
<i>Exchange</i>	Suggests an exchange of <u>favours</u> at a later stage
<i>Coalition Tactics</i>	Uses <u>peer</u> pressure as the reason
<i>Legitimizing Tactics</i>	States they have the <u>authority</u> to make you comply via the rules, policy, contracts, etc
<i>Pressure</i>	<u>Demands</u> , threats, frequent checking or persistent reminders

Table 39 below groups the proactive influence tactics into categories of effectiveness.

Table 39 Influence tactics categorized as effective or ineffective. Yukl (2006, p. 172)

INFLUENCE TACTIC		
High effectiveness	Moderate effectiveness	Low effectiveness
Rational persuasion	Apprising	Coalition tactic
Inspirational appeal	Ingratiation	Legitimizing tactics
Consultation	Exchange	Pressure
Collaboration	Personal appeal	
		
Effective leadership		Ineffective leadership
Good leader		Poor leader

A number of other researchers have utilized Yukl's influence tactics to describe effective leadership. Hysong (2008), using technical supervisors, and Taylor (2008) both utilized Yukl's integrating conceptual framework and IBQ to better understand how influence factors led to effective leadership within water infrastructure. Both researchers highlight the strong relationships between influence tactic used and the effectiveness or ineffectiveness of the leader.

Thus, for the LI measure, the reviewer will be asked to describe the exemplar using these eleven output statements rather than using the 44 questionnaire items of IBQ. This quantitative descriptive assessment approach will provide categorical data set for statistical analysis.

4.3.2.2. Leader Behaviour (LB) Variable

The second variable to describe effective leadership in phase B of this research focussed upon another variable in Yukl's integrating conceptual framework, namely, leader behaviour (LB).

As previously discussed in Chapter 3 concerning the literature review, the research measures available for leader behaviour are the most numerous. The measure for this research is one that has historically been used to demonstrate that effective leaders balance equally their focus on people issues and task issues. This issue of balance between these two factors is one of the most critical areas identified as the reason engineers fail to become effective leaders. Schein (2004) highlights that in an engineering culture the leaders tended to be task focussed whereas in an

operational culture the leaders tended to be people focussed and in an executive culture the leaders tend to be financially focused.

'Most theorists agree that task and relations behaviour are both important for effective leadership.' Yukl (2006, p. 59). Blake and Mouton (1964) model is a practical model for training leaders, it has strengths and weaknesses. Researchers support the adequacy of the historical two element model, task/relationships, to describe leader behaviour (Nadler & Tuchman 1999; Judge, Piccolo & Ilies 2004; Keller 2006; Baltilana et al 2010).

The two element measure chosen for this variable was the Grid® model developed by Blake and McCause (1991) and based on the original work by Blake and Moulton (1964). The Grid® model has been further researched by McKee and Carlson (1999) to highlight the seven relationship skills of critique, initiative, inquiry, advocacy, decision making, conflict resolution, and resilience for each of the seven grid leadership styles of controlling (9,1); accommodating (1,9); status quo (5,5); indifferent (1,1); paternalistic (9+9); opportunistic (Opp); and sound (9,9).

Leaders with 9,9 orientation have consistently proven to be successful in organizations and more likely to advance in their careers, (Blake & Mouton 1964; Hall 1976). Across the matrix the most effective leaders will be 9,9 orientation while the less effective leaders will be 1,1 orientation. Between the two ends of the scale exists the other five orientations which comply with varying degrees of effectiveness (Bass 2008).

The Grid® measure provides significant granulation of leadership behaviour to allow adequate reference to describe leader behaviour. McQueen (2005) explores some of the highlights of 45 years of research with the Grid® and noted that while 80% of leaders doing an initial self-assessment of Grid® will believe they have a 9,9 leadership style this drops to 18% after they are exposed to follower perception. For this reason it was considered to be valid and more reliable to get a reviewer's view of the exemplar's style than seek the exemplar's perception of their selves. In the LB measure, as in the previous LI measure, the reviewer will be asked to describe the exemplar (i.e. to categorize the leader) in terms of one of the seven styles. This will output a categorical data set for analysis rather than the 42 questions normally utilized. The reviewers' selection of one of the seven possible styles provides a scale around the effectiveness of the leader.

4.3.2.3. Leader Derailment (LD) variable

Both LI and LB utilized proven constructs from proven measures for describing effective leaders, namely IBQ and GRID®. The third variable for phase B, leader derailment, required a proven measure to describe the success or failure of a leader. Yukl (2009) highlighted the four approaches used by researchers that were suitable for determining the effectiveness of leaders. Measuring the performance of the organization is first approach and would be an ideal way to point towards effective leadership but the literature challenges the ‘heroic leader’ and their impact upon the organization (Yukl 2006).

In addition, infrastructure assets do not readily offer an easily obtained measure of organization success as success is measured over a longer period, often much greater than five years, commercial regulation restricts returns to investors, it is often politically skewed (Weber & Alfen 2010). The second approach reviews the leader’s contribution to group processes within the organization, this is also very difficult as the results to prove improvements driven from executive levels can take years to implement and the results are often difficult to quantify. The third approach, and most popular, the attitude of followers towards the leader is already reflected within the variables of LI and LB (Yukl 2010).

The fourth approach explores the extent to which a leader has a successful career, advancing up the organization, as an easily identified measure of the effectiveness of the leader. The exemplars chosen by the reviewers and the reviewers themselves are already successful leaders as they had advanced sufficiently in their careers to reach the executive levels of their organizations. McCall and Lombardo (1983) measure is an ‘*antitype*’ of this fourth approach by measuring ‘derailment’. Derailment describes ‘*people who were very successful in their careers (spanning 20-30 years and reaching very high levels) but who, in the eyes of the organisation, did not live up to their full potential*’ McCall and Lombardo (1983, p. 1-2).

This measure, leader derailment, used by McCall and Lombardo (1983) asked each executive to describe a ‘successful’ executive and an ‘unsuccessful’ executive. This is the same process used in phase A of this research with the good and poor exemplars chosen by the reviewers.

The measure used by McCall and Lombardo (1983) has been the basis of much research by other researchers, (Hogan, Hogan & Kaiser 2009) and the measure has the advantage that it has identified one or two items that derail a leader. The elements identified by McCall and Lombardo

(1983) were from several hour interviews with twenty leaders, each commenting on both an effective and ineffective executive leader. The literature highlighted the robustness of the measure and that it had universal application (Morrison, White & Van Velsion 1987; Renton & Van Lill 2006).

This same measure was utilized by McNally and Parry (2002) to understand CEO failure and found that the model indicates that not one combination of management and leadership skills is related to CEO success. They pointed towards the lack of theoretical development over the past twenty years and that the issue is complex and has been ‘problematically simplified’. Rather than understand the drivers of the model as McNally and Parry (2002) did, this research took the outcomes of the observations of the positive and negative behaviours of successful and derailed leaders. The reviewer is required to rank the top three behaviours that are both positive and negative for the leader under review. This simplified the process and allowed the participant to focus on ‘top of mind’ reasons for the success or derailment of their chosen exemplar. The positive and negative behaviours identified are shown below in table 40.

Table 40 Positive and negative behaviours identified by (McCall & Lombardo 1983)

POSITIVE BEHAVIOURS	NEGATIVE BEHAVIOURS
Outstanding track record	Insensitive to others, abrasive, bully
Outgoing, well-liked	Cold, aloof, arrogant
Technically brilliant	Betrayal of trust – ‘one-upping or failure to follow through’
Loyal and helpful to Management	Over managing – failure to delegate or build a team
Willing to make sacrifices	Over –ambitious – always looking for next job, playing office politics
Ambitious and managed career well	Failing to staff effectively – selecting poor people or recruiting not for the organisation
Moved up in reorganisation or merger	Unable to think strategically – over attention to detail
Excellent at motivating or directing subordinates	Unable to adapt to a Boss of a different style
	Overdependence on an advocate or mentor
	Pushing themselves too hard
Effective leadership	Ineffective leadership

As with the two previous measures, LI and LB, the reviewer was asked to describe the exemplar by selecting the top three of the eight positive behaviours of effective leadership and then top three of the ten negative behaviours of ineffective leadership. The output will be a categorical set

of data for analysis. Each of the three variables utilized within phase B (LI, LB, and LD) will be used to confirm that good and poor exemplars described by the reviewers, reflect the characteristics of the general literature and that they provide a scale for the measurement of effectiveness

4.3.3. Phase C – Leader skills (LS) assessment

This phase of the methodology was needed to enable the reviewers to describe the skills of exemplars in a quality framework which would enable the descriptions to be drawn together for analysis. As previously described in the previous section, leader skills (LS) constitute the first variable of Yukl's integrating conceptual framework, (Yukl 2006). The other three variables of the Yukl's framework were previously introduced in section 4.3.2 and their corresponding constructs that will be utilized to confirm the exemplars described by the reviewers reflect the behaviours and performance of effective/ineffective leaders of literature.

Most literature on leader skills is built upon the work of Katz (1955) who first called attention to skills and their impact upon effective leadership, (Peterson & Van Fleet 2004). Skills are interrelated with traits but *'there is real merit in examining each one separately'* Katz (1974, p. 34). These 'skills' are demonstrable, developable, observable, and focussed on what the leaders *'real concern should be for what a leader can do rather than what they are'* Katz (1974, p. 33).

'A skill is the ability to perform some specific behavioural task or the ability to perform some specific cognitive process that is related to some particular task..., a skill is conceived as comprising three components:

- 4) The existence of a domain specific knowledge base;*
- 5) A method for accessing this knowledge base; and*
- 6) The ability to enact a set of behaviours or cognitions using the retrieved knowledge to perform the given task.*

...The third component was what people can observe and label as a skill.' Peterson and Van Fleet (2004, p. 1298).

Katz (1955) proposed three categories of skills, while Peterson and Van Fleet (2004) summarized the new skill categories which researchers have attempted to expand. They summarize them as

ten core skills which are really subsets of Katz's original three, Peterson and Van Fleet (2004, p. 1303).

Badawy (1982, p. 17) highlights that '*managerial competency has three interrelated components: knowledge, skills and attitudes.*' The element of skills consisted of technical, interpersonal and administrative skills. His managerial skill mix (MSM) model provides a good model to demonstrate the relative skill mix for managerial effectiveness at different management levels. Badawy (1982) expands the administrative element to include conceptual skills or the ability to understand the whole system. Another element consistently highlighted in the literature and research was business knowledge which crosses over in to what Badawy defines as conceptual skills. What is included within both the technical and business focus is cognitive ability which is required in order to think strategically. Jaques (1989) highlights this ability as critical for competency at higher managerial levels.

Yukl (2006) defines the skills into a three-factor taxonomy but does acknowledge that '*some writers differentiate a fourth category of skills (called administrative skills) that are defined in terms of the ability to perform a particular type of managerial function or behaviour*' Yukl (2006, p. 181). In the table below a summary is given of the definitions of skill when applied to effective leadership as seen in current literature and research.

Table 41 Summary of Definitions of the word 'Skill' as used in current literature/research.

SKILLS – SUMMARY OF DEFINITIONS.			
Katz (1955)	Badawy (1982)	Northouse (2010, p. 40)	Peterson and Van Fleet (2004, p. 1303) Subsets
<u>Technical</u> – primarily concerned with working with 'things' (processes or physical objects).	Technical	Knowledge about and proficiency in a specific type of work or activity – work with <u>things</u> .	Technical Analytic Decision making
<u>Human</u> – primarily concerned with working with 'people'.	Interpersonal	'Knowledge about and ability to work with <u>people</u> .'	Human Communications Interpersonal
<u>Conceptual</u> – primarily concerned with the ability to see the organization as a 'whole'.	Conceptual and Administrative	The ability to work with <u>ideas</u> and concepts.	Conceptual Diagnostic Flexible Administrative

Based upon the literature of skills, (Katz 1955; Badawy 1978; Paterson & Van Fleet 2004; Yukl 2006; Northouse 2010) and observations of by the researcher, this research selected examining five skills, namely:

- 1) Technical – as per Katz’(1955) definition of technical
- 2) People – as per Katz’(1955) definition of human
- 3) Business skills
- 4) Strategic skills
- 5) Administrative skills.

The last three skills listed are really conceptual skills (Katz 1955) divided into the three sub elements. Breaking Katz’s original three skills into subsets has been done by previous researchers to allow further analysis (Paterson & Van Fleet 2004). Table 42 below details the five skills used within this research and lists examples from literature where they have been previously utilized.

Table 42 Description and background of the five skills typology used with leader skill assessment.

SKILL	DEFINITION	EXAMPLES FROM LITERATURE
Technical	Working with things –the assets of infrastructure and how they are constructed/operated and maintained	(Katz 1955) (Badawy 1982) (Hysong 2006) (Cordero et al 2004) (Schein 1994)
People	Working with people – knowledge, ability, to work with, lead, develop, and manage people within the infrastructure organization and stakeholders.	(Katz 1955) (Badawy 1982) (Cordero et al 2004) (Kaplan & Kaiser 2003) (Schein 1994)
Business	Working with the ideas – knowledge and ability to understand how infrastructure business makes ‘money’- revenue/profit.	(Katz 1955) (Jaques 1989) (Schein 1994) (Dai et al 2011)
Strategic	Working with the ideas – knowledge and ability to understand how the infrastructure business needs into the future	(Katz 1955) (Jaques 1989)
Administrative	Working with the ideas – ability to develop, implement and maintain systems, policies and procedures that underpin the business to deliver business outcomes	(Katz 1955) (Badawy 1982) (Anderson 1992) (Schein 1994) (Peterson & Van Fleet 2004) (Cordero et al 2004)

These five skill groupings are well supported in the literature, as shown above in table 41 and provide the leader skills assessment – Phase C of the methodology. The actual skill assessments used with these five skills are detailed in section 4.6.

This phase is the final component of the quantitative element of the methodology. Phase A captured the demographics of the expert reviewers and their exemplars of good and poor leadership with infrastructure businesses. Phase B utilizes three proven constructs from measures of effective leadership from literature – LI, LB, LD to enable the three constructs to confirm if the good and poor exemplars described by the reviewers align with the literature's description of effective and ineffective leaders. The skills of these exemplars are analysed in Phase C to identify which skills are requisite for effective leadership

The next phase, Phase D, is the qualitative phase of mixed method methodology.

4.3.4. Phase D – Observations of Effective leadership

The initial quantitative phase of the methodology utilizing phases A, B, & C is built around the literature of effective leadership. This initial phase allowed the reviewers to describe leadership using the proven measures of literature and provide constructs that could be analysed statistically. Phase D, the final phase of the interview, captures the thoughts and views of the expert reviewers using a qualitative semi structured questionnaire.

Robson (2002) explains the reasons for using interviews, one being to validate or clarify and illustrate the observations from the quantitative phase. He also explores the advantages of the technique as it is a flexible way of investigation that allows the line of inquiry to flow with the conversation to better understand the situation and world view of the participant in a way that a quantitative questionnaire cannot. It maps the issues that the participant deems important by both verbal and non-verbal methods with the most critical information given in the early phase of the process.

There are a number of significant advantages to be obtained by completing the open ended questionnaire after the first three quantitative phases. Firstly, by completing the qualitative phase

after the quantitative phase the reviewers are given the opportunity to expand in detail any comments made during the quantitative phase, to explain the situations they have found themselves in and to make their observations regarding effective leadership and the appropriate skills mix. Completing the quantitative section first ‘locks down’ the reviewer’s initial responses and keeps the data as ‘pure’ as possible for the statistical analysis while at the same time giving background to the participants prior to the discussion phase. This fourth phase allows exploration of the wealth of information to be obtained from these experts via key themes, arguments, words, and comments.

Secondly, since the reviewers are time constrained, completing the qualitative section last would allow the reviewer to become comfortable with the areas being investigated, stimulating their thoughts and thus they would begin to elaborate. Open-ended questions would allow them to relax and describe their experience in their own language and in their own time. Murphy et al (1998) points to this approach as the opportunity to follow up their ideas and explore dimensions that the researcher may not have anticipated.

The interviews were completed using a semi-structured guide with no digital recorder. Benefits exist with using a recorder as note taking never captures the exact tone and comments of the participants. However, it was considered to be more important to maintain the ‘openness’ of the responses from the participants by preserving anonymity rather than have them be concerned about confidentiality especially considering their leadership positions. The interview guide was only a road map to start the discussions and identify key issues in what many leaders find both an interesting and often emotive subject as most followers have been impacted both positively and negatively by good and poor leaders themselves. The interview guide is found in Appendix 3 but the table below explains the purpose for each of the open-ended questions.

Table 43 Open ended interview questions in the semi-structured phase of the methodology.

QUESTIONS	PURPOSE/PROBE
<i>You raised some interesting points as we completed the questionnaire. I would like to explore some of those observations.</i>	Explore and flesh out any additional observations either supportive or not supportive of the literature and previous research – understand any situation distinctive around their comments.
<i>What have you seen work well/not so well in making engineers more effective leaders?</i>	Many companies have attempted to make engineers more effective leaders often at great expense, time and commitment and understand the effectiveness of those initiatives. Explore these techniques used by the infrastructure companies.
<i>How would you describe an effective leader and does this change with the level of the organisation?</i>	Explore , in their own words what they perceive as effective and whether or not this was consistent with the literature, or whether it possibly was biased by their own skills background or business needs.
<i>What is the best level or levels to have engineering skills within an organisation – is it Board, CEO, executive team? And why?</i>	The levels of an organisation require different governance and leadership requirements. Does an engineer have the skills it takes to operate effectively in the highest levels? Is a leader with engineering skills supported or hindered by these same skills?
<i>Does the business context change the leadership requirements i.e. in sourced vertically integrated model verse an outsourced investor model? Please explain?</i>	An organisation’s framework may well require different skills basis to enable the leader to be effective. For example an outsourced investor model may have a dominant CEO culture not a traditional engineering culture purely by the numbers and skills of people at stakeholder and delivery level.
<i>What would you recommend that leaders with engineering skills do to make them more effective and suitable at the higher levels of Infrastructure businesses?</i>	Outline in their own words what they consider the most appropriate development plans for a technical leader. Functional skills versus Leadership style.

These questions of the semi structured interview were designed to enable time-constrained reviewers to speak of their experiences in identifying, developing and rewarding leaders outside the constraints of the researcher’s previous focus in the quantitative phases of A, B, and C.

This research used a mixed method model whose conceptual framework was developed in order to extract the necessary information from this expert group's experience and has done this by the use of four phases.

This conceptual framework needed to draw out this expert group opinion and has been able to do this in four phases. The first three phases which are quantitative were based on the vast quantity literature on leadership and the fourth and final phase, being qualitative, allowed the expert group to raise other points which may have been distinctive to infrastructure or additional to the focus of the previous phases. This use of mixed methods of structured and semi-structured interview allowed for some statistical analysis of the results within the constraints identified with such a knowledge-rich, time constrained expert group.

The next section of this chapter gives further detail regarding the application of the methodology. It discusses firstly, the selection of the reviewer sample; then the focus of the interview; the details around the constructs and scales used in phase B to confirm effective leadership descriptions among the exemplars; and finally the limitations inherent in the methodology.

4.4. *Sample of Reviewers and their exemplars of leadership*

The sample of reviewers required for this research needed to have access to and relationships with the senior levels of infrastructure businesses if they are to adequately provide exemplars and describe them adequately within the format of the structured and semi-structured interviews. These senior levels are normally levels 5 and 4 previously highlighted in table 34 (i.e. Board and Executive). They exist within a common governance framework required by legislators such as the Corporations Act 2001 for Australia. In this Act, Boards (level 5) are required to (1) participate with setting strategic direction; (2) making available resources for management (levels 4 and below) to achieve the strategic plan; (3) monitor the performance of the business against strategies and targets; (4) ensure adequate compliance to regulatory requirements of law and accounting; (5) set the risk appetite for the company; and (6) accountable to shareholders for performance reporting (Cadbury 1992). Boards may direct the company but all activity within the company is completed via the management team through the CEO. Directors of Boards direct while management manage the business. Trickler's (1994) framework below illustrates the roles

of the Board and how at the core is the CEO who enacts, through the management team, the directions of the Board.

	Compliance role	Performance role
External Role	Provide accountability	Strategy formation
Internal Role	Monitoring and supervising	Policy making
	Past and present orientated	Future orientated

Figure 13 Tickler’s framework for analysing Board function- Tickler (1994, p. 149).

It is the management team, led by the CEO, at levels 4 and 3 of the organization (shown in table 36) who lead and manage the business. The management team typically consists of a chief executive officer (CEO), chief financial officer (CFO) and chief operating officer (COO). Other function areas can be represented within an executive team such as engineering, information technology (IT), human resources (HR), occupational health and safety (OH&S), and treasury, depending on the size of the organization and the skill set within the traditional core of CEO, CFO, and COO (KPMG 2011).

Effective leadership at the Board level means ensuring that its members have adequate skills, experience and governance systems to enable the Board to exercise its decision-making powers. The Board can be viewed as a system but the chairperson and his/her leadership skills will have the largest impact upon the Board’s overall effectiveness (Leblanc 2004). The Board is seen as a source of experience and knowledge for the organization and this experience and knowledge is shared with management in particular through the CEO. It is one of the functions required of a Board to ensure roles and responsibilities are clearly understood. Board and Management’s effectiveness is related to the structure and culture. The tone at the Board level and through the executive team sets and builds the culture of the organization (Schein 1999).

Yukl (2005) acknowledges that most leadership research is centred around supervisors and middle managers (levels 2 and 3) whom are easier to access but he does note the recent shift in research of focus towards strategic leadership at the executive level. Few members of an organization have day-to-day interaction with executives as most actions from that level are delayed as they work their way down through the organization. Thus to understand the effectiveness of an infrastructure business it is critical to ensure that the sample is ‘informed’ enough to understand the performance at the executive level.

The reviewers were selected from infrastructure asset businesses that were previously privately owned being either former government business which were subsequently privatized and/or publically listed. All these businesses have been private for at least ten years after privatization. Government owned corporations (GOC) were not selected as a source of reviewers as they tend to reflect the traditional government organization and the less complex leadership as discussed in Chapter 2. GOC cultures tend to be in state of transition between being a traditional public utility to being a private infrastructure business (Conrad 1995; Helm 2009). To fully understand the complex leadership only private corporations were selected, ones that had been fully exposed to the open public market with stakeholders being private/institutional/retail equity providers and institutional debt providers.

The criteria for selecting sample reviewers included:

- 1) They must be a senior leader within an infrastructure business who has sufficient experience and exposure to leaders to be able to describe exemplars of leaders at senior levels (from 3 to 5).
- 2) The Infrastructure business is not government owned.
- 3) They must be senior leaders with either technical (i.e. engineering, science, trade) or non-technical (i.e. finance, law, accounting, management) qualifications/background.
- 4) Exemplars selected and described by the reviewer must have had responsibility for the technical operating function of the infrastructure business i.e. Board member, CEO, COO, Engineering Manager, etc.
- 5) Adequate time available (approximately an hour) to complete the four phases of the structured and semi-structured interview.
- 6) Relationships with exemplar needed to be direct (typical for a 360° review) as the interview is not an imperial process but ‘remembered perceptions of the leader’.
- 7) Ability to rate an exemplar as ‘good’ or ‘poor’.

Access to a large number of reviewers (n=46) was possible due to the researcher’s own role and experience within the infrastructure industry in Australia. The details pertinent to these reviewers will be discussed in the results section of Chapter 5.

These reviewers form part of the measurement tool as they choose the exemplars and their views are extracted through the structured part of the interview. The measures and their constructs, and scales to extract this rich source of data are discussed in the following section.

4.5. Measures and Scales used within the Structured Interview

The conceptual framework of the methodology identified the need for a number of measures for the three phases within the structured interview. Phase A required single-item measures for the capture of demographic information. Phase B required three previously published measures to confirm that the exemplars of leadership identified in Phase A had similar descriptions from the literature for effective and ineffective leadership behaviour/performance. Finally in Phase C, single-item measures were again required with two ratio scales to capture the five skills of leadership and their relationship to each other.

4.5.1. Phase A – single-item measures

Phase A consists of the demographic items relating to qualifications, industry experience, gender, type of infrastructure for both the reviewer and their two exemplars to be described by the reviewer. Some additional items were required of the exemplars relating to leadership team size and composition of technical and non-technical personnel within those teams. This approach using single-item measures for demographics is typical, (Wanous, Reichers & Judy 1997).

The other single-item measure within Phase A related to the reviewer giving the exemplar a score of one to ten on an ordinal scale of effective leadership, '1' being for the worst leader the reviewer had encountered and '10' being for the best leader the reviewer had encountered. The critical element of this scale was not to capture the interval proportion but to split the ordinal level of measurement into the correct ordering. Exemplars of ineffective leadership would score between 1 and 5 inclusive while exemplars of effective leadership would score between 6 and 10 inclusive.

4.5.2. Phase B – Proven measures and their constructs

The methodology identified the need for three measures in phase B (section 4.3.2) to measure effective leadership. These three measures relate to providing scores of categorical data which would enable the exemplars to be compared to the literature on styles of effective and ineffective leaders. The outcome from this phase is to confirm that the descriptions of good and poor exemplars reflect the literature and previous research on leadership. The measures used within phase B have all been published previously and have been the subject of previous research processes to confirm their validity. Their measures are not accepted as the only or the best measure, rather, as a 'suitable' measure that can be assumed to be robust and repeatable.

With this in mind the measures used were not implemented from first principles using the whole number of survey questions. This research was not meant to test the measures per se but to use the output from the measures to compare the exemplars against the literature statements. Ideally, the measures should be used from first principles but this would require a questionnaire of over one hundred questions for the exemplar of an effective leader and the same again for the exemplar of the ineffective leader.

Because the reviewers were informed experts and had limited interview time available, it was considered prudent to have the participants comment on their perception of where the leader would be positioned on the outputs or factors of the measures. What was important was not the exact statistical result but the approximate position on the measure output. This would allow for high level examination of the descriptions for each measure rather than the detailed bottom up analysis from each measure's elements if they had been built from first principles.

Table 44 Ordinal scales used with three constructs from measures of phase B of the methodology.

MEASURE	AUTHOR AND NUMBER OF ITEMS IN SURVEY	NUMBER OF FACTORS FROM SURVEY	ORDINAL SCALE OF MEASURES
Leader Influence (LI)	Yukl and Seifert (2002) 44 items in survey	11 statements	Reviewer to select the top <u>three</u> statements which describe the influence tactics of the exemplar.
Leader Behaviour (LB)	Blake and McCause (1991) 42 items in survey	7 statements	Reviewer to select the statement which best describes the exemplar.
Leader Derailment (LD)	McCall and Lombardo (1983) Gentry et al (2007) 40 items (<i>Equally for LD a more robust measure would be to use CCL's Benchmark® but this would require answering 130 questions for each exemplar being reviewed.</i>)	8 statements for success 10 statements for derailment	Reviewer to select the top <u>three</u> statements for both sets of statements which describe the success and derailment of the exemplar.

Table 44 summarizes the three measures for phase B and the number of statements used by the reviewers to describe the exemplars. An alternative approach would have been to select a single-item measure from each measure but Wanous, Reichers and Judy (1997) show how it can be seen as a 'fatal error' in the review process of academic research. Subsequently, with the time constraints this quantitative descriptive assessment approach producing a categorical set of data was selected. The validity of the construct for each measure was not required, only to confirm that exemplars in infrastructure reflected the literature and thus providing support for the single-point scale of leader effectiveness in phase A adequate for grouping exemplars into either category of good or poor leader.

4.5.3. Assessment of Skills

The methodology in section 4.3.3 required a scale to assess the five skills selected. Two scales were selected for this item as shown below in table 45.

Table 45 Two scales utilised by the reviewers to describe the skills of the exemplars.

SCALE	APPLICATION
Rank the five skills in order of importance (nominal scale)	Reviewer is required to rank the skills from most important (1) to least important (5) both for the exemplar and an ideal leader in the role of the exemplar.
Weight the five skills out of 100% of time (ratio scale)	Reviewer is required to allocate the percentage of time the exemplar would spend engaged doing the skill.

The expert reviewer is also required to describe an ‘ideal’ leader using both scales compared to the position of the exemplar they are describing. Similar to phase B, phase C could have used a proven measure such as Cordero, Farris and DiTomaso (2004) approach but that required 26 survey items. The interview time constraint and the focus on a short scale which may enable the scale to be easily used in industry, as per the overall job satisfaction Faces Scale (Kunin 1955), drove the focus not on the validity of the construct of which skills but more the application of these skills which are proven historical measures (Katz 1955).

The application of these assessments and scales is detailed in the following section which describes the data collection process involved in completing the structured and semi-structured part of the interviews with the reviewers describing their exemplars.

4.6. Data Collection Process

This section describes the process used by the researcher to apply the structured and semi-structured part of the interview. The interview process to collect the data for this research follows the methodology structure of four phases viz.:

- Phase A – Demographics of review and exemplar. Rating of the exemplar on a scale 1 to 10.
- Phase B – Good and poor exemplar’s description using three scales of effective leadership.
- Phase C – Good and poor exemplar plus an ideal exemplar, doing a similar role as exemplar, using the two scales of skills – rank (1 to 5) and weighting (out of 100%).
- Phase D – Semi-structured section of the interview with six open ended questions to explore the reviewer’s perceptions and ideas that may go beyond what was discussed in phases A, B, and C and that may be outside the general leadership literature.

Appendix 2 contains the interview questionnaire and Appendix 3 provides a more detailed explanation of the interview process by way of an introduction of the research, guarantee of confidentiality, ethical clearance and access to further information after the interview. The next four sections explain how and why the data was collected from the reviewers and provides adequate explanation for the methodology to be repeated by future researchers who may want to explore the methodology and/or apply the interview process to other industry groups.

4.6.1. Phase A – Demographics

The reviewer is requested to think about the leaders that they have worked for, with or directed at the senior levels of infrastructure businesses. The reviewer is required to select two leaders, one a good leader and the other a poor leader – these will be the two exemplars that the reviewer will describe in phases A, B, and C.

Beginning with the good leader the reviewer provides demographic details about themselves and then demographic details about the good leader exemplar. The table below captures each demographic question and explains the information required and purpose, after the reviewer completes phases A, B, and C for their good exemplar the process is repeated for their poor exemplar.

Table 46 Background for the demographic information about the reviewer and their exemplars.

DEMOGRAPHIC QUESTION	INFORMATION REQUIRED	PURPOSE OF DATA
Level in the organization	Reviewer to select which level they and their exemplar were at when they worked together.	Ensuring that the reviewer and exemplar are within the top three levels of an organization (i.e. levels 5,4 or 3)– the focus of this research.
Years known leader	Reviewer estimates the amount of time in years that they have known their exemplar.	Provides a measure of how well the reviewer knows the exemplar and thus gives some support to the strength of the description of the exemplar.
Sex	Gender of reviewer and their exemplar.	Identify gender population.
Years in industry	Reviewer estimates the amount of time in years that they and their exemplar have had in the infrastructure industry.	Provides a measure of both the experience of the reviewer and their exemplar and the strength of their views on leadership in infrastructure.
Highest education level	Reviewer and their exemplar's highest educational qualification such as MBA, Masters, PhD and discipline.	Provides a measure of the value of additional education especially for additional qualifications such as MBA or finance for engineering based qualifications.
Base qualifications	Reviewer to state their and their exemplar's initial qualification. Engineering/Science/trade qualifications are deemed as technical qualifications.	Provides a measure of separation of the two traditional groups – technical and non-technical. Reviewers and exemplars. This is a critical measure to identify these two cultural groups of executives.
Size of technical team (number of employees)	Reviewer describes the approximate size of the technical team – the engineering culture type group of infrastructure as per Schein (2004) includes engineering, services, construction maintenance, control room, design	Provides a measure of the leadership responsibility and the exemplar's impact on and from the technical team.
Percentage of technical employees I technical team	Reviewer describes the approximate percentage of their exemplar's team that are technically qualified.	Provides a measure of the dominant qualification and the subsequent dominant culture i.e. engineering (Schein 2004).
Rating of leader (1 worst to 10 best)	Reviewer rates their exemplar from 1 to 10, based on their experience of managing/reviewing leaders. 1 representing the worst leader and 10 representing the best leader they have encountered in infrastructure.	Provides a measure to rate the exemplars. As the reviewer will describe both a good and poor exemplar, the scale will be used to identify good/effective leaders (6 to 10 inclusive) and poor/ineffective leaders (1 to 5 inclusive).

4.6.2. Phase B – Description of exemplar's style

After the demographics information is captured in phase A, the reviewer then describes their exemplar using the framework provided by the three measures Leader Influence (LI), Leader Behaviour (LB) and Leader Derailment (LD). As discussed previously in section 4.5 these measures are not utilised to describe the exemplars using their numerous survey questions but the outcome statements from their application in historical research. It should be remembered that the goal of phase B is not to explore the constructs of each measure but to observe if the styles of the infrastructure exemplars have the same description as the literature and research around effective leadership. The following table explains the process the reviewers went through in understanding and scoring the three measures in phase B.

Table 47 Details of the historical measures used by the reviewers to describe their exemplars.

EXEMPLAR STYLE	DESCRIPTION OF STYLE	PROCESS OF SCORING
Leader Derailment (LD) based on measure McCall and Lombardo (1983)	Positive Statements Outstanding track record; Outgoing, well-liked; Technically brilliant; Loyal and helpful to Management; Willing to make sacrifices; Ambitious and managed career well; Moved up in reorganisation or merger; Excellent at motivating or directing subordinates.	The eight positive statements and ten negative statements of derailment are the outputs of researchers (McCall & Lombardo 1983). The reviewer was asked to select the top three positive behaviour statements <u>and</u> the top three behaviour statements which best describes their exemplar for the time they have known them. This was done as two processes as all these leaders will have positive behaviours or they would not have reached these levels in the organisation.
	Negative Statements Insensitive to others, abrasive, bully; Cold, aloof, arrogant; Betrayal of trust – ‘one-upping or failure to follow through’; Over managing – failure to delegate or build a team; Over –ambitious – always looking for next job, playing office politics; Failing to staff effectively – selecting poor people or recruiting not for the organisation; Unable to think strategically – over attention to detail; Unable to adapt to a Boss of a different style; Overdependence on an advocate or mentor; Pushing themselves too hard.	As the reviewer selected a statement it was given a rank. ‘1’ for the top statement, ‘2’ for the next statement and ‘3’ for the third point. If the reviewer could not select a statement i.e. negative statement for their good exemplar, then no score was recorded. Reviewers were requested to select <u>up to</u> 3 statements. The goal was to identify if poor leaders aligned to the negative behaviours and if good leaders align to the positive behaviours. Some cross over was expected.

EXEMPLAR STYLE	DESCRIPTION OF STYLE	PROCESS OF SCORING
<p>Leader Behaviour (LB)</p> <p>Based on measure McKee and Carlson (2003)</p>	<p><i>McKee and Carlson (2003, p. 16)</i></p>	<p>The seven behaviours of leadership were based on Blake and McCause's (1991) work on GRID® solutions. The reviewer was asked to select the statement which best described the behaviour of their exemplar. If the reviewer was not comfortable in selecting <u>one</u> style, a number of questions from Blake and McCause (1991, p. 17-23) were used as part of a self-assessment by the reviewer. Elements of conflict solving and decision making normally provided adequate guidance but all six questionnaires were made available. The reviewer decided to stop using the questionnaire when they were comfortable the statement best represented their exemplar. The goal was to again see if poor exemplars tended to use the poor styles from the literature and vice versa for the good exemplars.</p>
<p>Leader Influence (LI)</p> <p>Based on measure by Yukl and Seifert (2002)</p>	<p>Rational Persuasion; Apprising; Inspirational Appeals; Consultation; Ingratiation; Personal Appeals; Exchange; Coalition Tactics; Legitimizing Tactics; Pressure.</p>	<p>These eleven influence tactics are the results of researchers (Yukl & Serfeit 2002) describing the tactics that leaders utilize when they lead and manage teams. The reviewer was asked to select the top three tactics that describe how their exemplar would influence their team in the majority of cases. As the reviewer selected a tactic it was given a '1' rank for the most used tactic, '2' rank for the next most used tactic and '3' rank for the third most used tactic. The goal was to identify if the exemplar tended to utilize effective tactics or non-effective tactics of influence at the macro level not a construct of all tactics.</p>

All three measures of phase B were used to enable the reviewer's to describe their exemplars in statements which are the result of proven historical measures. The goal of this phase is to confirm

that the exemplars described as good or poor have corresponding statements which align to historical research and literature. If so, then the good/poor exemplars of infrastructure align to good/poor leaders of research and this was done without utilizing all survey questions in the historical measures (i.e. >100 questions) and in the shortened time frame of the interview.

4.6.3. Phase C – Skills Assessment

In the final phase of the quantitative section the reviewer describes the exemplar in terms of the skills they displayed doing their role. The skills are not the exemplar's qualifications but the broader definition used by Katz (1955) which consists of:

- 1) Specific domain knowledge
- 2) Ability to access this knowledge
- 3) Ability to use this knowledge doing tasks.

The reviewers have five skills to rank and weight, namely:

1. Technical – understanding how and why infrastructure assets are designed, constructed, and operated to meet the user requirements.
2. People – understanding how to lead, develop and work with people/stakeholders to align them to the business needs.
3. Strategic – understanding the business's operating environment and the current and future changes that will need to be strategically plan for the business to maintain a profitable business.
4. Business – understanding how the business works and how it is able to deliver objective of the business plan to shareholders/stakeholders.
5. Administrative – understanding how the systems and processes (such as IT) support the business and ensure robust reporting and governance requirements.

To ensure that reviewers were not confused by an academic definition of skills – such as 'competence' per se – they were asked to focus on what the exemplars pay *'attention to, measure and control on a regular basis'* Schein (2004, p. 246). This reflects what the leader considers important and will be how they will be assessed by the business.

The reviewers were asked two questions with regards to skills:

1. Rank the five skills in order of importance for an ideal leader doing the task of their exemplar. '1' being most important skill through to '5' being the least important skill. Then rank the five skills for the exemplar.
2. Apply a weighting of how much time out of 100% that an ideal leader should be spending focussing or using those 5 skills. Then apply a weighting for the exemplar.

The focus of this phase is to understand which skills are required for these senior executive roles and if an imbalance of skills exists between effective and ineffective leaders. The results of phase A and phase B will provide guidance around which exemplars represent effective and ineffective leaders and their corresponding skills and focus.

Phases A, B, and C were completed for a good exemplar and then for a poor exemplar. Only after both were done was Phase D completed.

4.6.4. Phase D – Semi-structured phase

While phases A, B, and C provide quantitative data for analysis, phase D was provided as an opportunity for the reviewers to share, in the time remaining, any additional information or observations they may have with respect to leadership of infrastructure businesses and the particularities of leadership of infrastructure assets.

In the semi-structured section of the interview the reviewers are free to directly describe effective leadership in their own terms and in their own way. This qualitative data does not provide a structured data set (i.e. where it can directly compare across reviewers) but does provide a greater richness and will be used to support or not support the conclusions drawn from the analysis of quantitative data sets. And, of course, the experts may also talk about things outside of the competency mix – including other competences and/or situational factors (e.g. in a new project X but in a long established infrastructure operation Y, etc.).

In summary the interview process consisted of the two sections, namely:

- 1) The structured section (quantitative) with 3 phases designed to prevent the reviewer ‘rambling’ and wasting limited interview time but describing a good and poor exemplar of leadership in constructs developed in the literature.
- 2) The semi-structured section (qualitative) which allowed the reviewer to provide ‘their wisdom’ about what particular leadership at the executive level in the remaining time of the interview.

This process enables the researcher to have an appropriate ‘prism’ that achieved the objectives below:

- Enabled simple statistics to be completed around the assessments of leadership ad skills.
- Enabled the focus to be on effective and ineffective executive leaders rather than generalizations or lower levels of the organization.
- Enabled access to the most senior of leaders of infrastructure to provide their observations of what works and what does not.
- Enabled the reviewers to go beyond their own understanding and knowledge by using the quantitative tool based on the vast quantity of available literature.

In addition the qualitative part which enriched the discussion and allowed reviewers to go beyond the structure of the initial part of the interview. This also enables an examination beyond the researchers own biases and enables collection of key themes, ideas or comments from the reviewers.

4.7. *Limitations*

Limitations exist for all research approaches, (Yukl 2006; Northouse 2010), and the methodology for this research has been developed to mitigate a number of limitations, the prime issue being the restricted interview time of one hour or less with these expert reviewers. This time restriction has been an overriding limitation in shaping the methodology. Its impact has been minimized by the following:

1. The reviewer describing the exemplars using output statements from historical measures of effective leadership (LI, LB and LD) rather than using the measures from first principles and in their entirety.
2. Using a mixed method approach – a structured interview (quantitative) sourced from the literature and previous research, followed by a semi-structured (qualitative) interview to allow these expert reviewers to add free flowing themes and key concepts.

The advantages of using this expert review group easily outweigh the time limitation for the interview since it is a rare opportunity to interview leaders at such high levels of infrastructure organisations.

The reviewers have brought strength to this research by sharing their rich experiences and providing some key reference points, namely:

- a) By providing descriptions of their chosen exemplar (for both good and poor) and scoring these exemplars on a scale of 1 to 10.
- b) Providing the description for an ideal leader's skill set compared to their exemplars.
- c) Providing both technical and non-technical exemplars to determine the impact of base qualification on leadership styles and effectiveness.
- d) After the structured phase based on historical research the reviewers shared their understandings of effective leadership, impact of technical skills and the distinctiveness of infrastructure leadership at the executive level.

4.8. Ethics

The research was conducted and approved under the governance framework of the Human Research Ethics Committee (HREC) at the Central Queensland University. The research was approved in accordance with the National Health and Medical Research council and the policies of the Central Queensland University (CQU). Under the CQU guidelines the research was deemed low risk but the critical element to ensure the participants felt free to answer candidly was to ensure that the participants, the leaders being measured, and the organizations they all worked for were not identified, this being a critical element in context of the sample group (Yukl 2009).

A letter of introduction was made available which explained the research and assured the participants that involvement was purely voluntary. This contained contact details of the researcher, HREC and the research supervisor if they had any concerns over the process or ensuring their anonymity. A copy of this introduction is provided in Appendix 1.

Computer entry of the data after receipt of the response was made using Excel® and analysed using SPSS 17 program. Original survey responses are stored in a secure location and control complies with the ethical approval.

4.9. Conclusions

The goal of this research is to explore the skills required for effective leadership of infrastructure businesses. This chapter outlined how the methodology was selected and how the mixed method approach was chosen to maximize the data from the expert reviewer sample. The methodology consists of four phases as shown below:

Table 48 Summary of the methodology across the four phases

METHODOLOGY			OUTCOMES
Data Collection	Section of Interview	Phase of interview	Data Collected
Quantitative (Qt)	Structured	A. Demographics	Demonstrate: Strengths of reviewer sample in terms of experience/level. Ranking of exemplars into good and poor leaders. Identification of reviewers and exemplars as technical or non-technical.
		B. Effective leadership style assessment	Demonstrate: Good and poor exemplars description compared to general literature in terms of LD, LI and LB. Any correlation between good and poor exemplars based on qualifications – technical/non-technical.
		C. Leader skills assessment	Demonstrate: Comparative results of ideal leader skills weighting between technical and non-technical reviewers. Differences between skill rank/weighting of exemplars compared to ideal leader exemplar by grouping good/poor exemplars and technical/non-technical exemplars.
Qualitative (Ql)	Semi-structured	D. Observations of effective leadership in infrastructure	Observations by key statements/themes: Comments on structured part of interview and measures. Distinctive characteristics of infrastructure leadership. Development of leaders for executive infrastructure leadership.

The outcome of this methodology is to elicit the views of expert reviewers who may not be experienced in using the form and language of the literature and previous research. This data is extracted through a structured interview built from the literature and enables data to be statistically analysed. The method also then enhances the ability of the experts to share their thoughts and key concepts freely in the semi-structured phase.

Chapter 5 is the first of two chapters which report the results of the research. The strength of the reviewers and how their exemplars have descriptions similar to those recorded in the historical literature as discussed in Chapter 3. Chapter 6 explores the results of the analysis of the skill assessment of the exemplar groups when compared to the reference point of an ideal leader.

5. Results – Demographics and exemplar leader style (phase A & B)

This chapter presents the results and analysis of the survey data collected from the reviewers. As discussed in section 4.6, the data was collected using a mixed methodology consisting of four phases. This chapter examines the data from the first two phases, A & B, and Chapter 6 will examine the data collected from the remaining two phases.

Table 49 The links between the mixed methods, interview modes and the four phases within the two interview approaches.

DATA COLLECTION	INTERVIEW MODE	PHASE OF INTERVIEW – DATA COLLECTED
Quantitative (Qt)	Structured	(A) Demographics of reviewers and their exemplars
		(B) Constructs of measures of Leadership of the good and poor exemplars
		(C) Assessment of leader skills of the good, poor and ideal exemplars
Qualitative (Ql)	Semi-structured	(D) Observations of effective leadership in Infrastructure businesses and appropriateness of the research descriptive framework.

This chapter examines the demographics of the expert executive reviewers and the scales which demonstrate their strength as a sample group. It then explores the demographics of the exemplars the reviewers have chosen, one good and one poor, and why these exemplars are strong exemplars of effective/ineffective leadership of infrastructure.

Section 5.1 examines the reviewers and the two subgroups, reviewers that have technical qualification/background and those that do not. The section explores whether or not any biases based upon their qualifications/background exist within these reviewer samples i.e. do technical reviewers consider technical leaders more effective than non-technical leaders or do they consider the leaders performance at a macro level rather than based upon the qualifications/background they possess.

After discussing the reviewers and their exemplars the next section examines phase B of the methodology, i.e. the description of the exemplars using constructs of three measures that have been used historically to measure leader style. The resulting styles for both good and poor

exemplars were compared against the results of literature to confirm if the good/poor exemplars have descriptions similar to the effective/ineffective styles of the literature for which the measures have been developed. This will also provide guidance as to the practicality of using this methodology when the sample group has limitations such as time constraints. The good/poor exemplars are then broken down into subgroups of good technical exemplars, good non-technical exemplars, poor technical exemplars and poor non-technical exemplars. These subgroups are then utilized to explore if the qualifications of the exemplars changes the outcomes of the descriptions using the constructs of three measures of leader style previously used with the good/poor exemplar sample.

This chapter closes with the answering of three of the ten research questions. The remainder of the research questions will be answered in Chapter 5 following the analysis of the results concerning the skills data.

5.1. *Demographics of both Reviewers and Exemplars*

This section explores the demographic data collected about the reviewer and their exemplars in part A of the methodology. This section confirms the strength of the reviewer sample and the good/poor exemplars which the reviewers have chosen to describe effective and ineffective leaders of infrastructure.

The strength of the reviewer sample is demonstrated by (1) their level within the organizational structure, and, (2) their years of experience in the infrastructure industry. The strength of the exemplars which the reviewers have selected as exemplars of good and poor leaders of infrastructure is demonstrated by (1) how many years the reviewers have known the exemplar; (2) the exemplar's level in the organization; (3) the exemplar's years of experience in the industry; (4) the size of the team that the exemplar is responsible for and the percentage of the followers who have technical qualifications and (5) rating the exemplars on a scale of effectiveness.

The research sample was a group of expert leaders known as reviewers. The reviewers provided background information about them and then commented on two leaders that they had worked for or with or had reported to. The reviewers were asked to nominate a "good" leader and a "poor" leader depending on that leader's effectiveness. The leaders described by the reviewers were designated "exemplars".

The reviewers were selected from asset businesses that were private or former government business which was privatized and/or public listed. All these businesses have been private for at least ten years after privatization. Government owned corporations (GOC) were not selected as a source of reviewers as they tend to reflect the traditional government organization. These private infrastructure businesses required the leadership to manage the competing demands of business/technical skills with a monopolistic business model.

The reviewers were chosen from the private infrastructure corporations and the selection criteria included:

- Experienced leaders in their own right with many years both as a leader and within the industry.
- Significant exposure to the leaders of the operational side of infrastructure which was dominated by engineering subculture.
- High enough in the level of organizational structure to ensure that the perceptions are based upon one to one relationships with the leader under review. (Typical of 360° approach to leadership reviews).
- Reviewers were to have technical (engineering/science/trade) or non-technical (finance/law/management) based qualifications. The selection was based upon their initial qualification.

5.1.1. Reviewer Demographics

The reviewers consisted of 46 participants and the summary to the demographics is shown below in table 50.

Table 50 Summary of Reviewer Demographics.

ATTRIBUTE	ALL REVIEWERS	TECHNICAL REVIEWERS	NON-TECHNICAL REVIEWERS
Number of reviewers	46	27	19
Mean Level in organization	3.5	3.3	3.8
% Male	96%	100%	90%
Mean number of years in industry	13 yrs	17 yrs	13 yrs
Mean number of years exemplar has been known by reviewer	6 yrs	6 yrs	6 yrs
% holding Technical Qualifications	59%	100%	0%
% holding a Bachelor of Engineering	48%	81%	0%
% MBA	15%	11%	21%

From table 50 all the reviewers had significant industry experience and had known the exemplar they had selected for review for a minimum of six years. Technical reviewers dominate the sample being 59% of the population. The definition of “technical” as used in this research is a reviewer with engineering or science or trade qualifications. There is a possibility that the reviewers qualifications may contribute to a bias towards leaders with similar qualification i.e. technical reviewers believe leaders with technical qualifications are the most effective leaders as implied by researchers such as Whitmore (2004) and Wolmar (2005). This potential for bias is explored in section 5.1.3.

The sample group, the reviewers, were chosen because they had one-to-one relationships with leaders at the top levels of infrastructure organizations within Australia. The interviews were conducted with 46 executives. No potential reviewers chose not to participate. All reviewers

except for one were able to provide two exemplars, one good and one poor, of leaders at the executive level. One reviewer could only provide a good exemplar and was unable to identify a poor exemplar hence the number of exemplars studied is 91 out of potentially 92. These reviewers, rather than having a subjective view of themselves and their description of successful leadership, are asked to describe two exemplars of success having worked one-to-one with these exemplars. Not only are these reviewers successful (having attained their current positions in the companies) but their roles require them to develop future leaders and assess current leaders hence provide a rich view of what infrastructure businesses deem effective executive leadership. In particular, they are familiar with the pressures and complexities that exist within infrastructure and the traditional 'engineer versus accountant as leader' debate post privatization or public listing.

Forty-four of the reviewers (96%) were male. Future researchers could explore the impact of a larger female sample population. The organizational level scores resulted in a mean of 3.5 which indicates that the reviewer sample is the senior manager or executive level. These reviewers have been working in the infrastructure industry for a mean of 13 years which would be expected of leaders at this high level of an organization.

The reviewers selected exemplars that they knew well but who could also not be career long colleagues. Fifty nine per cent (59%) of the reviewers (n=27) nominated that they have a primary technical background or qualification. The possibility of biases exists between these two review groups and this is explored in detail in section 5.1.3. This will determine if the review sample can be used in total or needs to be analysed as two subgroups i.e. technical reviewers and non-technical reviewers.

Table 51 Basic education distribution for the reviewer sample.

QUALIFICATIONS	NUMBER OF TECHNICAL REVIEWERS WITH THIS QUALIFICATION	NUMBER OF NON-TECHNICAL REVIEWERS WITH THIS QUALIFICATION	TOTAL
Bachelor – Engineering	22	0	22
Bachelor - Science	2	0	2
Bachelor – Finance	0	4	4
Bachelor – Commerce/Business	0	8	8
Bachelor - Other	0	3	3
Bachelor - TOTAL	24	15	39
MBA	3	4	7
Master’s degree	12	3	15
PhD	0	0	0
TOTAL Post Graduate qualifications	15	7	23

The majority (85%) of the reviewers hold a bachelor degree with half (50%) holding post graduate qualifications.

The next section explores the demographics of the exemplars that the reviewers have selected to describe good and poor leaders.

5.1.2. Exemplar Demographics

The reviewers were asked to select both a good and a poor exemplar of leadership. These exemplars needed to be people they knew well, at senior levels of infrastructure organizations

and who were responsible for the operational technical function of the organization. The reviewers were required to select an exemplar irrespective of the exemplar qualification.

Table 52 below summarizes the demographics of the exemplars and the various splits and subgroups to be analysed in the next sections.

Table 52 Demographics of Exemplars – broken into Good and Poor Exemplars.

	GOOD EXEMPLARS	POOR EXEMPLARS	TOTAL EXEMPLARS
n = Total number	49	42	91
Average level in organisation	4.1	4.0	4.1
% male	100%	91%	96%
Mean # years in Infrastructure industry	21	20	21
Mean # years known by Reviewer	8	5	6
% of exemplars with Technical background and qualifications	59%	41%	67%
Number of employees in team that exemplar is responsible to manage	1015	864	946
% of team with Technical background and qualifications	69%	67%	68%
Mean rating of exemplar	7.9	3.8	6.0

The exemplars were split into two subgroups, good and poor, based on the rating (1 worst to 10 best) attributed to them by their reviewer. This scale was chosen to provide a method by which the reviewers could rate their exemplars. A good exemplar was defined as one having a rating between 6 and 10 (10 being the best leader possible) while a poor exemplar was given a rating between 1 and 5 inclusive (1 being the worst leader possible). The exemplars could be further grouped into a further four subgroups: good technical (GT) exemplar, good non-technical (GNT)

exemplar, poor technical (PT) exemplar, and poor non-technical (PNT) exemplar depending upon their primary technical or non-technical background or qualifications. The table below summarizes the demographics of the four subgroups of exemplars.

Table 53 Demographics of Exemplars- broken into Good and Poor Technical and Non-technical Exemplars.

	GT EXEMPLAR	GNT EXEMPLAR	PT EXEMPLAR	PNT EXEMPLAR	TOTAL EXEMPLARS
n = Total number	36	13	25	17	91
Average level in organisation	4.1	4.2	4.0	4.0	4.1
% male	100%	100%	96%	82.4%	95.6%
Mean # years in Infrastructure industry	24	14	22	18	21
Mean # years known by Reviewer	8	7	4	6	6
% of exemplars with Technical background and qualifications	100%	0%	100%	0%	67.1%
Number of employees in team that exemplar is responsible to manage	1083	829	576	1288	946
% of team with Technical background and qualifications	72%	61%	67%	67%	68%
Mean rating of exemplar	7.9	7.9	3.8	3.7	6.0

The forty six reviewers selected a total of ninety one exemplars from infrastructure organizations. The sample size is strong and provides adequate numbers for the simple analysis required. The

GNT and PNT sample size is smaller and could represent the change of technical to non-technical leadership with the transition to privatization.

The exemplar sample demographics can be summarized as follows:

- The sample of exemplars is male dominated.
- The organizational level scores indicate that the sample is of exemplars working at the senior level – typically described as the executive level – mean being 4.1.
- The mean number of years, of the exemplars is 218 years working in the infrastructure industry sector is that which would be expected of leaders at this executive level. All of the subgroups of exemplars had means around 20 years except the GNT group which was only 14 years.
- Two thirds of the exemplars nominated have a primary technical background and/or qualifications. None the less, the remaining third (n=30) is an adequate sub-group sample size for analysis.
- The average size of the teams (mean = 946) employees for which the exemplars are accountable are large reflecting the executives level at which the exemplar operates.
- The competency base of the teams is dominated by technical background and skills. This is consistent with the nature of employees working in the infrastructure industry sectors.
- Although reviewers nominated good and poor exemplars the scores within each subgroup are spread across the respective halves of the ten point scale (1 to 5 for poor leaders and 6 to 10 for good leaders) indicating that the measure is achieving effective discrimination between good and poor exemplars and also within each subgroup. The table below highlights this distribution.

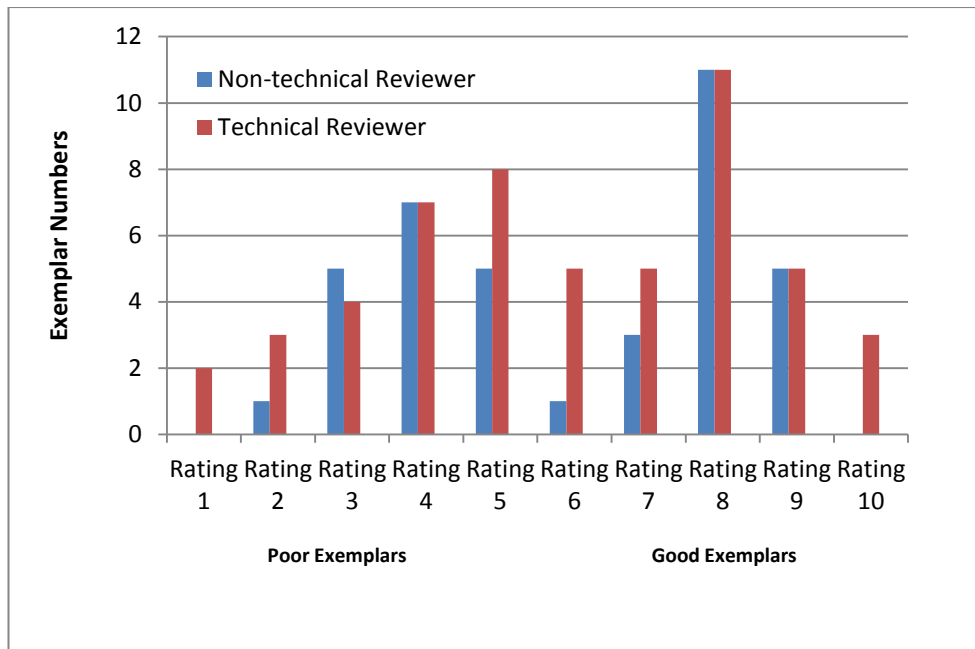


Figure 14 Total Exemplar Ratings depending on the type of Reviewer (technical or non-technical).

Table 54 below shows the qualifications for the exemplars groups.

Table 54 Basic Education distribution for the exemplar groups.

QUALIFICATIONS	GT	GNT	PT	PNT	GOOD TOTAL	POOR TOTAL	TOTAL
Bachelor – Engineering	28	0	19	0	28	19	47
Bachelor - Science	2	0	1	0	2	1	3
Bachelor – Finance	0	4	0	4	4	4	8
Bachelor – Commerce/Business	0	4	2	2	4	4	8
Bachelor - Other	7	0	4	0	7	4	11
Bachelor - TOTAL	37	8	26	6	45	32	77
MBA	12	7	5	5	17	12	29
Masters degree	4	0	4	0	4	4	8
PhD	0	0	5	0	0	5	5
TOTAL Post Graduate qualifications	16	7	14	5	21	21	42

The majority (85%) of the exemplar sample holds a bachelor degree with almost half (46%) holding post graduate qualifications. Note the demographics of exemplars education are almost identical as the reviewers sample at this level. The exemplars work in a variety of industry sectors as shown below in table 55.

Table 55 Infrastructure industry sectors that the good/poor exemplars work in.

INDUSTRY SECTOR	GOOD EXEMPLAR	POOR EXEMPLAR	TOTAL
Gas Transmission & distribution	20	16	36
Electricity Transmission & Distribution	5	5	10
Ports	4	5	9
Water	2	1	3
Rail	7	4	11
Gas/Electricity	11	11	22
TOTAL	49	42	91

Table 56 Infrastructure sectors that the subgroups exemplars work in

INDUSTRY SECTOR	GT EXEMPLAR	GNT EXEMPLAR	PT EXEMPLAR	PNT EXEMPLAR	TOTAL
Gas Transmission & distribution	16	4	8	8	36
Electricity Transmission & Distribution	5	0	5	0	10
Ports	2	2	2	3	9
Water	1	1	1	0	3
Rail	4	3	4	0	11
Multiple sectors (Gas/electricity)	8	3	5	6	22
TOTAL	36	13	25	17	91

Tables above show that all subgroups good/poor and GT/GNT/PT/PNT exemplars in the sample are spread across the industry sectors. It demonstrates that the expert reviewers did not allocate good and poor rating on the basis of the sector in which the exemplars worked. The pie chart below demonstrates graphically the distribution of the industry sectors that the reviewers worked in. These sectors reflect the history of sectors which are privately operated as an outcome of privatization. For example the majority of the sectors (75%) reflect the sectors of greatest

privatization i.e. electricity and gas (this also includes multi sectors which are composed of both gas and electricity.)

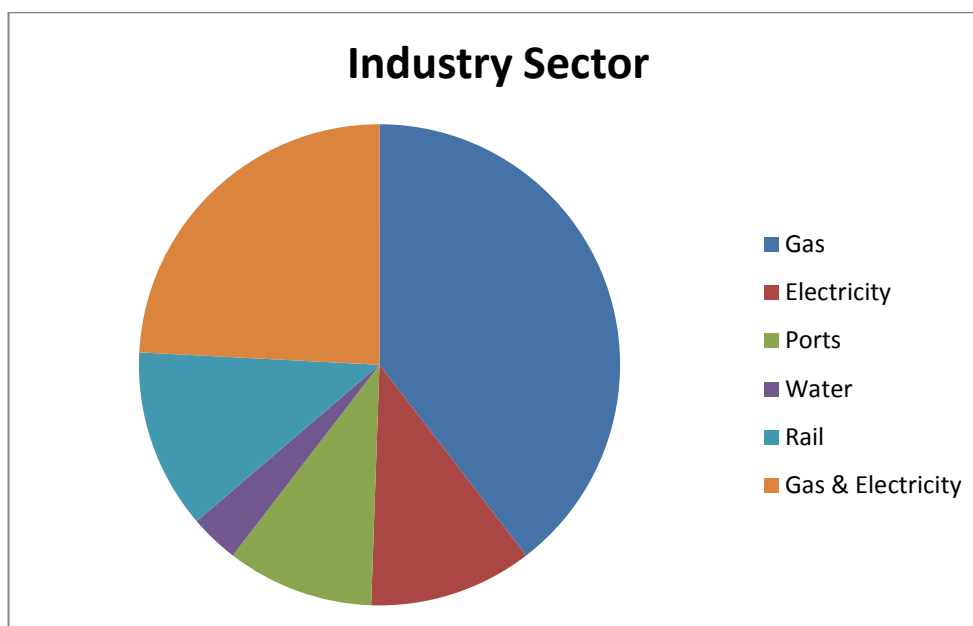


Figure 15 Distribution of industry sectors of exemplars.

The exemplars selected by the reviewers were required to be at the higher levels of the organization.

Table 57 Good/poor exemplar distribution across organizational levels.

LEVEL OF ORGANIZATION	GOOD EXEMPLAR	POOR EXEMPLAR	TOTAL EXEMPLAR
Level 5 - Board or MD	27%	12%	20%
Level 4 - Executive team or CEO	57%	76%	66%
Level 3 - Senior Management	16%	12%	14%
Level 2 - Supervisor	0%	0%	0%
Level 1 - Operational	0%	0%	0%
TOTAL	100%	100%	100%

Table 58 GT/PNT/PT/PNT exemplars distribution across organizational levels.

LEVEL OF ORGANIZATION	GT EXEMPLAR	GNT EXEMPLAR	PT EXEMPLAR	PNT EXEMPLAR	TOTAL EXEMPLAR
Level 5 - Board or MD	28%	23%	16%	6%	20%
Level 4 - Executive team or CEO	50%	77%	68%	88%	66%
Level 3 - Senior Management	22%	0%	16%	6%	14%
Level 2 - Supervisor	0%	0%	0%	0%	0%
Level 1 - Operational	0%	0%	0%	0%	0%
TOTAL	100%	100%	100%	100%	100%

The table above shows that all exemplars (a) were all at or above senior management level – with 86% of them at executive level or above; and (b) overall the 49 good exemplars were distributed 27% at Board/MD level, 57% at executive level and 16% at Senior Management level.

The expert reviewers selected a high standard of exemplars. The next section examines if a bias exists between the technical and non-technical reviewer sample. This is necessary prior to analysing the data in phases B and C of the methodology.

5.1.3. Bias with the Reviewer Sample

This section explores whether or not a bias existed within the reviewers due to their technical or non-technical background and/or qualifications. If no bias exists then the two samples can be utilized as one group rather than two groups.

The 46 reviewers were asked to describe the weighting of the five skills of an ideal leader for the 91 exemplars they had selected. Each skill was given a weighting out of 100%. The 27 technical reviewers (those with technical background and/or qualifications) described 53 ideal exemplars while the 19 non-technical reviewers described a further 38 ideal exemplars.

This ideal scale provides a ‘control’ or reference point to compare the results of good and poor exemplars. This is examined in detail in the next chapter.

Table 59 Ideal exemplar weightings described by the technical and non-technical reviewers.

SKILL WEIGHT % TIME SPENT	TECHNICAL SKILLS	PEOPLE SKILLS	STRATEGIC SKILLS	BUSINESS SKILLS	ADMINIST. SKILLS	TOTAL
Technical Reviewers ideal exemplars (n=53)	16.2%	29.8%	18.7%	24.3%	10.5%	100%
Non- technical Reviewers ideal exemplars (n=38)	17.2%	25.5%	22.0%	24.3%	10.5%	100%
All Reviewers ideal exemplars (n=91)	16.6%	28.0%	20.1%	24.3%	10.5%	100%

Table 60 Means and Standard Deviations for Ideal Leader - Skill Weighting Components by Reviewer at Time One.

SKILLS WEIGHTING	REVIEWER	NO.	MEAN	STD. DEVIATION
Technical Skills	Technical Reviewer	53	16.2	8.8
	Non-technical Reviewer	38	17.2	7.1
People Skills	Technical Reviewer	53	29.8	9.6
	Non-technical Reviewer	38	25.5	8.9
Strategic Skills	Technical Reviewer	53	18.7	8.8
	Non-technical Reviewer	38	22.0	7.8
Business Skills	Technical Reviewer	53	24.3	9.9
	Non-technical Reviewer	38	24.3	10.1
Administration Skills	Technical Reviewer	53	10.5	5.6
	Non-technical Reviewer	38	10.5	5.8

Both reviewer groups identified similar mean scores for the amount of time within each of the five skill functions of leadership. In the areas of business and administrative function the mean result were identical and a t-test for independent variables of the results shown below in table 61 confirms that the only significant result (<0.06) was in the function of people skills.

Table 61 Independent Samples t – Test for Skills Weighting and components by Reviewer at Time Two.

SKILLS WEIGHTING		LEVENE'S TEST FOR EQUALITY OF VARIANCES		T – TEST FOR EQUALITY OF MEANS		
		F	Sig.	t	df.	Sig. (2 tailed)
Technical Skills	Equal variances assumed	0.929	0.338	-0.548	89.000	0.585
	Equal variances not assumed			-0.568	87.685	0.572
People Skills	Equal variances assumed	0.318	0.574	2.169	89.000	0.033
	Equal variances not assumed			2.194	83.001	0.031
Strategic Skills	Equal variances assumed	1.924	0.169	1.852	89.000	0.067
	Equal variances not assumed			1.890	85.091	0.062
Business Skills	Equal variances assumed	0.100	0.920	-0.001	89.000	0.999
	Equal variances not assumed			-0.001	78.456	0.999
Administration Skills	Equal variances assumed	0.185	0.668	0.009	89.000	0.993
	Equal variances not assumed			0.009	77.808	0.993

The results in table 61 show the findings of the independent samples t-test conducted at time one. At time one, the only difference was found in people skills.

The emphasis on people by the technical reviewer is expected with their affinity with the majority operations group. Table 61 above highlights that the across four of the five functions for an ideal leader, that both reviewer populations can be considered homogeneous for the population to be considered as one sample group.

Thus for the remainder of the analysis of the exemplars the reviewer sample is considered as one.

The results and analysis of the phase a of the methodology demonstrates a number of attributes which illustrate the strength of the two sample groups, the reviewers and their exemplars. This strength is summarized below in table 62.

Table 62 Strength of the demographic elements for the reviewers and their exemplars.

DEMOGRAPHIC ELEMENTS	REVIEWERS	EXEMPLARS
Sample size is large enough for analysis.	YES n=46	YES n=91
Level in the organization is appropriate.	YES Mean = 3.5	YES Mean = 4.1
Years working in the industry to represent experience.	Mean = 13.4 years	Mean = 20.8 years
Number of years the reviewers worked with exemplars.	N/A	Mean = 6.3 years
Percentage with Bachelor degrees.	85%	85%
Percentage technical background and/or qualifications.	59%	67%

5.2. Phase B – Exemplar's Style Results

This phase of the methodology examines the reviewer's descriptions of the exemplars using a quality framework built upon constructs of three historical measures. This quality framework enabled the reviewers to describe their exemplars in the output description statements of three variables, LD, LI, and LB. For the LD variable the reviewer described their exemplars by selecting the top three statements (from eight statements) which best described their positive behaviours and the top three statements (from ten) which best describe their negative behaviours of leader derailment. The second variable, LI, the reviewer described their exemplar by again selecting the top three statements which best described the exemplar's proactive influence tactics (eleven statements). The final variable, LB, the reviewer selected from seven statements the one which best represented the exemplar's approach to leader behaviour when balancing focus on task and focus on people issues.

All three variables provide a categorical data set suitable for non-parametric analysis. The purpose of this phase was to confirm that the descriptions of the exemplars of infrastructure align to the descriptions of effective leadership from the general literature. This analysis will also support if using constructs of historical measures as part of the methodology is practical and systematic enough manner for research with senior executives with limited time available for the interview due to their schedules and commitments.

This section utilizes the exemplars sample and splits the sample group depending upon the rating of the leader. Good exemplars are defined as those with a score from the reviewers from 6 to 10 while poor exemplars are defined as those with a rating from 1 to 5. The demographics of the two groups were shown in the previous section. The score observations between the leaders rated good and poor leaders rated poor are summarized below:

- A higher percentage of good leaders have technical (59%) compared to poor leaders with only 41% having technical qualifications.
- Similar attributes included average level in organizations (4.1 compared to 4.0); average years in industry (21 years compared to 20 years); and follower characteristics (good leader – 1015 average number of followers with 69% technical background and poor leader – 864 average followers with 67% technical background).

The dominant difference between the two groups highlight that good leaders sample has a significantly higher percentage of technical background. These two groups are now compared through the constructs of three measures within phase B of this research selected to describe the characteristics of a good (i.e. effective leader).

5.2.1. Leader Derailment (LD)

This section analyses the good and poor exemplar sample using the first of three variables, leader derailment. The objective is to confirm whether or not the good/poor exemplars reflect the literature for leaders and their effective/ineffective descriptions and to identify any different descriptions due to the background of the exemplars.

The table below summarizes the results of the LD measure. Because it was necessary to make best use of the limited time available with reviewers only the top three characteristics of the leader were identified by the reviewer. Therefore the data does not allow a mean and standard deviation score to be completed for each element of LD. Furthermore most reviewers identified less than three characteristics as clearly applicable to either the good or the poor exemplar they reviewed. Some reviewers had difficulty in ascribing positive characteristics to poor exemplars and negative characteristics to good exemplars. In some instances the result was that no negative statements were ascribed to good exemplars and/or no positives were ascribed to poor exemplars.

The table below summarizes the results of the eight positive LD statements by measuring the percentage of times that a statement was selected as one of the top three statements which best describes the exemplar. The detail within the top three statements, i.e. the statement that was selected first, then second, then third, is recorded in Appendix 4. The grouping of the top three statements provides a ranked scale to compare with the other statements. As discussed previously some reviewers did not attribute a statement to the exemplar, they are recorded as 'no statement recorded' to make the data set complete.

Table 63 Good/Poor exemplar descriptions using the positive statements of the LD variable.

POSITIVE DESCRIPTORS OF LD VARIABLE	GOOD EXEMPLAR	POOR EXEMPLAR
Outstanding track record	18.9%	7.9%
Outgoing, well liked	11.6%	4.8%
Technically brilliant	11.6%	10.3%
Loyal and helpful to management	13.7%	11.9%
Willing to make sacrifices	6.8%	5.6%
Ambitious and managed career well	11.0%	21.4%
Moved up in reorganization or merger	4.2%	20.6%
Excellent at motivating or directing subordinates	21.9%	1.6%
<i>No recorded statement</i>	0.7%	15.9%
TOTAL	100%	100%

The positive statements above in table 63 highlight the percentage of times that the statement was utilized by the reviewer to describe the exemplars positive behaviours as part of the leader derailment variable. Subsequently the statements can be ranked in order of preference by these scores, the percentage of times they were selected by reviewers.

Table 64 Ranking of LD positive statements between good and poor exemplars.

GOOD EXEMPLAR n=49			POOR EXEMPLAR n=42	
Rank	Positive description of LD variable	Score %	Positive description of LD variable	Score %
1	Excellent at motivating or directing subordinates	21.9%	Ambitious and managed career well	21.4%
2	Outstanding track record	18.9%	Moved up in reorganisation or merger	20.6%
3	Loyal and helpful to Management	13.7%	<i>No statement recorded</i>	15.9%
4	Outgoing, well- liked	11.6%	Loyal and helpful to Management	11.9%
5	Technically brilliant	11.6%	Technically brilliant	11.9%
6	Ambitious and managed career well	11.0%	Outstanding track record	10.3%
7	Willing to make sacrifices	6.8%	Willing to make sacrifices	7.9%
8	Moved up in reorganisation or merger	4.2%	Outgoing, well- liked	5.6%
9	<i>No statement recorded</i>	0.7%	Excellent at motivating or directing subordinates	4.8%
		100%		100%

Table 64 above ranked the positive statements that the reviewer most utilized to describe their exemplars. For over 50% of the time the reviewers selected the following three statements to best describe the positive behaviours of the good exemplars:

- (1) They were excellent at motivating or directing subordinates.
- (2) They have outstanding track records.
- (3) They are loyal and helpful to management.

For the poor exemplars — who have nonetheless secured appointments to these executive levels of an organization — the reviewers had very different top three statements accounting for over 50% of the responses. The top responses were that these poor exemplars were:

- (1) Ambitious and managed their careers well.
- (2) They moved up in the organization or merger.
- (3) The reviewers chose not to select any of these positive statements.

The use of this scale highlights some observations about the reviewer's view of the exemplar. For a positive exemplar the reviewers could not select a positive statement in only 0.7% of the time while for the negative exemplars this was the third highest statement. In addition the highest ranked statement (21.9%) selected for positive exemplars was that they were excellent at motivating or directing subordinates while this same statement was the lowest rank (1.6%) for the negative exemplar. The following table summarizes the negative statements of leader derailment.

Table 65 Good/Poor exemplar descriptions using the negative statements of the LD variable.

NEGATIVE DESCRIPTORS OF LD VARIABLE	GOOD EXEMPLAR	POOR EXEMPLAR
Insensitive to others, abrasive, bully	3.4%	17.5%
Cold, aloof, arrogant	4.8%	9.5%
Betrayal of trust – ‘one-upping or failure to follow through’	2.0%	9.5%
Over managing – failure to delegate or build a team	8.8%	13.5%
Over –ambitious – always looking for next job, playing office politics	3.4%	11.9%
Failing to staff effectively – selecting poor people or recruiting not for the organisation	6.1%	15.1%
Unable to think strategically – over attention to detail	4.8%	8.7%
Unable to adapt to a Boss of a different style	10.9%	4.0%
Overdependence on an advocate or mentor	2.7%	5.5%
Pushing themselves too hard	12.9%	4.8%
<i>No statement recorded</i>	40.2%	0%
TOTAL	100%	100%

The negative statements above in table 65 highlight the percentage of times that the statement was utilized by reviewers to describe the exemplars negative behaviours as part of the leader derailment variable. Subsequently the statements can be ranked in order of preference by those scores.

Table 66 Ranking of LD negative statements between good and poor exemplars.

GOOD EXEMPLAR n=49			POOR EXEMPLAR n=42	
Rank	Negative description of LD variable	Score %	Negative description of LD variable	Score %
1	<i>No statement recorded</i>	40.2%	Insensitive to others, abrasive, bully	17.5%
2	Pushing themselves too hard	12.9%	Failing to staff effectively – selecting poor people or recruiting not for the organisation	15.1%
3	Unable to adapt to a Boss of a different style	10.9%	Over managing – failure to delegate or build a team	13.5%
4	Over managing – failure to delegate or build a team	8.8%	Over –ambitious – always looking for next job, playing office politics	11.9%
5	Failing to staff effectively – selecting poor people or recruiting not for the organisation	6.1%	Cold, aloof, arrogant	9.5%
6	Cold, aloof, arrogant	4.8%	Betrayal of trust – ‘one-upping or failure to follow through’	9.5%
7	Unable to think strategically – over attention to detail	4.8%	Unable to think strategically – over attention to detail	8.7%
8	Insensitive to others, abrasive, bully	3.4%	Overdependence on an advocate or mentor	5.5%
9	Over –ambitious – always looking for next job, playing office politics	3.4%	Pushing themselves too hard	4.8%
10	Overdependence on an advocate or mentor	2.7%	Unable to adapt to a Boss of a different style	4.0%
11	Betrayal of trust – ‘one-upping or failure to follow through’	2.0%	<i>No statement recorded</i>	0%
	TOTAL	100%	TOTAL	100%

Table 66 above ranked the negative statements of the good and poor exemplars by the reviewers. For the positive exemplars 40.2% of the time the reviewers were unable to select up to three negative statements to describe them. The highest negative statement that was selected by the reviewers was that these positive exemplars could be described as pushing themselves too hard. But for the poor exemplars, the reviewers always selected at least three statements to describe

their exemplars. The highest three negative statements — which accounted for almost fifty per cent of the responses — were that the poor exemplars were:

- (1) Insensitive to others, abrasive, bully (17.5%).
- (2) Failing to staff effectively – selecting poor people or recruiting not for the organization (15.1%).
- (3) Over managing – failure to delegate or build a team (13.5%).

The LD variable was able to be used to describe the good and poor reviewers and their different behaviours. The two groups are described by different statements which reflect the results from literature. This will be explored in greater detail in the following discussion chapter. The subgroup of this sample, GT, GNT, PT, and PNT had the following positive LD statements. They are ranked as previously with the good/poor sample.

Table 67 GT/GNT/PT/PNT exemplar descriptions using the positive statements of the LD variable.

GOOD TECHNICAL EXEMPLAR n=36			GOOD NON-TECHNICAL EXEMPLAR n=13		POOR TECHNICAL EXEMPLAR n=25		POOR NON-TECHNICAL EXEMPLAR n=17	
Rank	Positive description of LD variable	Score %	Positive description of LD variable	Score %	Positive description of LD variable	Score %	Positive description of LD variable	Score %
1	Excellent at motivating or directing subordinates	23.1	Outstanding track record	23.1	Ambitious and managed career well	20.0	Ambitious and managed career well	22.5
2	Outstanding track record	17.6	Ambitious and managed career well	20.5	Moved up in reorganisation or merger	20.0	Moved up in reorganisation or merger	21.6
3	Technically brilliant	13.9	Excellent at motivating or directing subordinates	17.9	<i>No statement recorded</i>	17.3	Loyal and helpful to Management	15.7
4	Loyal and helpful to Management	13.9	Outgoing, well-liked	12.8	Technically brilliant	12.0	<i>No statement recorded</i>	13.7
5	Outgoing, well-liked	11.1	Loyal and helpful to Management	12.8	Outstanding track record	9.3	Technically brilliant	7.8
6	Willing to make sacrifices	8.3	Technically brilliant	5.1	Loyal and helpful to Management	9.3	Outstanding track record	5.9
7	Ambitious and managed career well	7.4	Moved up in reorganisation or merger	5.1	Willing to make sacrifices	6.7	Outgoing, well-liked	5.9

GOOD TECHNICAL EXEMPLAR n=36			GOOD NON-TECHNICAL EXEMPLAR n=13		POOR TECHNICAL EXEMPLAR n=25		POOR NON-TECHNICAL EXEMPLAR n=17	
8	Moved up in reorganisation or merger	3.7	Willing to make sacrifices	2.6	Outgoing, well-liked	4.0	Willing to make sacrifices	3.9
	No statement recorded	0.9	No statement recorded	0.0	Excellent at motivating or directing subordinates	1.3	Excellent at motivating or directing subordinates	2.0
TOTAL		100%		100%		100%		100%

The table above displays how the reviewers described the four subgroups exemplars using the positive statements of the LD measure. The good and poor exemplars are split by their qualifications/background. The GT exemplars and GNT exemplars have similar descriptions but some differences do exist in the ranking of statements. GT exemplars highest rank statement, excellent at motivating or directing subordinates (23.1%) was the third highest statement (17.9%) for the GNT exemplars. This may reflect the fact that the GT exemplars had the same background/qualifications as the majority of the workplace. The GNT exemplars highest rank statement, outstanding track record (23.1%) was the second highest statement for the GT exemplar. The PT and PNT exemplars share the same two highest rank statements with different scores i.e.:

- (1) Ambitious and managing career well.
- (2) Moved up in reorganization or merger.

They also share the same lowest rank statement, excellent at motivating or directing subordinates.

The negative statements of LD are also ranked and are shown below.

Table 68 GT/GNT/PT/PNT exemplar descriptions using the positive statements of the LD variable.

GOOD TECHNICAL EXEMPLAR n=36			GOOD NON-TECHNICAL EXEMPLAR n=13		POOR TECHNICAL EXEMPLAR n=25		POOR NON-TECHNICAL EXEMPLAR n=17	
Rank	Negative description of LD variable	Score %	Negative description of LD variable	Score %	Negative description of LD variable	Score %	Negative description of LD variable	Score %
1	No statement recorded	35.2	No statement recorded	53.8	Insensitive to others, abrasive, bully	20.0	Failing to staff effectively – selecting poor people or recruiting not for the organisation	19.6
2	Unable to adapt to a Boss of a different style	13.9	Pushing themselves too hard	12.8	Over managing – failure to delegate or build a team	13.3	Insensitive to others, abrasive, bully	13.7
3	Pushing themselves too hard	13.0	Over managing – failure to delegate or build a team	10.3	Betrayal of trust – ‘one-upping or failure to follow through’	12.0	Over managing – failure to delegate or build a team	13.7
4	Over managing – failure to delegate or build a team	8.3	Cold, aloof, arrogant	7.7	Failing to staff effectively – selecting poor people or recruiting not for the organisation	12.0	Over –ambitious – always looking for next job, playing office politics	13.7
5	Failing to staff effectively – selecting poor people or recruiting not for the organisation	7.4	Insensitive to others, abrasive, bully	5.1	Cold, aloof, arrogant	10.7	Unable to think strategically – over attention to detail	13.7
6	Unable to think strategically – over attention to detail	6.5	Over –ambitious – always looking for next job, playing office politics	2.6	Over –ambitious – always looking for next job, playing office politics	10.7	Cold, aloof, arrogant	7.8
7	Cold, aloof, arrogant	3.7	Failing to staff effectively – selecting poor people or recruiting not for the organisation	2.6	Overdependence on an advocate or mentor	6.7	Betrayal of trust – ‘one-upping or failure to follow through’	5.9

GOOD TECHNICAL EXEMPLAR n=36			GOOD NON-TECHNICAL EXEMPLAR n=13		POOR TECHNICAL EXEMPLAR n=25		POOR NON-TECHNICAL EXEMPLAR n=17	
8	Over –ambitious – always looking for next job, playing office politics	3.7	Unable to adapt to a Boss of a different style	2.6	Unable to think strategically – over attention to detail	5.3	Pushing themselves too hard	5.9
9	Insensitive to others, abrasive, bully	2.8	Overdependence on an advocate or mentor	2.6	Unable to adapt to a Boss of a different style	5.3	Overdependence on an advocate or mentor	3.9
10	Betrayal of trust – ‘one-upping or failure to follow through’	2.8	Betrayal of trust – ‘one-upping or failure to follow through’	0.0	Pushing themselves too hard	4.0	Unable to adapt to a Boss of a different style	2.0
11	Overdependence on an advocate or mentor	2.8	Unable to think strategically – over attention to detail	0.0	<i>No statement recorded</i>	0.0	<i>No statement recorded</i>	0.0
	TOTAL	100%		100%		100%		100%

For the GNT exemplar, over 50% of the time, the reviewer could not select up to three negative statements. For the GT exemplars this also occurred but for only 35.2% of the time. Their next highest statement was that they were unable to adapt (13.9%) followed by pushing too hard (13.0%) which is the similar score as for the GNT exemplar for the same statement. The PT and PNT exemplars were described using similar negative statements for the two poor exemplar groups. The PT exemplar was 'insensitive to others, abrasive, bully' (20.0%); over managing – failure to delegate or build a team (13.3%) and betrayal of trust (12.0%). The PNT exemplar was similar but ranked number one was failing to staff effectively (19.6%); insensitive to others, abrasive, bully (13.7%) and over managing – failure to delegate or build a team (13.7%). Along with the last two statements another two statements had the same score as the second/third highest score.

The descriptions of the exemplar sample using the LD measure have identified a number of key observations:

1. Reviewers were able to use the methodology and select up to three descriptions for their exemplars. In 15.9% of the time the reviewers could not attribute three positive statements to the poor exemplars and 40.1% of the time they could not attribute three negative statements to the good exemplars. This indicates that the two sample groups, good and poor align with descriptions of effective/ineffective leadership. Effective leaders (good leaders) would not be expected to have as many negative descriptions (59.9%) as the ineffective leaders (poor leaders) which had 100% of the time. And the reciprocal, for the effective leaders the reviewers were able to attribute good descriptions in 99.3% of the time and for the poor or ineffective leaders the score reduced to 84.1%. The ineffective leaders at this level are successful and this success is reflected in them being able to be described with up to three positive statements.
2. Success for the poor exemplars appear to be career focussed and reflected the poor exemplars managing their careers (21.4%) and/or moving up in a merger (20.6%). The success of the good exemplars appears to be more delivery/outcome focussed — excellent at networking (21.8%) and/or outstanding track record (19.0%) which leads to their careers being successful.
3. GT exemplars appear to be slightly more focussed on motivating employers (23.1%) compared to the GNT exemplars (17.9%) who tended to have a higher ranking on delivery, outstanding track record (23.1%) compared to GT (17.6%). This may be a people focus by the GT exemplar compared to business focus by the GNT exemplar.

Both have them at highest descriptors but in reverse order. This people focus, excellent at motivating or directing subordinates, is the lowest ranked description for both PT (1.3%) and PNT (2.0%) exemplar groups.

4. On the negative derailment scale the highest ranked statements point towards some interesting observations for the four subgroups.
 - GT — ‘unable to adapt to a new boss of a different style’ (13.9%) points toward the technical leader dealing with the new business focus. Note the GNT leader had a much lower score at 2.6%.
 - GNT — ‘pushing themselves too hard’ (12.8%) was similar to GT (13.0%) score. For most statements the GNT leader had similar scores as the GT exemplars.
 - PT — ‘Insensitive to others, abrasive and bully’ (20.0%) reinforces the previous low positive score for the excellent at networking (1.3%).
 - PNT — ‘failing to staff effectively’ (19.6%) points towards the exemplars being more comfortable with people they can trust not necessarily those that can deliver.
5. Using LD measure in this modified methodology highlighted the consistency of the approach and the exemplars — good exemplars reflected effective leadership and poor exemplars reflected ineffective leadership.

5.2.2. Leader Influence (LI) variable

This section analyses the good and poor exemplar sample through the prism of the leader influence measure. The LD assessment confirmed that the good/poor exemplars reflect the effective leader literature. This variable is to also confirm if good/poor exemplars reflect the literature and if any differences exist in the descriptions between those exemplars with and without technical background/qualification. As in the LD assessment, the reviewers were asked to select the top three statements of the eleven statements of the leader influence measure. The table below summarizes the results and the ranking of the eleven statements for good/poor exemplar sample.

Table 69 Good/poor exemplar description using the statements of the LI variable.

GOOD EXEMPLAR n=49			POOR EXEMPLAR n=42	
Rank		Score %		Score %
1	Rational Persuasion	26.5	Legitimizing Tactics	26.2
2	Consultation	20.4	Pressure	17.5
3	Collaboration	17.0	Apprising	11.9
4	Inspirational Appeals	14.3	Coalition Tactics	11.9
5	Ingratiation	6.1	Rational Persuasion	7.9
6	Apprising	5.4	Ingratiation	7.1
7	Legitimizing Tactics	4.1	Inspirational Appeals	5.6
8	Pressure	2.7	Exchange	4.8
9	<i>No statement recorded</i>	1.4	Personal appeals	3.2
10	Personal appeals	0.7	Consultation	1.6
11	Exchange	0.7	Collaboration	1.6
12	Coalition Tactics	0.7	<i>No statement recorded</i>	0.8
	TOTAL	100%	TOTAL	100%

The LI statements in the table above are ranked in the same manner as the LD statements. The statements are ranked by the percentage of time the statements were selected as one of the three top statements which best describes the exemplar. Further detail regarding the number of time each statement was chosen in order i.e. 1st, 2nd, or 3rd is recorded in Appendix 4. This analysis examines the total number of times not the order, that the statement is selected by the reviewer.

Similar to the LD scale in the previous section, the LI scale demonstrated that the good exemplars are described using statements reflect that those of effective leaders and the ineffective exemplars are described by less effective influences statements. Unlike the LD measure the LI measure is one scale of positive and negative statements rather than two separate scales as in LD, a set of positive statements and a set of negative statements.

The percentage of times that a reviewer was unable to select a statement is very low at less than 1.5% for both cases which is similar to what was found in the LD scale when good exemplars were described by the positive LD statements and vice versa for the poor exemplars.

The overall results from table 69 demonstrate that the good exemplars are described by the effective approaches of influence. 60% of the time the reviewers described that these good exemplars used rational persuasion (26.5%), consultation (20.4%) and collaboration (17.0%). The same reviewers described their poor exemplars utilizing ineffective approaches of legitimating tactics (26.2%) and pressure (17.5%) and one effective approach, namely, apprising (11.9%). Again as in LD assessment, these poor exemplars must have some effective approaches. These poor exemplars are not entirely ineffective as they have reached these executive levels. Promotion or appointment to a higher level is dependent on the quality of the poor available (Yukl 2009). The results from dividing the two samples into those with and those without technical background/qualifications are shown in table 70 below.

Table 70 GT/GNT/PT/PNT exemplar description using the statement of the LI variable.

GOOD TECHNICAL EXEMPLAR n=36			GOOD NON-TECHNICAL EXEMPLAR n=13		POOR TECHNICAL EXEMPLAR n=25		POOR NON-TECHNICAL EXEMPLAR n=17	
Rank		Score %		Score %		Score %		Score %
1	Rational Persuasion	25.9	Rational Persuasion	28.2	Legitimizing Tactics	25.3	Legitimizing Tactics	27.5
2	Consultation	21.3	Consultation	17.9	Collaboration	17.3	Collaboration	17.6
3	Collaboration	16.7	Collaboration	17.9	Coalition Tactics	13.3	Apprising	11.8
4	Inspirational Appeals	13.9	Inspirational Appeals	15.4	Apprising	12.0	Inspirational Appeals	11.8
5	Ingratiation	7.4	Apprising	10.3	Rational Persuasion	9.3	Coalition Tactics	9.8
6	Apprising	5.4	Legitimizing Tactics	5.1	Ingratiation	8.0	Rational Persuasion	5.9
7	Legitimizing Tactics	3.7	Ingratiation	2.6	Exchange	6.7	Ingratiation	5.9
8	Collaboration	3.7	Exchange	2.6	Consultation	2.7	Personal Appeals	3.9
9	<i>No statement recorded</i>	1.9	Personal Appeals	0.0	Personal Appeals	2.7	Collaboration	2.0
10	Personal Appeals	0.9	Coalition Tactics	0.0	Inspirational Appeals	1.3	Exchange	2.0
11	Coalition Tactics	0.9	Collaboration	0.0	Collaboration	1.3	<i>No statement recorded</i>	2.0
12	Exchange	0.0	<i>No statement recorded</i>	0.0	<i>No statement recorded</i>	0.0	Consultation	0.0
	TOTAL	100%		100%		100%		100%

The table above displays the results of the subgroups of good and poor leaders. For the two good exemplar groups, GT and GNT, they are described and in same rank for the first four statements which account for over 75% of the responses. All four statements are effective approaches of influence. There are differences within the remainder of the statements but the scores only account for less than 25% of the responses when compared to the first four statements. For the poor exemplar groups, PT and PNT, the similarities are not as strong as the good exemplar groups but the two highest statements which are the two most ineffective approaches, legitimating tactics and pressure, account for the majority of the statements with over 40% of the responses. The impact of the technical/non-technical background/qualifications is less marked than that for the LD measure. The methodology appears to provide a level of granularity but a test for significance could be future research.

The key finding of using the LI measure in this way has again shown that the methodology appears to be able to identify effective and ineffective leaders through their descriptions of leadership influence. In addition the good and poor exemplars were described in similar ways as those of effective and ineffective leaders of literature. The influence of technical/non-technical background/qualifications does not appear to modify the rank of descriptions the exemplars.

5.2.3. Leader Behaviour (LB) variable

The previous two sections, LD and LB have supported that the reviewer's exemplars have descriptions similar to those of effective and ineffective leaders of literature. The methodology of selecting the top three statements from the output statements of historical measures appears to be sound. The third measure selected as part of phase B of the methodology was the GRID® measure the leadership behaviour when balancing people and task issues. Rather than selecting the top three statements, the reviewer was required to select the leadership style the exemplar tended to utilize in the majority of cases. The table below displays the results of using this approach for the good and poor exemplars.

Table 71 The results of leadership styles of the good and poor exemplars.

GRID® DESCRIPTIONS	GOOD EXEMPLAR n=49	POOR EXEMPLAR n=42
9,1 Controlling Results	4.1%	40.5%
1,9 Accommodating People	6.1%	11.9%
5,5 Status Quo	16.3%	0.0%
1,1 Indifferent	0.0%	19.0%
Paternal Prescribe & Guide	32.6%	2.4%
Opportunistic Exploit & Manipulate	6.1%	23.8%
9,9 Contribute & Commit	34.7%	2.4%
<i>Did not select a style</i>	0.0%	0.0%
TOTAL	100%	100%

In table 71 above it can be clearly seen that the majority of good exemplars, accounting for over 80% of exemplars, were described using one of three effective leadership styles, namely, 9,9 Contribute and Commit (34.7%), Paternal – Prescribe and guide (32.6%) or 5,5 Status-quo (16.3%). In contrast the overwhelming majority of poor exemplars — over 80% — were described using the ineffective leadership styles of 9,1 controlling – results (40.5%), Opportunistic – exploit and manipulate (23.8%) and 1,1 Indifferent (19.0%). The exemplars also reflect the descriptions of literature. Table 72 below explores if the subgroup of technical/non-technical impacts the leadership style ranking and scores.

Table 72 The results of leadership styles of the GT, GNT, PT, and PNT exemplars.

	GOOD TECHNICAL EXEMPLAR (GT)		GOOD NON-TECHNICAL EXEMPLAR (GNT)		POOR TECHNICAL EXEMPLAR (PT)		POOR NON-TECHNICAL EXEMPLAR (PNT)	
	n=36		n=13		n=25		n=17	
Rank	Style	%	Style	%	Style	%	Style	%
1	9,9	33.3	9,9	38.5	9,1	48.0	9,1	29.4
2	9+9	33.3	9+9	30.8	Opportunistic	24.0	Opportunistic	23.5
3	5,5	13.9	5,5	23.0	1,1	20.0	1,9	23.5
4	1,9	12.2	Opportunistic	7.7	1,9	4.0	1,1	17.6
5	Opportunistic	5.6	1,9	0	9,9	4.0	9+9	5.9
6	9,1	5.6	9,1	0	5,5	0	5,5	0
7	1,1	0	1,1	0	9+9	0	9,9	0
8	No style selected	0	No style selected	0	No style selected	0	No style selected	0
	TOTAL	100%		100%		100%		100%

The results of the four subgroups did not display any material differences in their ranking for the 80% of the results in for good exemplar subsets and for over 50% of the results in the poor exemplar subgroups.

The key findings of this final assessment again confirm that the good exemplars are described using effective leadership styles while the poor exemplars display ineffective leadership styles. It also highlights that successful leaders, those who have made it to executive levels of infrastructure organization can still have ineffective leadership styles.

5.3. Conclusions

This chapter explored the demographics of the reviewers and confirmed that they were at executive level. Comparison of the two reviewer subgroups (technical and non-technical) identified only one skill as having significant difference in their weighting of ideal skills. Therefore the reviewer sample and their exemplars were analysed as being from one sample group.

The reviewer's exemplars (n=91) demographics confirmed that they were also at executive level of infrastructure business and that they could be split into two major groups good (n=49) and poor (n=42) exemplars and further subset groups based on technical/non-technical background/qualifications. The major sample group (good/poor) and their subgroups (GT, GNT, PT, PNT) had descriptions based on the constructs of the three historical measures as previously selected in phase B of the methodology, LD, LI, and LB.

Results from using the constructs on all three measures confirmed that the good exemplars described by the reviewers match the descriptions of effective leadership and vice versa for the poor exemplars. Therefore the exemplars of leadership within infrastructure have similar descriptions for the poor exemplars. Thus the exemplars of leadership within infrastructure have similar descriptions to the literature of effective leadership.

This research's methodology of selecting and utilizing the constructs of historical measures to describe the exemplars has proven to be a practical and efficient method of eliciting data from this expert reviewer group. Their exemplar descriptions aligned with literature.

The results of this chapter have confirmed that the reviewers are an expert group and that they have chosen executive exemplars which align to the descriptions of effective or ineffective leadership of general literature. The following chapter explores the results of the skill assessments for the good and poor exemplars and the subgroup exemplars GT (good technical), GNT (good non-technical), PT (poor technical), and PNT (poor non-technical).

6. Results – Exemplar skill assessment and semi-structured interview (phase C & D)

The previous chapter presented the results for phases A and B of the methodology. This chapter focuses on the final two phases, the quantitative phase on Leadership skills and the qualitative phase which explores additional insights of this expert reviewer group. The first two phases of the methodology confirmed that the reviewers and their exemplars were strong samples.

The results of using three historical measures of effective leadership proved that the good and poor exemplars had similar descriptions from literature. The measures also identified some differences in descriptions of the exemplar group when examining the subgroup of technical/non-technical background/qualifications: GT, GNT, PT, and PNT exemplars.

The skill assessment further explores the differences of this exemplar subgroup compared to the ideal exemplar as previous described in Chapter 5.2. The skill assessment enables simple analysis to determine if significant differences exist between the subgroups and when compared to the ideal exemplar scale.

The leader skill (LS) assessment records a number of attributes, in particular:

- Dominant skill rating for an ideal exemplar and the actual skill ranking for the exemplar under consideration at their particular level in the organization; and
- Skill weighting i.e. the amount of time an exemplar spends on a particular skill/task, for both an ideal and actual exemplar at their particular level in the organization.

For the skill rating element of the LS assessment a mean and standard deviation can be calculated for each of the five skills (technical, people, strategic, business, and administrative). The mean is calculated using the number of times the reviewer ranked the skill for ‘1’ (being the most important) to ‘5’ (being the least important). The ideal leader score provides an additional reference point for the analysis of the LS assessment.

6.1. Skill Ranking

The first skill assessment is to determine if the five skills have a particular ranking and if the ranking varies with the exemplar groupings and/or the level of the organization. Reviewers

provided an ideal exemplar description for each historical exemplar they described. The table below displays the results of the five skills for the ideal exemplars for each level.

Table 73 Skill ranking for the executive levels using ideal exemplar data.

IDEAL EXEMPLARS (n=91) & SKILL RANKING (1 TO 5)	SKILLS	MEAN \bar{x}	STANDARD DEVIATION σ	RATING
Level 5 (n=18)	Technical	4.1	0.8	4
	People	2.3	0.8	3
	Strategic	12.2	1.2	2
	Business	1.9	1.0	1
	Administrative	4.4	1.0	5
Level 4 (n=60)	Technical	3.8	0.7	4
	People	2.0	0.8	1
	Strategic	2.1	1.2	2
	Business	2.3	1.0	3
	Administrative	4.8	0.5	5
Level 3 (n=13)	Technical	43.4	1.0	4
	People	1.9	1.0	1
	Strategic	2.9	1.3	3
	Business	2.1	1.0	2
	Administrative	4.7	0.9	5
All Levels (n=91)	Technical	3.8	0.8	4
	People	2.0	0.8	1
	Strategic	2.35	1.2	3
	Business	2.2	1.0	2
	Administrative	4.7	0.7	5

The table above ranks the five skills for the ideal exemplars at each level. The table below presents the ranking of the five skills across the three levels.

Table 74 Skill rating of ideal exemplar across the three senior levels of infrastructure.

IDEAL EXEMPLAR RATING	TECHNICAL	PEOPLE	STRATEGIC	BUSINESS	ADMIN.
Level 5 (n=18)	4	3	2	1	5
Level 4 (n=60)	4	1	2	3	5
Level 3 (n=13)	4	1	3	2	5
All Levels (n=91)	4	1	3	2	5

The results of the ideal exemplar in the table above shows that at all levels from 3 to 5 technical skills and administrative skills are ranked 4 and 5 respectively. The ideal exemplar has people rated 1 until the Board level (5) and then it becomes third. Business skills starts as a ranking of 2 at level 3, as the ideal leader moves up from senior management to executive level (level 4) people skills remain ranked 1, the business skills become ranked 3 while the strategic skills move from 3 to 2. At the Board level business skilled are ranked number 1, followed by strategic and then people skills.

Key findings of the ideal exemplar and the ranking of the skills are as follows:

- Ranking of people, strategic and business skills change across levels 3 to 5. This may suggest a change of focus. At levels 3 and 4 the exemplars are required to lead and be responsible for large numbers of people, hence people skills ranked 1. While as the exemplars move from senior roles (level three) dealing with operational and delivery issues to level four the roles become more strategic and goal setting hence strategic skills change from rating 3 to 2. At the Board level the responsibility of the people and strategy is with the executive team. The board reflects a focus on business performance and

governance for all shareholders. Hence business skills especially corporate finance and governance become ranked 1 while strategic and people skills are 2 and 3.

- All reviewers accepted the need for technical and administrative skills at all levels and they had the same ranking for all three. Relative to the other three skills, technical and administrative skills are important but not ranked higher at these levels. Further research is required to determine if this is the case for levels 2 and 1.
- Reviewer's ability to describe the ideal exemplar using only the five skills presented supports that the five skills selected provide sufficient coverage for the roles at these levels.

The ideal exemplar provides a reference point or a control and this is explored in more detail when the *weighting* of the skill rather than its *rating* is examined further in this chapter.

The reviewers also provided data on their exemplars skill ranking. The table below shows the results of the good/poor exemplars and for reference the ideal exemplar rankings for all exemplars.

Table 75 Results of leader skill assessment – skill ranking for ideal, good and poor leaders – all levels.

SKILL RANKING	IDEAL EXEMPLAR (N=91)		GOOD EXEMPLAR (N=49)		POOR EXEMPLAR (N=42)	
	Mean \bar{x}	Standard deviation σ	Mean \bar{x}	Standard Deviation σ	Mean \bar{x}	Standard Deviation σ
Technical	3.8	0.8	3.3	1.2	3.0	1.6
People	2.0	0.8	2.3	1.4	4.1	1.2
Strategic	2.3	1.2	2.5	1.1	3.1	1.2
Business	2.2	1.0	2.4	1.2	2.2	1.0
Administrative	4.7	0.7	4.5	1.0	2.6	1.4

The table displays the ranking of the skills for good and poor exemplars using all levels. A t-test confirms that the significant difference exist between the good and poor exemplars in their ranking of people, strategic and administrative. This is captured below in table 76.

Table 76 Independent t-test for skills ranking, good/poor exemplars.

SKILL RANKING	GOOD/POOR EXEMPLARS	NUMBER IN GROUP	MEAN	STANDARD DEVIATION'	T-TEST (SIGNIFICANT <0.05)
Technical	Good	49	3.33	1.162	>0.05
	Poor	42	2.98	1.554	>0.05
People	Good	49	2.31	1.388	0.000
	Poor	42	4.07	1.177	0.000
Strategic	Good	49	2.51	1.102	0.016
	Poor	42	3.10	1.165	0.016
Business	Good	49	2.39	1.169	>0.05
	Poor	42	2.21	1.048	>0.05
Administrative	Good	49	4.47	0.960	0.000
	Poor	42	2.64	1.428	0.000

The data can be simplified by ranking the skills and scoring them 1 to 5, this is shown below in table 77.

Table 77 Skill Score for ideal, good and poor exemplars across all levels.

LEVEL OF ORGANIZATION	SKILL TYPE	SCORE		
		Ideal exemplar	Good exemplar	Poor exemplar
All Levels	Technical	4 th	4 th	3 rd
	People	1 st	1 st	5 th
	Strategic	3 rd	3 rd	4 th
	Business	2 nd	2 nd	1 st
	Administrative	5 th	5 th	2 nd

The ranking data identifies a number of observations:

- Ideal and good exemplars display the same ranking of skills.
- Poor exemplar skill was highest in business which may explain their success to these levels.
- Poor exemplars skill was lowest with people which may explain the reviewer's perception of their being an ineffective leader.

The table below shows the data for the subgroups of exemplars GT, GNT, PT, and PNT and how the reviewers ranked their skills across all levels.

Table 78 Skill ranking for the GT, GNT, PT, and PNT exemplars using all levels data.

ACTUAL SKILL RANKING ALL LEVELS	GT EXEMPLAR (N=36)		GNT EXEMPLAR (N=13)		PT EXEMPLAR (N=25)		PNT EXEMPLAR (N=17)	
Skills	\bar{x}	σ	\bar{x}	σ	\bar{x}	σ	\bar{x}	σ
Technical	3.1	1.2	3.9	0.9	2.4	1.3	3.8	1.5
People	2.1	1.4	2.9	1.4	4.5	0.9	3.5	1.3
Strategic	2.6	1.2	2.4	0.9	3.0	1.3	3.9	1.0
Business	2.7	1.2	1.5	0.7	2.3	1.1	2.1	1.0
Administrative	4.5	0.9	4.3	1.2	2.8	1.4	2.4	1.5

Table 79 Skill ranking of GT, GNT, PT, and PNT scored using 1 to 5.

SKILLS	GT EXEMPLAR (N=36)	GNT EXEMPLAR (N=13)	PT EXEMPLAR (N=25)	PNT EXEMPLAR (N=17)
Technical	4 th	4 th	2 nd	5 th
People	1 st	3 rd	5 th	4 th
Strategic	2 nd	2 nd	4 th	3 rd
Business	3 rd	1 st	1 st	1 st
Administrative	5 th	5 th	3 rd	2 nd

The rerated scores for the skills shown above simplify the differences between the subgroups of exemplars. The GT and GNT exemplars have the same score for technical, administrative and strategic skills. The differences are around people and business skills which align with their technical background i.e. GT exemplar would have more alignment with technical workforce while GNT exemplars are more aligned with business outcome. Both the PT and PNT exemplar groups have business skills as top ranking which represents why the exemplars, although rated poor, have been able to get to this level of the business. After this skill both groups move towards their ‘technical’ skill area. For PT exemplars it is to the technical part of the business while the administrative side of a business, the systems and processes of the business can be seen as the ‘technical’ area for the non-business exemplars. This fact was identified by a number of the reviewers in the qualitative phase of the interview and will be discussed later. Both groups, PT

and PNT, are seen as having low people skills — 5 and 4 respectively. It would appear that PT exemplar's people skills are not seen as an enabler as in the case for GT exemplars.

Ranking of the skills does provide some discussion around the subgroups and why they are perceived this way by their reviewers. These observations are further discussed in the next chapter. The next section explores in more detail the skills through the second scale, namely, skill weighting, or how much time the exemplar spends using the skill.

6.2. Skill Weighting

The second skill assessment is the weighting, the amount of time that an exemplar spent applying the five skills in the course of performing his role during the year. The scale for this assessment is percentage of time with the total time being 100%. Again the reviewers provided with their exemplars an ideal exemplar which provides a reference point for comparing the good/poor exemplar groups. The ideal skill weighting was used initially in section 5.1.3 to demonstrate that both reviewer samples, technical and non-technical, could be treated as one group for analysis and not two. As in the previous section on skill ranking, the skill weighting of the five skills varies across each level of the organization. The table below shows the data for each skill across the three levels of the ideal exemplars for their weightings out of a total 100%.

Table 80 Skill weighting for the three executive levels using the ideal exemplar data.

IDEAL EXEMPLARS (n=91) & SKILL WEIGHTING (/100%)	SKILLS	MEAN \bar{x}	STANDARD DEVIATION σ
Level 5 (n=18)	Technical	14.2	9.6
	People	29.7	10.8
	Strategic	21.1	8.8
	Business	23.9	11.6
	Administrative	9.4	6.4
Level 4 (n=60)	Technical	15.7	5.8
	People	27.8	9.4
	Strategic	21.1	8.4
	Business	24.1	9.4
	Administrative	11.0	5.6
Level 3 (n=13)	Technical	24.2	10.8
	People	26.5	8.5
	Strategic	13.9	5.5
	Business	26.2	10.6
	Administrative	9.2	4.5
All Levels (n=91)	Technical	16.6	8.1
	People	28.0	9.5
	Strategic	20.1	8.5
	Business	24.3	9.9
	Administrative	10.5	5.6

The data above for the ideal leader demonstrates that the amount of time varies not only for each skill but for each level. This is consistent with the intent of Badawy's (1982) MSM model. As previously discussed in Chapter 3, the five skills selected are based primarily on Katz's (1955) work. Badawy's work also builds upon three skills to create his representation of the change of skill weighting across the levels. The table below compares the results from the ideal exemplars and Badawy's diagram. Because Badawy's (1982) diagram has no actual data to support the MSM model, a comparison is made by scaling values from Badawy's model. The scaled value and the ideal leader scores are shown in the table below.

Table 81 Comparison of the ideal exemplar skill weightings for level 4 and 3 compared against the extrapolated values of technical, interpersonal and cognitive/administrative skill for two levels of Badawy's (1982) MSM diagram.

BADAWY'S SKILLS SETS					
Badawy (1982) Managerial Skill Mix (MSM)		Technical Skills	Interpersonal skills (people)	Cognitive and Administrative skills (business, strategic and administrative)	TOTALS
Executive level (Equates to level 4 of ideal exemplar)	Scaled results from Badawy MSM diagram	7%	39%	54%	100%
	Ideal exemplar – level 4	16%	28%	56%	100%
Middle manager level (Equates to level 3 of ideal exemplar)	Scaled results from Badawy MSM diagram	19%	56%	25%	100%
	Ideal exemplar – level 3	24%	27%	50%	100%

The data above can be conceptually compared to Badawy's MSM diagram as shown below.

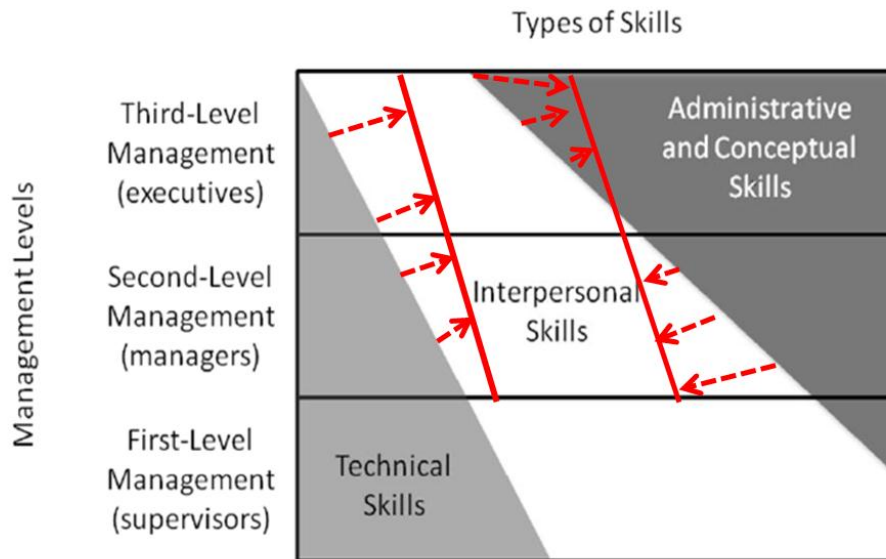


Figure 16 Comparison of Badawy's MSM diagram and an equivalent diagram based on results of ideal exemplar.

The key findings of scaling the area under the MSM diagram and comparing to the ideal exemplars data is that the skills do change with level of organization. People skills are over represented in Badawy's MSM diagram while technical skills are underrepresented.

The administrative and conceptual skills of MSM are also under represented when compared to the ideal exemplar skills (strategic, business and administrative). This comparison with Badawy's diagram will be further discussed in the following chapter as the diagram fails to highlight the issue of imbalance between the skills and the effect.

Graphing the data of the ideal exemplars across the three levels is shown below in figure 17.

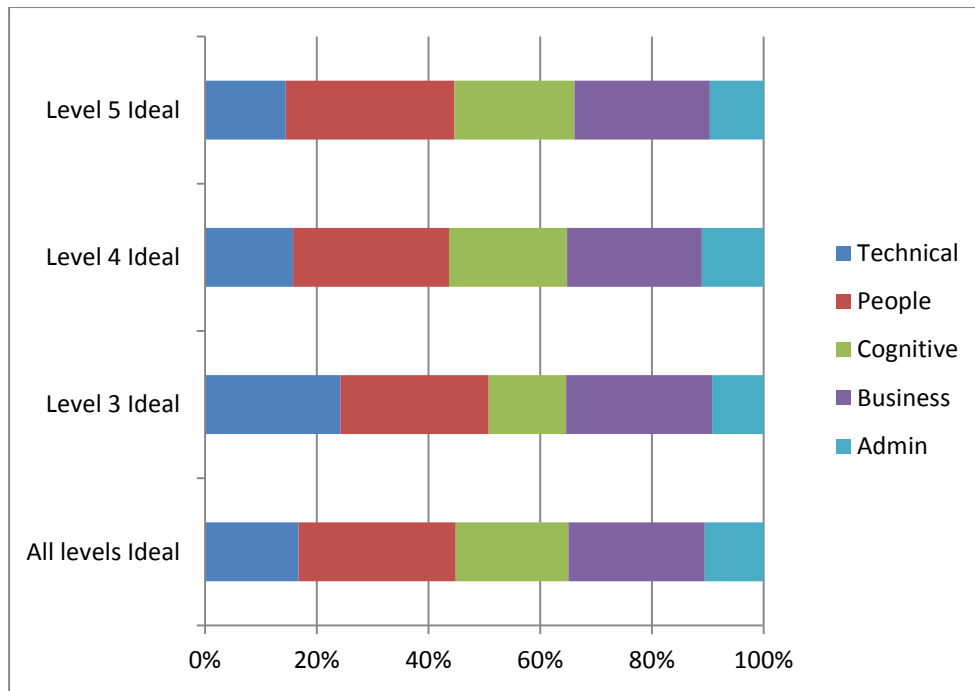


Figure 17 Skill weighting across levels of the organization using the ideal exemplar.

The skill weighting across the levels highlights:

- The use of technical skills is reduced the higher the level a leader is in an infrastructure organization.
- The use of people and cognitive skills both increase the higher the level a leader is in an infrastructure organization while the use of business and administrative skills remains relatively constant.

6.2.1. Skill weighting Results for Good and Poor exemplars

In the previous section the skill weighting for the ideal exemplars was introduced and it was shown how the weighting changes across the levels of the organization. In this section the skill weighting for the good/poor exemplars is analysed and compared to the ideal exemplar's

weighting score. The purpose of the analysis is to examine if there is a difference in the actual scores of good and poor exemplars and if there is an imbalance when compared to the ideal exemplar means for each skill weighting.

Table 82 Results of exemplar skill assessment – skill weighting for ideal, good and poor exemplar – all levels.

	IDEAL EXEMPLARS (N=91)		GOOD EXEMPLAR ACTUAL (N=49)		POOR EXEMPLAR ACTUAL (N=42)	
	Mean \bar{x}	Standard deviation σ	Mean \bar{x}	Standard deviation σ	Mean \bar{x}	Standard deviation σ
Skill Time Weighting (All Levels)						
Technical	16.6	8.1	18.0	13.2	18.8	12.9
People	28.0	9.5	27.4	12.9	14.4	8.6
Cognitive	20.1	8.5	18.5	9.3	15.7	11.4
Business	24.3	9.9	25.0	11.0	24.9	13.2
Administrative	10.8	5.6	11.5	6.2	25.7	18.9

A number of observations can be made from the data, namely:

- Good exemplar skill weighting align in rating with the ideal exemplar, similar to the results of the skill rating scale.
- Good exemplar and poor exemplar have different skill weightings.

The data for the good and poor exemplar skill weightings was also analysed by t-test to determine if the differences identified between the good and poor exemplars above were in fact significant.

The independent samples test using the t-test for equality of means is shown below in table 83.

Table 83. Independent samples test for good and poor exemplars – skill weighting – all levels.

SKILLS WEIGHTING		LEVENE'S TEST FOR EQUALITY OF VARIANCES		T-TEST FOR EQUALITY OF MEANS BETWEEN GOOD AND POOR LEADER EXEMPLARS – SKILL WEIGHTING		
		F	Sig.	t	df	Sig. (2-tailed)
Technical Skills	Equal variances assumed	.244	.623	-.301	89	.764
	Equal variances not assumed			-.302	87.329	.763
People Skills	Equal variances assumed	4.799	.031	5.532	89	.000
	Equal variances not assumed			5.702	84.020	.000
Cognitive Skills	Equal variances assumed	.812	.370	1.272	89	.207
	Equal variances not assumed			1.252	78.893	.214
Business Skills	Equal variances assumed	.844	.361	.047	89	.963
	Equal variances not assumed			.046	80.162	.963
Administ. Skills	Equal variances assumed	40.764	.000	-4.971	89	.000
	Equal variances not assumed			-4.670	48.656	.000

From table 83 above the t-tests identified that only two of the skill weighting variables were significant – people and administrative. Good leaders spend significantly more time on people tasks (27.4%) versus 14.4% for poor leaders. While the poor exemplars spend significantly more time on administrative tasks, 25.7% compared to 11.5% for good exemplars.

The t-test displays the significant difference between the good and poor exemplars. The literature on leadership highlighted the importance of balance (Kaplan & Kaiser 2003)). The ideal exemplar data provides a reference point to quantify the balance of the good and poor exemplar skills weighting to the ideal position. This assessment should be viewed as a practical scale rather than a sophisticated statistical scale i.e. a spring balance scale rather than an electronic scale to ten decimal points, this research is built upon this practical approach not only in obtaining the data from an expert group with limited time but also presenting the data back to the same type of audience, senior executives, as practical observations of the results.

$$\text{Skill balance (\% under or over use of skill by exemplar)} = \frac{(\bar{x}_a - \bar{x}_i)}{\bar{x}_i} \times 100$$

\bar{x}_a = actual mean score

\bar{x}_i = ideal mean score

For example skill balance of the good leader exemplar's technical skill is calculated as:

$$\begin{aligned} \text{Skill balance} &= \frac{(17.76 - 16.62)}{16.62} \times 100 \\ &= 8.1\% \end{aligned}$$

The result of 8.1% indicates an “over use” of the technical skill. A -8.1% would indicate an “under use” of the skill. The table below displays the results of applying the skill balance equation to the five skill weighting results of the good and poor leader exemplars.

Table 84 Skill balance of good/poor leader exemplars to the ideal exemplar skill weightings.

SKILL BALANCE USING SKILL WEIGHTING ALL LEVELS	GOOD LEADER EXEMPLAR (N=49)	POOR LEADER EXEMPLAR (N=42)
Technical skill	8%	13%
People skill	-2%	-49%
Strategic skill	-8%	-22%
Business skill	3%	2%
Administrative skill	10%	146%

The above results highlight the differences between the good and poor exemplars but also provide a scale to demonstrate the under (-ve) or over (+ve) use of the skills relative to the ideal exemplar. The data can be displayed graphically and is shown below in figure 18.

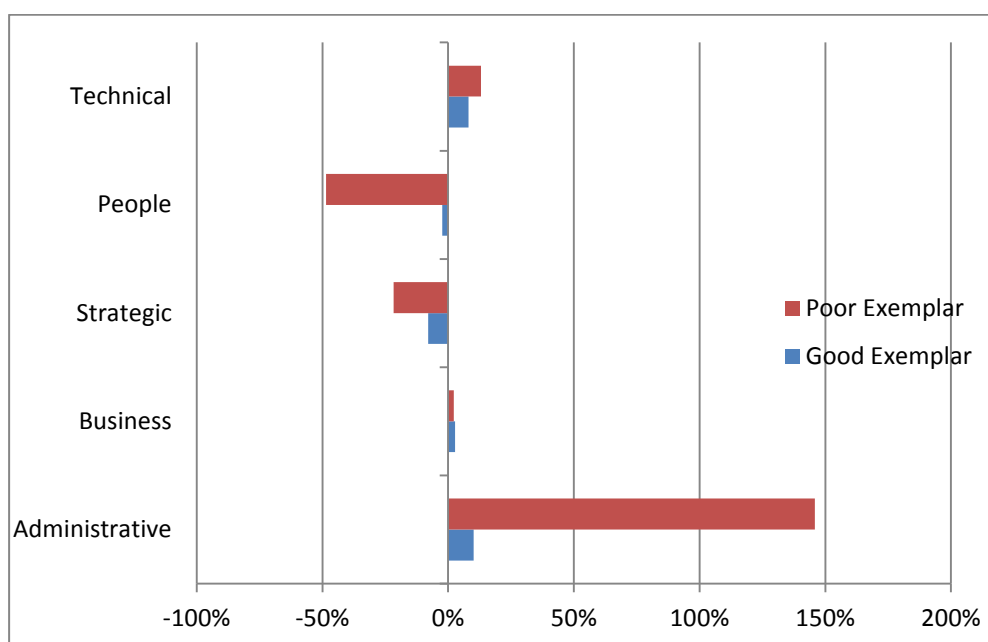


Figure 18 Skill balance of good/poor exemplars compared to the reviewer's perceived ideal leader exemplar.

The figure above displays the under-use or over-use of each skill by the exemplars as noted by the reviewer. They display a direction of difference compared to the ideal exemplar data provided by the expert opinion of the reviewers. It can be seen that the good exemplars are always closer to the ideal (at zero on the scale above) than the poor exemplars. Both types of exemplars display somewhat more technical, somewhat less people, somewhat less strategic, somewhat more business, and somewhat much more administrative than an ideal exemplar. For good exemplars the largest deficit is strategic skills. The results indicate this could be balanced or addressed by giving less time to the technical and administrative skill areas of their role. For the poor exemplars the areas of deficit in people and strategic areas are far greater. The total time is 7 times greater than the deficit of the good exemplars. The data shows that this deficit and the consequential imbalance is largely driven by giving almost 1.5 times the required times to administrative tasks. This may be a result of using engagement with administrative tasks to avoid engagement with people and strategic tasks where their competency is weaker and where activity is outside their comfort zone. Furthermore, the under engagement with people is more than twice that of the under engagement with strategic tasks indicating that engagement with people is the dominant area in which, as poor infrastructure leaders, their discomfort is the greatest. This weaker competency in people and strategic is reflected by the previous analysis of the skill rating scale where the expert reviewers rated poor exemplar's two lowest skills being strategic and then people skills respectively. See table 76 in section 6.1.

6.2.2. Skill weighting results for GT and GNT exemplar sample.

As was shown in the previous section the good exemplars demonstrated that they were more closely aligned to the ideal exemplar and were much less imbalanced than the poor exemplars. This section explores this good exemplar sample by reviewing the data for the good technical (GT) exemplar and the good non-technical (GNT) exemplar. The table below displays the results of the skill weighting for the ideal exemplar and GT/GNT exemplars.

Table 85 Skill weighting for GT and FNT leaders – all levels.

SKILL WEIGHTING	IDEAL EXEMPLARS (N=91)		GT EXEMPLARS (N=36)		GNT EXEMPLARS (N=13)	
LEADERS – all levels	\bar{x}	σ	\bar{x}	σ	\bar{x}	σ
Technical	16.6	8.1	19.9	14.6	12.7	5.3
People	28.0	9.5	28.3	12.6	24.6	13.9
Strategic	20.15	8.5	18.3	9.8	18.9	8.0
Business	24.3	9.9	22.6	9.8	31.5	12.1
Administrative	10.5	5.6	11.3	6.0	12.3	7.0

Both GT and GNT are from the good exemplar sample which aligns closely with the ideal exemplar. A t-test between the GT exemplars and the GNT exemplars identifies that significant differences exist between the technical and business focus of the two groups. The other three skills do not have significant differences. The table below shows the scores and the result of the t-test for the skills where the differences were significant i.e. if <0.05 .

Table 86 Skill weighting for GT and GNT exemplars – all levels – group statistics.

	GT VS GNT	N	MEAN \bar{X}	STD. DEVIATION	STD. ERROR MEAN	T TEST (IF < 0.05)
Technical	GT	36	19.86	14.613	2.436	0.092
	GNT	13	12.69	5.250	1.456	0.015
People	GT	36	28.33	12.593	2.099	>0.05
	GNT	13	24.62	13.914	3.859	>0.05
Strategic	GT	36	18.33	9.783	1.631	>0.05
	GNT	13	18.85	7.946	2.204	>0.05
Business	GT	36	22.64	9.746	1.624	0.011
	GNT	13	31.54	12.142	3.368	0.029
Administrative	GT	36	11.25	6.021	1.003	>0.05
	GNT	13	12.31	6.957	1.929	>0.05

The GT and GNT leader exemplars tend to spend more time in their ‘comfort’ zones hence the GT’s spend more time in the technical area and the GNT’s spend more time in the business area. They both spend the same amount of time in people, strategic and administrative work. They appear to work to their strengths but not to the detriment of their overall performance. Applying

the means of the GT and GNT exemplars to the skill balance formula the two exemplar groups can be compared to the ideal exemplar. The table below shows the results.

Table 87 Skill balance of GT and GNT exemplars to the ideal exemplar skill weighting.

SKILL BALANCE USING SKILL WEIGHTING ALL LEVELS	GT EXEMPLAR (N=36)	GNT EXEMPLAR (N=13)
Technical skill	20%	-24%
People skill	1%	-12%
Strategic skill	-9%	-6%
Business skill	-7%	30%
Administrative skill	7%	18%

Again, displaying this data graphically in the figure below highlights the balancing both GT and GNT exemplars do when compared to the ideal exemplar group for all levels.

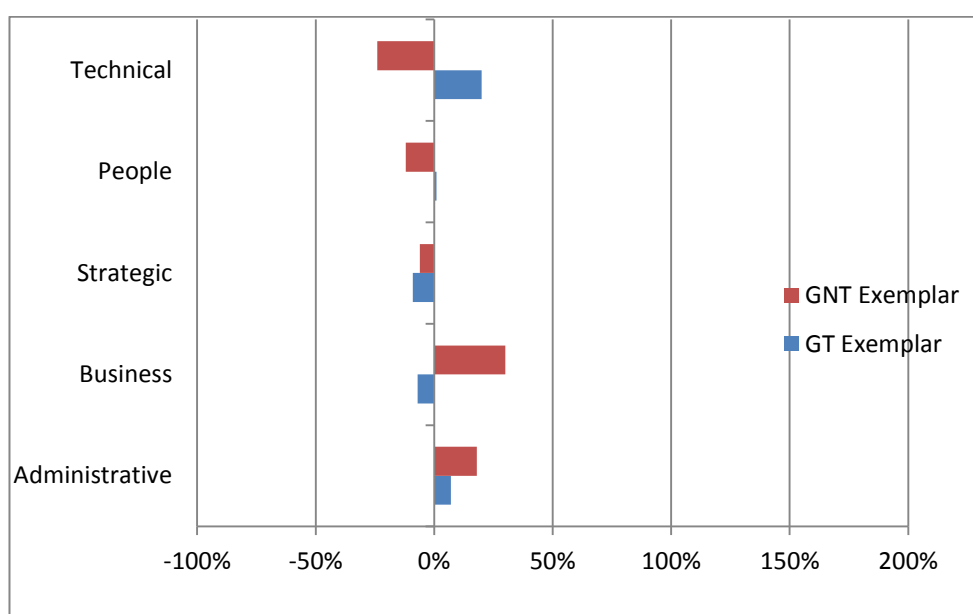


Figure 19 Skill balance of GT and GNT exemplars compared to the reviewers perceived ideal exemplar.

The above figure shows the direction of difference between the GT and GNT exemplars compared with the reviewer's ideal exemplar. Both exemplars are close to the ideal but the GT exemplar had somewhat less of a strategic and business focus with a somewhat more technical focus. The data shows that the GT imbalance is measured around deficit with strategic and business being driven by an over focus on technical tasks which reflects their background/competency in business and administrative. This creates a deficit in the technical, people and strategic areas which in total time is twice as much as is seen in the deficit for the GT exemplar. The GT exemplar has almost the ideal engagement with people which could reflect the alignment of background/competency. The under engagement with technical tasks by the GNT exemplar is twice as much as the people under engagement which indicates that for GNT exemplars the technical tasks not the people (who have a technical background) tasks in which their discomfort is the greatest. The imbalance may reflect the exemplars background, they may prefer to focus on their areas of strength, but the magnitude of the imbalance is less than what was observed for the imbalance seen in the poor exemplar sample. The GT and GNT exemplar results imply that a variance of $\pm 30\%$ (actual variance being -24% and +30% for the GNT exemplar) could be considered as within an acceptable range of imbalance. Comparing this to the poor exemplars results of the previous section people (-49%) and administrative (+146%) imbalance would be considered outside the acceptable range of imbalance and indicates a possible area that requires addressing in order to improve effectiveness of infrastructure leaders.

6.2.3. Skill weighting results for GT and PT exemplars

In the previous section it can be seen that the good exemplars were more closely aligned to the ideal exemplars. It was also seen that the GNT exemplars, although being a subgroup of the good exemplar sample, when analysed as the subgroup displayed an imbalance. This imbalance appeared to be acceptable as the exemplars are rated good. The range was $\pm 30\%$ and highlighted that the GNT exemplar overemphasised technical tasks (+20%) and underemphasised the strategic (-9%) and business (-7%). This section examines the data of PT exemplar and if a poor leader displays a greater imbalance in the same areas.

The LS assessment for skill weighting shown below identifies the small amount of time the PT exemplars spend on people issues and the large amount of time spent on administrative functions — doubles the amount of time spent by the GT exemplar.

The t-test of the data identified that both the people and administrative skills weighting are significantly different for the GT and PT exemplars. The table below displays the group statistics.

Table 88. t-test results for skill weighting all levels for GT and PT leaders.

GT VS PT		N	MEAN	STD. DEVIATION	STD. ERROR MEAN	T TEST (IF < 0.05)
Technical	GT	36	19.86	14.613	2.436	0.433
	PT	25	22.80	13.850	2.770	0.429
People	GT	36	28.33	12.593	2.099	0.000
	PT	25	12.00	5.774	1.155	0.000
Cognitive	GT	36	18.33	9.783	1.631	0.494
	PT	25	16.40	12.121	2.424	0.512
Business	GT	36	22.64	9.746	1.624	0.424
	PT	25	25.00	13.150	2.630	0.449
Administrative	GT	36	11.25	6.021	1.003	0.001
	PT	25	23.00	17.795	3.559	0.004

As in the previous comparisons, (good/poor and GT/GNT exemplar groups), applying the mean results of the GT and PT to the skill balance formula a comparison to the ideal exemplars can be made as can be seen in table 89 below.

Table 89 Skill balance, all levels, comparison of percentage difference between GT and PT exemplars with ideal exemplars.

SKILL BALANCE USING SKILL WEIGHTING ALL LEVELS	GT EXEMPLAR (N=36)	PT EXEMPLAR (N=25)
Technical	20%	37%
People	1%	-57%
Cognitive	-9%	-18%
Business	-7%	3%
Administrative	7%	120%

Displaying this data graphically highlights the balancing being done by the PT exemplar to maintain their senior role in the organization. Also note the results greater than ($\pm 30\%$) by the PT exemplar compared to the GT exemplar and GNT exemplars as noted in the previous section.

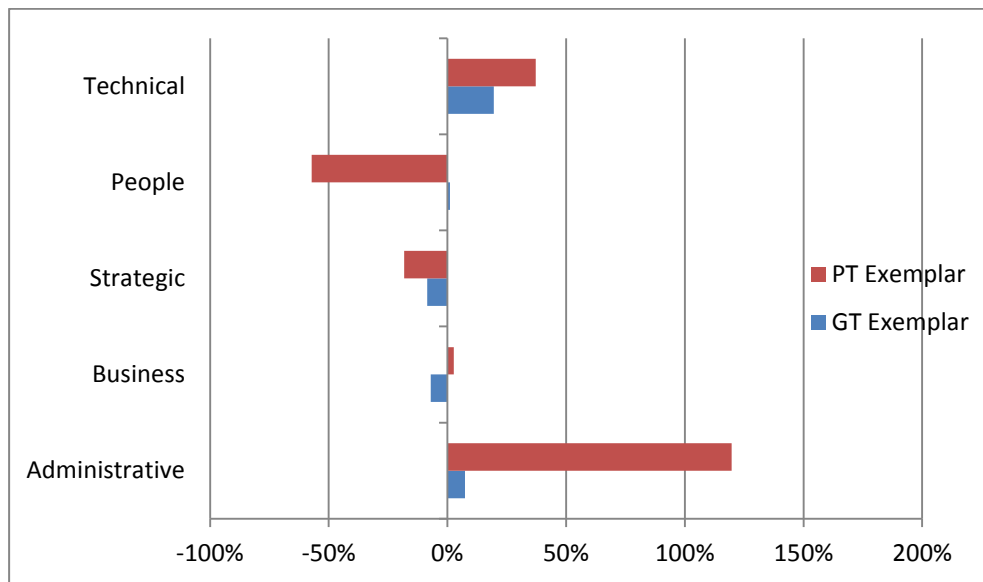


Figure 20 Skill balance, over and under time spent by GT and PT exemplars as a percentage compared to ideal exemplar.

The direction of difference can be clearly seen in the figure above between the GT and PT exemplars when compared to the ideal exemplars. The imbalance of the PT exemplar is much larger than the $\pm 30\%$ previously seen between the GT and GNT exemplars which appears to represent an effective imbalance range for the exemplars to remain considered ‘good’ exemplars. The data shows that the PT exemplar’s imbalance is measured with a disengagement of people tasks and the over engagement in technical and administrative tasks. The results indicate that this could be addressed by giving less time to the administrative tasks and focus on the people tasks. The total deficit time of the PT exemplar is over 5 times that of the GT exemplar.

This imbalance is driven in majority by an application of 1.2 times the ideal time spent on administrative skills. This appears consistent with the broader poor exemplar group which may

use engagement with administrative tasks to avoid engagement with people and, to a lesser extent, strategic tasks. The under engagement with people is almost three times that of strategic tasks, indicating that people disengagement is the dominant area and maybe an area of lower competency or, it may be an attempt to be more commercially focused in which case they neglect the people issues in an attempt to distance themselves from their traditional strength which made them successful in the first instance. This is in contrast to the GT exemplar who displays almost the ideal amount of engagement with people.

The skill ranking of the PT exemplars in table 77 indicated that the PT exemplar's people skill was ranked lowest of all their skills. This, combined with their disengagement in this area, may reflect a competency issue rather than a neglect to spend more time in the administrative area considering their high scores for business and administrative skills. It would appear that the PT exemplars success has been the result of the business focus but their lack of competency in the people skills makes them ineffective. The comparison of the GNT and PT in the next section may identify if the technical or non-technical background/qualifications of exemplars has an effect on the imbalance and the magnitude.

6.2.4. Skill weighting results for GNT and PNT

The good exemplars demonstrate an effective imbalance of $\pm 30\%$ compared to the ideal exemplars, The GT and PT exemplars identified that the PT displayed an imbalance outside this effective range. To determine if this ineffective balance is being driven by the exemplars qualifications or background this section explores the GNT and PNT exemplar data set.

The skill weighting data shown below highlights that PNT has significant variance in administrative functions; this is confirmed by the t-test between GNT and PNT.

Table 90 Results of group statistics for skill weighting for GNT versus PNT exemplars.

	GNT VS PNT	N	MEAN	STD. DEVIATION	STD. ERROR MEAN	T TEST SIGNIFICANT (IF < 0.05)
Technical	GNT	13	12.69	5.250	1.456	0.946
	PNT	17	12.88	8.803	2.135	0.942
People	GNT	13	24.62	13.914	3.859	0.149
	PNT	17	17.94	10.761	2.610	0.166
Cognitive	GNT	13	18.85	7.946	2.204	0.247
	PNT	17	14.71	10.528	2.553	0.230
Business	GNT	13	31.54	12.142	3.368	0.167
	PNT	17	24.71	13.747	3.334	0.161
Administrative	GNT	13	12.31	6.957	1.929	0.006
	PNT	17	29.76	20.179	4.894	0.003

Unlike the previous sample group, (GT and PT), the GNT and PNT did not have a significant difference in the people skills only in the administrative skills. Applying the mean data into skill balance formula provides a comparison to the ideal exemplar, the results are displayed below.

Table 91 Skill balance, all levels, comparison of percentage difference between GNT and PNT exemplars with ideal exemplar.

SKILL BALANCE USING SKILL WEIGHTING ALL LEVELS	GNT EXEMPLAR (N=13)	PNT EXEMPLAR (N=17)
Technical skill	-24%	-23%
People skill	-12%	-37%
Strategic skill	-6%	-27%
Business skill	30%	2%
Administrative skill	18%	184%

Displaying the data graphically below in figure 21 highlights that GNT exemplar balances the lack of technical time with more focus on business and administrative time. The PNT displays significant variance by spending less time on technical, people and strategic skills while over compensating — not in the business area as for the GNT exemplar — but in the administrative tasks.

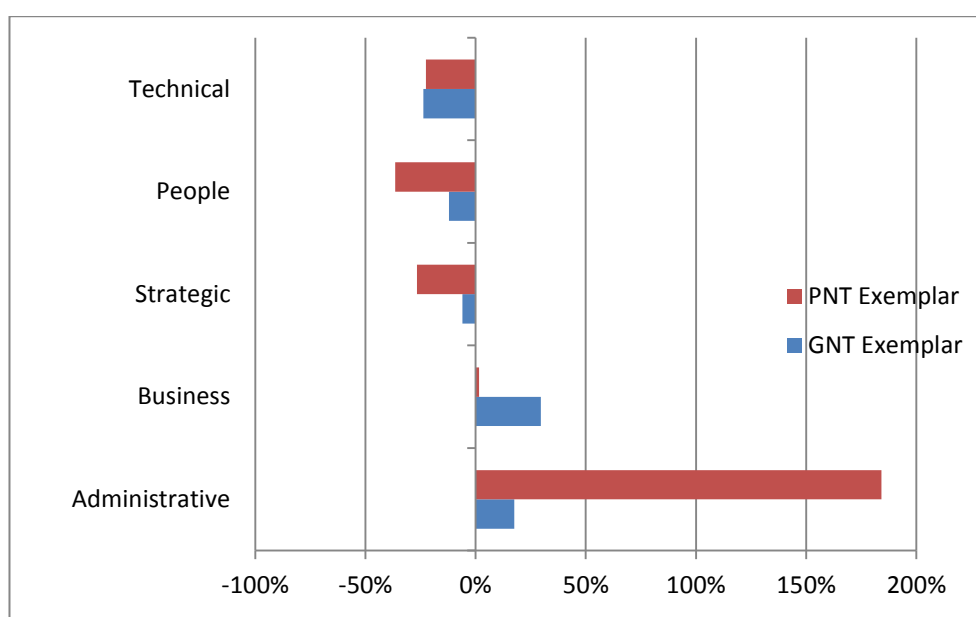


Figure 21 Skill balance, over and under time spent by GNT and PNT exemplars as a percentage compared to ideal exemplar.

The PNT exemplar demonstrates an over engagement (almost twice as much as the ideal amount of time) in the administrative tasks which is similar to the PT exemplar as shown in the previous

section. This over use creates under engagement with people, strategic and technical tasks. The under engagement in the area of technical tasks is similar between both the GNT and PNT. The PNT disengagement of people and strategic is almost 4 times higher than that of the GNT exemplar.

Similar to the PT exemplar, the PNT exemplars do not have strong people skills (ranked 4 out of 5). The PNT's under engagement of people tasks is almost 3 times that of the GNT exemplars. The administrative skills of the PNT is strong at 2 out of 5 and this may account for their over engagement in the administrative tasks, almost twice the ideal amount.

The PT and PNT exemplars' over engagement in the administrative area results in an under engagement in a number of common areas i.e. people and strategic. The strength of the skills, their competency, may influence the deficit of skill such as seen in the technical tasks. The PNT has a deficit in technical tasks while the PT does not but has an over engagement, almost twice as much, as the GT exemplar.

The reason for the imbalance may be a combination of competency and perception of importance by the exemplars. The following section summarizes the fourth and final phase of the methodology, the qualitative phase where the expert reviewers provided their views on what is effective leadership in infrastructure and what is required to develop these leaders.

6.3. Phase D – Semi-structured interview results

The structured interview section of the methodology, phases A, B, and C, was used to make best use of the expert reviewers knowledge whose time availability was limited to allow them to describe good and poor infrastructure leader exemplars from memory that they had worked with. This final phase enables the reviewers to identify any clear shortcomings in the discussion about the skills of effective leadership and what makes technical leaders effective at the executive levels of an infrastructure business. Thirty four of the forty six reviewers had time to complete this phase, time being the critical determinant. The six questions of the qualitative phase are open ended questions designed to draw out the experts thoughts regarding effective leadership. Five distinct components of effective leadership were identified by the expert reviewers, namely:

1. Perceptions of engineers as executive leaders in infrastructure.
2. Skill mix for effective executive leaders.
3. Skill balance for effective leaders.
4. Culture of infrastructure.
5. Development of infrastructure executive leaders.

These five components will be discussed in the following sections.

6.3.1. Perceptions of engineers as executive leaders in infrastructure.

The technical leaders within infrastructure are normally engineers and the reviewers had a number of observations. A number of the reviewers pointed towards the negative perceptions:

Referring to the engineers inability to understand the broader business issues:

Reviewer AD (Legal Counsel):

'I love engineers; they make me look like a free thinker!'

Reviewer AL (Asset Leader):

'Not many engineers are strategic and have people skills – their education tells them that everything is predictable thus they maintain the stereotypical view of engineers.'

Reviewer B (Consultant to Energy):

'Engineers understand the process of making an asset effective, but what they miss out, is it in not asset effectiveness but 'effectiveness of income' and that they can't deal with issues because they box it technically, people skills are lacking, they understand finance and planning skills.'

Reviewer P (Asset Manager):

'Engineers are fairly poor leaders as a group – occasional leader but normally poor. I think it is because they have a prescriptive outlook.'

Reviewer R (Treasurer):

'Letting go' is what engineers struggle with. Letting go of technical side and managing people. Engineers like to do 'things' - leadership is moving back from this. They understand the financial aspect of the business but they get very frustrated by not being able to do all projects within a cheque book owned by the CFO.'

Reviewer Y (Operations Manager):

'The engineers fail to understand as leaders they must 'work on the business not work in the business'

Other reviewers were more positive and saw that engineers had advantages within infrastructure:

Reviewer AP (Legal Counsel):

'Engineers can be good motivators; they need to be very business focus. They can generate respect because people value their judgements – they can have the right balance of big picture and detail (not too much either side).'

Reviewer U (COO):

'Engineers come at different angle than finance and operation and understand the drivers of cost better than operation and finance.'

Reviewer V (Finance Controller):

'I am scared by engineers. Their biggest strength is their understanding between the workforces up to board. They understand the people – out in the field – they understand the issues and what is important. They have better relationships and empathy with the workforce rather than CFO/lawyer.'

Reviewer T (Businessman) highlighted the strength the executive leader with engineering background brings:

'They bring the ability to articulate the value of engineering to non-engineering – not simplifying but conveying the value of the technical issues.'

In general, the reviewers' perception of engineers as executive leaders in infrastructure appears consistent with the literature (Badawy 1983; Yates 2001; Farris & Cordero 2002).

6.3.2. Skill mix for effective executive leaders

Some of the respondents, in raising the attributes of engineers, also identified the other skills that are required by engineers and the leaders within infrastructure.

Reviewer B, (Consultant to the Energy Industry) highlighted the cognitive strength required of the executive leader:

'The person has to have the ability to grasp issues quickly and develop ways to get around the issues by structuring a pathway through and using the best skills of the people around them to build a team.'

This people skill focus is common among the reviewers being mentioned 65 times by reviewers in answering the six questions; this was followed in importance by business skills (mentioned 50 times), strategic skills (mentioned 29 times) and finally technical skills (mentioned 15 times). At no time was the issue of getting further administrative skills raised. The ranking of the skills follows the same order as the skill ranking for the ideal leader in the quantitative phase. This people focus was 'front of mind' with the reviewers as the open questions were asked from a technical leader world view. Examples are:

Reviewer G (Engineering Manager):

'...manage the people and make them feel important and equally give them reinforcement – when people come to you help, make sure you given them the time, they have taken the time to see you.'

Reviewer P (Asset Manager):

'People sensitive, not arrogant, amenable.'

But the reviewers highlighted that it was more than technical and people skills.

Reviewer X (Engineering Manager):

'They need to develop people/strategic/technical skills – don't get into too much detail but understand it and utilize the people who have that skill below you, trust them. You need to understand - don't dig too deep.'

Reviewer Y (Operations Manager):

'They need strategic thinking and work 'on' the business. Shape the business, focus on what we need to change and drive for success – proactive in making change – empathy with the technical people...'

'They need to have both strategic and people skills. Having the strategic/technical skills and bring the people along the journey – engineers are not normally good at this...'

Reviewer AC (Executive Engineer):

And reviewer AC continued by highlighting the skill mixes changes with the level of the organization:

'...Leader's role and skills focus changes with each level but they must have reasonable business processes (administrative systems) below them. This allows the senior leaders to move away managing the day to day issues. Lower you go down the organization the strategic skills and thinking values and the business processes increase but the technical skills remain required...'

Reviewer AJ (Commercial Manager points to the other skills):

'...they need to be good people person and good understanding of the business rather than just technical skills...'

And Reviewer AB (Generalist highlights):

'The technical leader needs to select the right team and cultural fit. As they move up in the structure, priority moves to strategic and business focus but people skills remain critical.'

The reviewers also highlighted that the skill mix may not be just in the leader but within the executive or Board team. Reviewer AS (Commercial) said:

'Leader needs to surround themselves with people with appropriate skills to offset their own – called team'

And reviewer AH (CFO):

'...You must have technical leaders at the Board level to have someone who understands the asset – also at the executive levels. Boards are 'creatures' themselves and without technical expertise is quite dangerous if only reliance is management.'

Reviewer AP (Legal Counsel):

'...most effective Boards need diversity and having 1 or 2 technical directors is good, eight is not but this is the same for other professions accountants, lawyers etc. The same situation occurs at the executive team level.'

But Reviewer AN – Managing Director challenged the need for an engineer on the Board:

'I don't believe – not necessarily an engineer is required but a strategic thinker with the skill to know when to pull in experts and give advice. If at board level – legal skill is critical. Not a believer that the Board can cover all disciplines but need people who can grasp things quickly with a high level analytic skills and strategic focus.'

Thus the reviewers highlighted two approaches, the leaders having the multiple skills and/or the skills being within the individuals of the team at the Board or executive levels. They also highlighted the importance of having an understanding of the subject matter not necessarily being an expert in all the skills. They point to still relying on the people and team below them who support the business.

6.3.3. Skill Balance for effective leaders

The reviewers consistently raised the skills necessary for effective leaders namely, people, technical, business, strategic, commercial and financial. They also raised personal attributes such as honesty, resoluteness, trustworthiness, visionary, role model and communication. While the reviewers did not highlight the imbalance that the quantitative phase of this research did they did highlight that a general balance between skills was required. Reviewer AD (Legal/commercial) highlighted the balance requires of the engineers in these executive roles:

‘...engineers, like lawyers, don’t necessarily have the people skills, but they do have the technical skills and general management. As they go up in the organization they need to develop those people skills as their world changes from black and white to shades of grey. Here they have to apply a balance across multiple skills, technical, commercial, finance and legal – can’t be perfect I all skill requirements.’

This balance between ‘black and white’ views of the world was also highlighted by reviewer AB (Generalist):

‘They must learn to be flexible not so black and white. They need to be interested in people and their issues and activities – a balance between task and people.’

Reviewer AD (Legal Commercial):

‘Law teaches you that the world is grey not black or white. Engineering teaches them that there is a single optimal answer – they can balance the skills and any more out of one answer is scary – they can’t deal with it.’

This balance was also raised by reviewer AR (Chief Engineer):

‘...engineers need to have a balance of commercial and technical acumen and then have the ability to communicate to people to get them to align to the strategy...’

Reviewer R (Treasurer):

‘...if the technical leader can learn to adapt they then remain effective – some are more disposed to effective leadership. They are self-aware and organizationally aware – they adapt normally because they have had exposure to a range of business areas.’

Reviewer AB (Generalist):

‘Some technical skills at Board level to understand the issues. But lower down, the technical skills need to be more concentrated. Accountants traditionally run the infrastructure businesses – not necessarily a good thing – need balance.’

Reviewer AN (Managing Director) point to the balance of skills required for the CEO’s position:

'...ideally they should be engineering but must have commercial and strategic – more importance is experience than qualifications. No hard and fast view that accountants are better CEO's than engineers. Ideal CEO should be technical with balance of accounting and finance skills;' and

'Most engineers are risk adverse. They need to have commercial skills to give balance with risk. They must learn to have a tolerance of risk.'

The need for balance and mix of skills is further highlighted in the section on the development of infrastructure leaders.

6.3.4. Culture of infrastructure

The reviewers were not directly asked questions regarding the culture of infrastructure but they did highlight a number of observations about the way leaders of infrastructure gain acceptance within the organization. Reviewer AC (Executive Engineer) notes:

'...technical skills are the key to loyalty and ability to challenge the infrastructure team. This enables them to show clear direction and they can also explain to all levels and get people engaged – the language of most infrastructure people is technical. Need to be able to ask the right questions to demonstrate your understanding and then you can get by in....they (organization) can sense a short term and commercial approach over the right long term solution – this destroys loyalty within the culture.'

Reviewer AA (Asset Management) also highlights the advantage technical skills within the leader bring:

'Running infrastructure business is technically demanding and the skill is required at every level. It also gives credibility through the organization. If management is run by accountants then the rest of the organization will doubt the ability of the leaders – they must be able to communicate across all levels and the whole organisation.'

Technical skills were identified as the language of infrastructure business but at the higher levels the engineer had a responsibility to articulate the culture to the broader group. Reviewer AN (Managing Director) notes:

'They must be able to communicate effectively to the senior people in the other disciplines in a language not often that of infrastructure – technical.'

The culture of infrastructure did not appear within the discussion with the reviewers as often as the researcher expected. This may be due to the fact that at these executive levels they create and influence the culture, Schein (2004).

The 'outsourced model' is a subset of the culture of infrastructure as it is the contracting out of the majority of the resources to run the infrastructure business. This leaves executive leaders leading both an internal and external workforce. Question for the reviewers was if they believed with the outsourced model did the executive leader need to be more commercial/contractual and allow the leadership of the outsourced workforce to be accountable for the workforce or which may suit more technical leaders without people skills.

The reviewers had similar views, for example reviewer AB (Generalist) highlighted that the skills are required with the outsourced model:

'...in the outsourced model you cannot abdicate your responsibility hence you need all the skills.'

Reviewer AG (Manager of Operations):

'...even more important when dealing with a contractor – not just legal/contract skills but must be able to motivate contractor and their people.'

Also, reviewer AH (CFO) points out that both models internal and outsourced workforce need good leadership:

'Both models need strong leadership – different approach for the internal workforce compared to the outsourced workforce. They still need skills and good communication...'

Reviewer AI (Business Professional) identifies that:

'The skills are the same but the focus on business need to be more – the executives must be able to deal with ambiguity and change rather than this is the way we have always done it this way.'

The reviewers supported that the leadership of both delivery models, (internal and external contracted workforce) required similar skills but the focus may be different for the leader to be effective.

6.3.5. Development of infrastructure leaders

The reviewers identified a number of different approaches to develop effective leaders within infrastructure. They appear to be based on their personal experiences of which made them successful and what they have recommended to colleagues as part of the reviewer's role of developing, measuring and rewarding leaders within infrastructure. Three approaches were identified:

- Formal qualifications such as an MBA or other non-engineering training;
- Experiential learning by leading other functions within infrastructure; and
- Using a mentor to challenge and push the leader to facilitate the leader to see a different world view.

An MBA was identified as the traditional approach for technical leaders to expand their skills. Reviewer AC (Executive Engineer) comments:

'All my strategic thinking came from doing my MBA – taught me to think about the direction of business and then experience taught me how to get people on board.'

Reviewer AK (Chairman) notes:

'When I did my MBA, the single largest group were engineers. They saw it as a 'door' from technical to management function. They get an exposure which gives you the theory but if they go back to a technical role they lose out. I don't see managerial type qualified leaders doing engineering post graduate qualification – maybe we miss something.'

This observation about technical leaders completing business training but not vice versa was also identified by reviewer B (Consultant to Energy Industry):

'...technical leaders have a decision to either remain an engineer or move toward managing people. To each the senior corporate levels you need business, administrative and people

skills – MBA is a good area but I don't encourage it. What is more important is need 5 to 7 years of experience – I don't see finance people doing engineering courses but engineers doing business...'

The response may be that the MBA provides an ability to communicate with the finance/business side of the business while the engineering language is more intuitive? A question for future research. The training issue was raised again by another Reviewer U (COO) who said:

'Engineer at a certain level must do financial or MBA course – they need exposure to other skills such a strategic thinking. It is important that engineers don't get stuck in one organisation and get caught with one method and practice. They need to be proactive and understand the importance of broad exposure to other industries.'

Surprisingly only one reviewer identified a program of training supplied by Engineers Australia – but said that it was not necessarily supportive for executives within infrastructure. Reviewer X (Engineering Manager) noted:

'Our CEO wants all engineers at the executive positions and has a real focus on us gaining Charter status. All graduates must reach Charter status but I question it that helps them be effective. In our situation I see engineers promoting engineers to the top but see a gap in their business acumen to focus on the right things at the right time.'

This experience and exposure to other parts of the organization and other industries has highlighted by a number of reviewers. They supported training but experience and exposure to other thinking was critical. Examples of comments include:

Reviewer T (Businessman):

'...they need secondment – put them in the front line first then put them into finance or operations to challenge their technical urge to spend money. It will also give them an insight into other perceptions and understand the activities they are measuring and judging...'

Reviewer AB (Generalist):

'....doing an MBA plus job rotating through different areas i.e. treasury/finance to understand the department areas. Even exchange with other companies...'

Reviewer AN (Managing Director):

'...they need to learn as much legal and finance and learn to speak their language Search for more senior roles with larger people numbers and budget. In the end make a team do what you want them to do: technical plus finance. What is most important is that you deliver!'

Reviewer AO (CFO):

'...try and get exposure of different elements of operation and financial otherwise they will get 'siloed' – need exposure to business process.'

Reviewer AP (Legal Counsel):

'Best former engineers – out of engineering for a while and gain experience in business. They don't spend too much time in technical field (maybe 7 or 7 years) then they don't focus on detail but bigger picture.'

Reviewer R (Treasurer):

'Letting go is the hardest thing for engineer and letting your people do it. Must let the technical side to – they need a mentor to support this.'

This mentor requirement and the mentor's task was raised as a solution more than MBA/training and experience. It was not that the other two approaches were not necessary but it was generally agreed that the best way to initiate and develop a leader was through either a formal or informal mentor process.

Reviewer Z (Manager of Risk):

'...training – not sure about training alone – you need to put yourself in different roles to take advantage of the experience. They need to do that rather than training – they need mentoring and leadership from their leader demonstrating it by what they do....'

Reviewer AG (Manager of Operations):

'Best way to learn is to get exposure to problems and a mentor is the best way to help them with those problems.'

Reviewer AK (Chairman 0):

‘...mentoring – they need t be told to make them incorporate some other functions into their role i.e. take over the direct line of commercial manager or HT manager or run a strategic workshop for the executive team...’

Reviewer AS (Commercial):

‘...they need to take their engineering strengths and build their peole and business strengths.’

Reviewer AT (COO):

‘Get a mentor — internal or external. A mentor with leadership in the broader areas, someone who will challenge you. Seek to get someone in areas outside of your normal areas – different skills – they lead onto other opportunities. Don’t neglect strategic, leadership and management training.’

The reviewers provided a range of approaches to develop leaders of infrastructure. What was clear is that to reach these senior roles the leaders, especially engineers needed development to be considered for these roles. Qualifications in business provided ability to communicate – proven value-adding experience was critical to be accepted.

6.4. *Practicality of the Methodology*

The methodology for this research required a compromise of the standard application of the three historical measures to describe effective leadership. The overriding driver was to ensure the methodology would be compatible with the limited interview time the reviewers had available. The breadth and depth of the results obtained supports the methodology used and was practical in providing the reviewers with a framework that they were able to describe their exemplars in terms consistent with the literature.

As a process, all reviewers (100%) completed the interview process and all but one reviewer were able to provide two exemplars and thereby were able to complete the structured phase of the interview twice. Keeping the structured phase of the interview to one page per exemplar appeared to relax the reviewers about the scope of the interview.

Another critical process was the complete anonymity that was provided to the reviewers. No identifiable details about the exemplars, the reviewers, or the companies for which they worked were recorded. These reviewers are senior leaders of their businesses and their identification can have a significant impact both internally and publically. A number of reviewers needed assurance that nothing was being recorded that could identify them. This was particularly critical when they described a poor exemplar and the “negative” aspects of that leader.

The selection of a good and poor exemplar provided the reviewers with a contrast. Their rating (1-10) of the two exemplars enabled them to position the exemplar along an arbitrary scale which all reviewers found acceptable and pragmatic.

All reviewers commented on the practicality of the issue to their roles and that the interview was practical in that they were not asked to fill out “hundreds of questions of which an answer appears” but were asked to comment on statements (sourced from the literature) which they were able to select as the descriptions which most reflected their exemplars. Reviewers also appreciated not being “forced” to select a statement if none were suitable. This was also seen as a demonstration of valuing the opinion of the reviewer not the supporting all the results of past researchers. A number of reviewers also commented on the fact that in selecting the good and poor exemplars they didn’t realise how “close to the surface” some of the emotions were about that leader. They gained comfort in using the framework as they believed that they may not be able to describe the leader objectively enough for the research.

The reviewers also appreciated the semi-structured phase of the methodology as the reviewers were able to freely share their own thoughts about effective leadership and in some cases raise issues distinctive to infrastructure businesses.

All reviewers commented positively on the suitability of the methodology and a number also commented on how much appeared to be covered in the process. They believed it was a more holistic approach not just focussing on yet another “silver bullet” approach to effective leadership such as all executive leaders need to be engineers.

6.5 Conclusions

This chapter addressed the second section of the results analysis, the skills of the exemplars. The first chapter (see Chapter 5) concerning results presented the demographics of the reviewers and the good and poor exemplars to demonstrate that they were at the appropriate level of the

organization and a good sample for analysis. The chapter analysed the exemplars' style utilizing a standard framework consisting of constructs of three historical measures of effective leadership. The results of this analysis proved that the good and poor exemplars of infrastructure were described in similar way as to the effective and ineffective leaders of literature. This presents three findings, viz.:

1. Good infrastructure exemplar is equivalent to an effective leader;
2. General leadership literature can be applied to infrastructure leaders; and
3. Using the constructs of measures was a practical way to obtain descriptions from a large, time constrained expert group.

The second results chapter, taking the scale of good and poor exemplars, compared the skills of the exemplars utilizing the two assessments, ranking and weighting. The skill ranking was able to confirm that the five skills developed from the literature described the skills required for leadership of infrastructure and that the skill ranking changed dependent on the level within the organization. The data also demonstrated that the ratings varied with the performance of the exemplar. The skill weighting scale provided an additional scale for rating the five skills, how much time did an exemplar spend utilizing this skill. The results of the skill weightings also varied with the performance of the exemplar.

In addition to the two exemplar groups, good and poor, the reviewers also provided a description of an ideal exemplar using both skill assessments. This ideal exemplar provided a 'control' case for comparing the good and poor exemplar results. For the skill weighting, the good/poor exemplar mean score of the five skills were compared to the ideal exemplar means of the five skills in a skill balance formula. The resulting skill balance score showed that across the five skills the background/qualifications of the exemplars varied the skill weightings.

Good technical/non-technical exemplars did over-used or under-used the skills, but they still remained effective. Poor exemplars displayed a greater imbalance of this over use and under use of the five skills. Primary imbalance was by over engaging in the administrative functions and under engaging in the people function.

The qualitative phase of the methodology closes out the four phases by exploring through a semi structured interview what the reviewers believe to be effective infrastructure leadership. These discussions raised a range of observations around effective infrastructure leaders' i.e.

1. Perceptions of engineers;
2. Skill mix;
3. Skill balance;
4. Culture of infrastructure; and
5. Development of leaders.

The methodology was determined to be a practical approach for accessing detailed descriptions of leaders within infrastructure from an expert group with time constraints for research. The acceptance of the methodology by the reviewers enabled sufficient data to be completed on the structured phase data and also enabled the expert group to share their thoughts on effective leadership of infrastructure.

These observations and the outcomes of the two results chapters will be discussed in the next chapter against the aim and research questions of this research and the theory and practice from literature.

7. Discussion & Conclusions

In this chapter the results (see Chapter 5 & 6) are discussed in the context of both the literature (see Chapter 3) and the aims and questions of this research (see Chapter 1). Answering these research questions enables discussion about the implications of the results concerning several areas of practice and literature. Areas of future research are identified and the chapter ends with the conclusions of this research and how it responds to the aim as stated in this research.

7.1. Introduction

Infrastructure assets have experienced a change in ownership after being sold and privatized by governments resulting in a switch from the engineering dominated utility leadership to a business leadership focus. A review of the literature highlighted that both researchers and industry had identified the tension resulting from this change of leadership (Kniflick 2002; Whitmore 2004; Wolmar 2005; Weber & Alfen 2010; Readman 2010). This research's primary aim is to investigate the requisite skills for effective leadership at the executive level of infrastructure businesses. A secondary aim, which would enable the primary aim to be met, is to explore a practical methodology for systematically accessing the expert opinions of senior executives on the skills and capabilities that characterise good and poor infrastructure leadership. These two aims led to the posing of ten research questions. This next section links the results from Chapters 5 and 6 to these ten questions and provides answers which will form the body of the discussion for this research. The conclusions section will respond to the aims of this research and the significant findings identified as a result of the research.

7.2. Comparing the Results with the research questions

Ten research questions are summarised in the table below which also links them to the relevant results chapter:

Table 92 Aim and research questions of thesis.

Primarily, the aim of this study is to: Investigate the requisite skills for effective infrastructure leadership at the executive organisational level of the business; and secondarily, to Explore a practical methodology for systematically and efficiently accessing the expert opinions and experience of senior executives regarding the skills and capabilities that characterise good and poor infrastructure leadership.	
Questions	Chapter 5 – Leader style
1	Are technical <i>qualifications</i> required to be an effective leader of infrastructure?
2	Do leaders in infrastructure have <i>styles</i> similar to those outlined in the broader general research and literature of leadership effectiveness?
3	Do the <i>qualifications</i> of the leaders in infrastructure influence their styles?
	Chapter 6 – Leader skill
4	Are technical <i>skills</i> the most important skill in leadership of the engineering cultured infrastructure?
5	Are technical <i>skills</i> requisite for effective leadership?
6	Does an imbalance in the use of the <i>skills</i> diminish the effectiveness of the leader?
7	Do <i>qualifications</i> , technical or non-technical, of the leader amplify the imbalance of the use of the skills?
8	Can technically <i>qualified</i> leaders be developed to become more effective?
9	Can technically <i>unqualified</i> leaders be developed to become more effective?
10	Did the <i>methodology</i> enable the large sample of senior executives to describe their exemplars in a framework which provided logical empirical data for analysis based on historical proven measures of effective leadership?

7.2.1. Question 1 — Technical qualifications

The first question addresses whether or not technical qualifications are required for an infrastructure executive leader to be effective. The data demonstrated that executive leaders could be effective with either technical or non-technical qualifications/backgrounds. Both groups of good exemplars, technical and non-technical rated a score of 7.9 out of 10. Thus either technical qualifications or non-technical qualifications are not a requisite for effective infrastructure executive. The results do not support the position that effective leadership is provided by either technical or non-technical leaders as posited by some authors (Whitmore 2004; Wolmar 2005). It does support the position that both technical and non-technical leaders can be effective and that

effective infrastructure leadership is determined by skills and action that are not principally determined by skills developed as a result of the initial area of formal qualification held by the leader.

7.2.2. Question 2 — Infrastructure leader styles

Question 2 addresses whether or not effective and ineffective executive infrastructure leaders differ in leadership style from executive leaders in other areas of industry and business. Phase B of the methodology utilizes three constructs from historical measures to describe the good and poor exemplar leaders. The results of this phase support the view that infrastructure exemplar leaders do have styles similar to that from the literature. Good exemplars and poor exemplars both display styles aligned to that of effective and ineffective styles of leaders as in the literature. The description of infrastructure leaders aligns with literature allowing the vast amount of previous research to be applied to infrastructure leaders. In addition, because the separating of the exemplars into good and poor groups also aligned with the literature the rating given by the reviewers is also validated. Executive leaders of infrastructure can have an informed view of what an effective or an ineffective leader is.

7.2.3. Question 3 – Leader style influenced by qualifications

The previous question explores if the executive leaders of infrastructure behave in ways distinct from the broader literature. They did not. Question 3 is in a similar vein but asks whether or not there is a difference in the style when the leaders have different qualifications/backgrounds. Again the data did not identify any substantive differences between the two groups. The qualifications of the leaders in infrastructure do not influence their styles in ways that are materially different to the literature. Questions 2 and 3 utilize phase B of the methodology and the results, in demonstrating alignment across constructs of three historical measures, gives support to the robustness of the methodology when utilized with the expert reviewers and their exemplars of executive leadership.

7.2.4. Question 4 — Technical skills

Questions 4 through 10 are answered based on the results of the Chapter 6 which focussed primarily on the skills typology and their ranking, weighting and balance. The first question of

this section raises an issue often quoted in the literature in the technical versus business skill debate (Wolmar 2005), namely, are technical skills the most important skill in leadership of the engineering cultured infrastructure? The ideal and good exemplars have technical skills ranked fourth out of five. Additionally, in terms of time weighting across the five skills, technical skills also ranked fourth behind people, business and strategic skills in that order. Thus, technical skills are not the most important skill.

7.2.5. Question 5 — Requisite Skills

Question 5 follows from question 4 where technical skills were shown to be one of the skills. The question asks whether or not technical skills are requisite for effective leadership? All reviewers acknowledge, in both ranking and weighting scale, that for executive leaders there are five skills which are requisite, one of which is technical skills. The reviewers did not identify any additional skills they considered necessary. This may have been due to the broadness and overlapping of the five skills as previously highlighted by Katz (1955). The reviewers' answers: (1) identified that executive leaders of infrastructure can be effective with technical and non-technical qualification/background; (2) effective leaders and ineffective leaders of infrastructure displayed characteristics similar to the literature; and (3) the reviewers ranked (for an ideal leader) that technical skills are not the most important skill but they are requisite for the leader to be effective.

7.2.6. Question 6 — Skill imbalance

The results demonstrated that all five skills are requisite for effective leadership. The five skills varied in ranking and weighting depending on the leaders' effectiveness and their qualification/backgrounds (technical and non-technical). Question 7 asked whether or not an imbalance of the use of the skills diminishes the effectiveness of the leader? The use of the skills refers to the weighting of the skills scale and the imbalance is in reference to the comparison of the ideal leader's skill weighting. Differences existed between the good and poor leaders in scales, skill ranking and skill weighting. One example is that good leaders spend the majority of their time on people issues while the poor leaders focus primarily on the administrative tasks. Good leaders had similar weightings to the ideal leader but when the poor ineffective leader was compared to the ideal exemplar leader an imbalance was observed. The poor leader spends too much time — almost 150% too much — focussing upon administrative tasks when compared to the ideal leader. This imbalance was to the detriment of other skill areas, the major one being the people tasks (almost 50% too little time). It appears that this imbalance with the skills, spending

too much or too little time and focus on particular skill tasks does diminish the effectiveness of the leader.

7.2.7. Question 7 — Impact of exemplar's background on imbalance

The previous question introduced the fact that imbalance in skills has an impact on the effectiveness of the leader. Question 7 explores if qualification, technical or non-technical, of the leader amplify the imbalance of the use of the skills. The data showed that good leaders had similar skill weightings as the ideal leader while the poor leaders showed an imbalance compared to the ideal leader, The PT leader exemplars spent too much time on administrative tasks (+120%) while the PNT leader exemplars had greater imbalance with the administrative tasks (+184%). This over balance in the administrative skills was at the expense of other areas – PNT exemplars spent -23% of the time on people tasks while the PT exemplars had over twice as much imbalance at -57% for people skills.

The qualifications/background of the poor exemplars does magnify the imbalance across the five skills compared to the ideal exemplar. They have a common imbalance pattern with their over-focus on administrative tasks and under-focus on people tasks but the magnitudes are different — over twice as much when comparing people skills. They also had imbalance in the area of technical tasks with the technical exemplar over-using (+37%) while the non-technical exemplar under-uses (-23%). This aligns with their background/qualifications. This fact was observed by one reviewer,

Reviewer AC (Executive Engineer):

'the expectation of some senior executives is that they will spend a material amount of time on the business process and administrative tasks. This because this is the 'comfort zone' for the finance guys (this is their 'technical' area) and it is the area they fall back into – they hide in these processes, they appear busy – not necessarily effective executives...'

Ineffective executive leaders of infrastructure tend to 'hide' in the administrative tasks of the business (systems and processes) rather than work with people. The ineffective leaders also hide in the skills of their background/qualification, the PT leader in technical tasks and the PNT leader in the administrative tasks.

7.2.8. Question 8 — Development of effective leaders

The research questions have shown that both technical and non-technical leaders can be effective. Technical skills are not the most important skill, but they are requisite for effective leadership. Ineffective leaders demonstrate an imbalance of skills, the most significant being the over emphasis on administrative skills. Question 8 asks if technically qualified leaders can be developed to be more effective. The structured part of the methodology showed that 33% of GT leaders had an MBA compared to only 20% of the PT exemplars. Interestingly 20% of the PT exemplars had PhD qualifications compared to none (0%) of the GT leaders. This may reflect the technical focus that enabled them to be promoted into these executive roles.

The reviewers identified a number of ways that a technical leader can obtain the skills to be more effective. In the reviewer discussions people skills were the most often raised skill, followed by business and then strategic skills. This corresponded with the ranking of skills for the ideal leader. The reviewers pointed to three primary ways for the technical leader to obtain these skills: (1) completing an MBA which would provide the ‘theory’; (2) working or leading a team in a function which is not engineering focussed; and (3) finding a mentor to challenge them to look outside their current world view. Gaining experience by working in different areas was the most consistent recommendation, with reviewers identifying that an MBA is further training that gives the leader more ‘tools’ not necessarily the skill which is the application of these tools. Mentoring was also highly recommended by the reviewers but they did qualify this by saying that it had to be right mentor, ‘*one that could demonstrate it by example*’ Reviewer AB (Generalist); and that they needed to have ‘*...not just engineering skills but ‘wisdom’ – experience and knowledge – and the ability to convey it to enthuse people*’ Reviewer AG (Operations).

Reviewers were of the view that technically qualified leaders can be developed to be more effective, and the majority of reviewers had provided an exemplar of an effective technical leader.

7.2.9. Question 9—Developing non-technical leaders for infrastructure

The primary focus of the research was regarding technical skills and technical leaders within infrastructure. The research has highlighted a number of issues concerning the non-technical leaders and how they too can become even more effective. Good non-technical leaders behave similarly to the good technical leaders and both groups display characteristics of effective

leadership in general leadership literature. The same statement can be made regarding the poor technical and poor non-technical leaders except they display the characteristics of ineffective leadership. Thus a PNT leader needs to be aware of the skills required and the ranking, weighting and balance of these in order to be an effective leader.

The skill balance scale highlights the skills the PNT should focus upon to maintain balance. Primarily they over focus on administrative skills and under focus on people and technical skills. Phase B of the methodology demonstrated that the technical and non-technical exemplars had similar descriptions. Thus the methods of development for the technical leader are equally applicable for a non-technical leader.

7.2.10. Question 10 — Practical utility of the methodology

The question of whether or not the methodology is practical answers the secondary aim of the research. Did the methodology enable the large sample of senior executives to describe their exemplars in a framework that provides logical empirical data for analysis based upon constructs from historical proven measures of effective leadership? The results from the previous two questions support the view that the reviewers are able to use this standardised descriptive framework within the limited available interview time by utilizing methodological compromises to enable:

- An effectiveness rating to be applied to good and poor exemplars.
- Description of infrastructure leader style using constructs at a high level.
- Description of infrastructure leader skill assessment at a high level.

As a practical methodology this approach, although not providing traditional validation of measures themselves, does give outcomes which can be interpreted to provide input into research areas. The strength of the approach appears to come from accessing the expert executive leaders who select, monitor and reward leaders and the structured approach built upon proven measures. It is questionable that the approach would be as strong without these expert leaders providing their input based on their vast experience. These experts are time constrained and the methodology enable a material amount of data to be obtained for analysis and still allows time for the reviewers to articulate their views. Informally and unbidden, the reviewers gave feedback following the interview process that it was ‘painless’ , interesting and a significantly better approach than answering a couple of hundred survey questions. The interview process also

enabled the reviewers to seek clarification regarding scope and meaning of the questions which further enhanced their ability to respond appropriately.

7.3. *Implications for Policy and Current Practice*

The findings of this research impact both on policy and practice of leadership for infrastructure businesses. The research on leadership within infrastructure is limited and, as discussed in Chapter 3, most leadership has been focussed on policy and practice. Kniflick (2002) and Whitmore (2004) did not focus on understanding skills of effective leadership but rather on describing the impact of change in leadership within infrastructure after privatization demonstrated by the clash of engineering and executive culture.

Commentators Casazza (1992), Strangleman (2004) and Wolmar (2005) blame the crisis in infrastructure on the new focus on profits above public service and that engineers being ‘purged’ from the key leadership roles. The existing engineering leaders were labelled as ‘risk adverse’ and ‘commercially naive’ and it was noted that ‘gold plated’ solutions were not an efficient use of an investors funds. Thus the replacement of technical leaders with non-technical leaders was perceived as an effective approach to create a step change in the way infrastructure was lead and managed (Yates 2001).

However, replacing technical leaders with non-technical leaders created issues. This research highlighted that technical skills are a requisite for effective leadership but they only form part of the skills required. Both technical and non-technically skilled leaders were found to be effective. The research confirmed that, in terms of general leadership styles, good and poor leaders in infrastructure displayed the characteristics that would be expected within the broader leadership population. This was confirmed in terms of leader derailment, leader influence, and leader behaviour using the constructs of three historical measures. Good infrastructure leaders, as defined by the reviewers, displayed effective styles while the poor infrastructure leaders displayed ineffective styles. Yukl’s framework had ensured that at a macro level a number of attributes of effective leadership styles had been explored concurrently. Thus the results of this research highlight six areas that impact policy and practice for effective leaders in infrastructure. These six areas include:

- skill mix;
- balance of skills;

- perception regarding engineers as executive leaders
- culture of infrastructure;
- development of infrastructure leaders; and
- assessing infrastructure leadership.

An additional observation concerned the research methodology and its effectiveness to, in a practical way, extract from an expert group valuable data in a limited time frame and provide high level analysis.

7.3.1. Skill mix for effective leadership

The primary focus of this research was around skills, the requisite skills for effective leadership. The focus on skills is not about what good leaders are (their innate characteristics and traits) but rather what they do (the kinds of skills which they demonstrate in completing their roles effectively). Additionally, skill implies an ability that can be developed and the effectiveness of the action will vary depending on conditions. Most of the research has been built upon Katz's (1955) classic work which reinforced this focus on the 'doing' function of the leader. The three basic skills identified by Katz — technical, people and conceptual — have been the basis of much research as summarized by Peterson and Van Fleet (2004) who support the skill focus but highlighted the possible expansion from three skills to ten. This research expands upon Katz's three-skill approach to a five-skill approach i.e. breaking up the conceptual into strategic, business and administrative. Katz (1955) separated skills from traits (he acknowledges significant overlap), and he also linked the 'doing' function with the fact that these skills, all three, can be improved by the application of training and coaching. The five skills used in this research capture all activities of an executive and the scales assessment may be developed to provide a practical tool for executives to measure the effectiveness of a leader and may be a guide as to future development and training. This will be discussed in section 7.3.5.

This research supported the five-skill approach and reinforced the appropriateness of the level of granularity. People skills were highlighted as both the most important skill and the function that requires the most amount of time for executives. The requirement of people skills is supported by both the quantitative and qualitative data in this research and previous researchers (Katz 1955; Mann 1965; Yukl 2006). Table 93 below summarizes the ranking and weighting of the five skills of an ideal leader.

Table 93 Comparison of skill ranking and skill weighting for ideal leader for all levels (1 is highest to 5 lowest).

SKILL ATTRIBUTE	SKILL RANKING		SKILL WEIGHTING	
	<i>Mean score</i>	Rank	<i>Mean score</i>	Rank
Technical	3.8	4	16.6	4
People	2.0	1	28.0	1
Strategic	2.3	3	20.2	3
Business	2.2	2	24.3	2
Administrative	4.7	5	10.5	5

The ideal exemplar provides this research with a reference point to what the expert reviewers perceive an ideal executive should be capable of and working on. An ideal leader of infrastructure should have 28% of their time dedicated to people issues and this should be their strongest skill. Business skills should be their next strongest skill and should take 24% of their time. This is followed by strategic activities for 20% of their time and their third strongest skill. A technical leader, who may have been promoted because of their technical skill to solve problems as identified by Badawy (1982) and Farris and Cordero (2002), will have to be ‘satisfied’ with their technical skill being ranked fourth and only spending 17% of their time in a function that historically may have accounted for significantly more of their time. Their value to the business may be that, within the executive team, they bring a clarity around technical issues and the risks within infrastructure but their greatest value add is not technical skills but skill with people, business and strategic skills. The final skill for an ideal leader is administrative and this should take only 11% of their time.

The research demonstrated that poor leaders can become ‘busy’ doing administrative activities which may give the appearance of ‘activity’ but not effective leadership. This skill appears to be a ‘hiding’ spot for the executive leader who for a number of reasons considers it appropriate to focus on the administrative activities rather than engage with those skills ranked more important.

The results of ranking the skills from this research follow similar ranking results of previous researchers. Goh, Coaker and Thorpe (2008), in their analysis of the required skills for CEOs, identified the top five skills to be leadership, communication ability, business acumen, strategic

planning and financial management. Their two highest skills, leadership and communication ability, are contained within the definition of people skills in this research. This suggests alignment of people, business and strategic skills, in ranking. They had technical skills seventh and, last, administrative skills. Some ‘greyness’ may exist around their definitions (Goh, Coaker and Thorpe 2008) as they explored skills and attributes in their ranking, but their ranking does appear to be supportive of this research.

Wyse (2007, p. 95), although using only four skills groups, identified that the rank should be strategic skills, people skills, ‘self’ skills, and organizational/business skills for ideal executive leaders within the Australian Public Sector. While this research is at the executive level the researcher would suggest that the differences around skill ranking can be attributed to these being Government businesses and this could be an opportunity for future research into GOC infrastructure businesses. Both of these examples highlight the similarity of results compared to this research.

The use of the weighting scale provides visibility about what an effective infrastructure leader should be focussed upon. Schein (2003) highlights that what is ‘important’ to the business will take the greatest amount of time. This is a signal to the organization of what is important for success. The weighting scale of time provides a measure that leaders traditionally use as a performance measure (i.e. we are paid by number of hours we work) of effectiveness for the colleagues. Measuring the time taken using a skill is a simple scale that leaders can assess themselves, and others, if they are using their time wisely and in the right skill areas. Poor or ineffective leaders focus their time on administrative tasks of the business, the systems and processes that support the business. These leaders, while initially successful as demonstrated by reaching these executive levels were described as spending over 50% of their time on administrative and business skills. This may be perceived as a good use of time within the executive culture and even rewarded by this culture, but the leader is ineffective primarily because of the lack of time they spend on people issues. The issues of being ‘insensitive to people’ and ‘unable to motivate and direct employees’ were listed as the prime reasons ineffective executives derail.

The expert reviewers described ineffective executives as being promoted to these executive levels primarily by managing their careers well or through a merger or acquisition. They display predominantly ineffective influence tactics of ‘legitimizing tactics’ or ‘pressure with a leadership

style of controlling of results (40%) or 'opportunistic – exploiting or manipulating' (24%). Yukl's (2005) integrating conceptual frameworks identifies that the source of this performance and style begins with the leader skill/trait variable. This would suggest that the ineffective leader's lack of people skills (ranked lowest compared to first for the effective leader) and the fact that they spend the least amount of time on people tasks (rather than the most time in the case of the effective leader) contributes to their ineffective performance. Their focus on business and administrative tasks keeps them aligned with the executive culture (Schein 2003) and may result in their ongoing success but they remain ineffective and more likely to derail than the effective leader due to people issues. The possible assessment and development of these ineffective leaders is discussed in the following sections.

In their descriptions the experts noted that the technical or non-technical background of these ineffective leaders did not significantly change their leadership behaviour, influence tactics or the way they derail. Their qualification/background mainly influenced the skill scale for the two ineffective leader groups. Both the PT and PNT leaders were described by the experts as having business skills ranked highest. The PT leader ranked technical skills second and people last. The PNT leader ranked administrative skills second. This appears to support an observation in the qualitative phase that the administrative skill is the 'technical' skill of the non-technical leader. People and technical skills ranked fourth and fifth, respectively, for the PNT leader. On the weighting scale both PT and PNT spent over 50% of their time on business or administrative tasks. The PT leaders spent twice as much time on technical tasks as the PNT leader. This may reflect their strengths in the technical skills. The PT leader spends the least amount of time on people while the PNT people skills were second lowest, lowest being technical skills. It would appear that if a leader has strong skills they 'favour' that activity – 'doing the tasks they like and are good at'. The reviewer's description of these poor leaders demonstrates that the leaders will work in the area of their strengths and this may create an imbalance. It also tends to point out that the dominant skill which causes this imbalance is poor people skills. This imbalance is discussed in detail in the following section.

The expert reviewer's description of the good leaders said that they reached these executive roles because they 'were excellent at motivating or directing subordinates' and had 'outstanding track records'. If they were to derail it may be from 'pushing themselves too hard' or 'being unable to adapt to a new boss'. These good leaders tended to influence people using 'rational persuasion' and/or 'consultation'. They tend to use leadership styles of 'contribute and commit (9,9)' or

‘paternal- prescribe and guide’. The description of the effective leaders reflects a strong people focus and this is seen in their skills with people skills being ranked strongest and the task they spend the most time upon. Unlike the ineffective leaders, they spend least amount of time on the administrative tasks. The skill balance within the GT and GNT leaders is also discussed in the following section.

The reviewer’s descriptions of the effective and ineffective leaders reflect results seen in the literature for leader derailment (McCall & Lombardo 1983); leader influence (Yukl 2006); and leader behaviour (Blake & McCause 1991).

The expansion from three skills (Katz 1955) to five skills has provided additional granularity which has been able to delineate differences between effective/ineffective and technical/non-technical leaders of infrastructure.

7.3.2. Skill balance for effective leadership

The findings of this research as detailed in the last section, suggested that the five-skills approach was not only appropriate but also provided a level of granularity around the effectiveness of leadership not previously seen in the literature (Katz 1955; Badawy 1982). The literature did highlight that the over or under use of a certain skill may lead to derailment (McCall & Lombardo 1983; Kaplan & Kaiser 2003) and may vary with the level of the organization (Badawy 1982; Mumford, Campion, & Morgeson 2007). The results of this research support the view that research suggests that the skills mix does vary with the level of the organization but not as significantly as figuratively portrayed in Badawy’s (1982) skill mix.

While recognising that Badawy’s management skill mix (MSM) is illustrative, it does highlight the perceived weighting of the three skills and the changing of weighting score as the leader moves up the levels of the organization. The scaling of the MSM in section 6.2 demonstrated that Badawy’s (1982) MSM diagram underrepresents technical skills while over emphasising the people skill weightings. This weighting scale and the previous ranking scale provided two scales to describe effective infrastructure leadership.

In this research the ‘ideal leader’ provided a control point to reference the leader’s effectiveness but also confirms the appropriateness of the five-skill approach i.e.:

- All were ranked and weighted by the reviewers.

- Ranking of good and poor leaders was reflected in the skills weighting and the skill ranking thus providing another way of identifying leader effectiveness.

McCall and Lombardo (1983) pointed to an overuse of technical skills plus Kaplan and Kaiser (2004) pointed towards an imbalance between both forceful enabling leadership and strategic/operational leadership. This research identified that an imbalance between the skills, the doing function of the leaders, also correlated with the effectiveness of the leader.

Kaplan and Kaiser (2004) highlighted lopsided leadership and that the effective leader is a versatile leader who has an absence of imbalance of qualities and skills. They choose two groupings: forceful/enabling and strategic/operational leadership. They utilize a scale, virtue (the right balance) and vice (overuse of the skill) to describe the imbalance.

The previous section on skill mix highlighted that skills ranking and their weighting correlated with descriptions of the ineffective and effective leaders. The ideal leader scale enabled a comparison of the five skill weighting for each exemplar groups. The variance of imbalance within the good leaders was $\pm 30\%$ this corresponds to Kaplan and Kaiser's (2004) description of 'virtue' balance. The magnitude of imbalance in skills seen in the ineffective leaders carries the similar description of 'vice' used by Kaplan and Kaiser (2004) and corresponds to an imbalance being greater than $\pm 30\%$ variance to the ideal leader weighting score.

Table 94 Summary of the skill balance results comparing exemplar to the ideal leader for the five skills

SKILLS	GOOD EXEMPLAR	POOR EXEMPLAR	GT	GNT	PT	PNT
Technical	8	13	20	-24	37	23
People	-2	-49	1	-12	-57	-37
Strategic	-8	-22	-9	-6	-18	-27
Business	3	2	-7	30	3	2
Administrative	10	146	7	18	120	184

(Shaded cells are the exemplars skills that displayed 'vice' – overbalance (+ve) or under-balance (-ve) i.e. those skills with greater than $\pm 30\%$ variance.)

The table above summarises the imbalance of skills for each exemplar group and highlights the between over use of the administrative tasks and the under use of the people tasks by the poor exemplars.

Kaplan and Kaiser (2003) pointed towards five root causes of the imbalance, namely: (1) uneven skill development; (2) skewed mental models; (3) one-sided values; (4) fear of inadequacy; and (5) tendency to polarize. Their work provides a framework for examining possible root causes within the results of the exemplars of infrastructure. The expert reviewers description of the exemplars viewed through the prism of the constructs of the three measures highlight a number of observations that may explain the imbalance observed within the poor leader exemplars. The reviewers suggested that the reason a poor exemplar experienced success in reaching the executive level in over 40% of the time was because they were ‘ambitious’ and ‘managed their careers’ well and/or ‘moved up in a reorganization or merger’. A good infrastructure leader, however, in over 40% of the time, reached these executive levels by being ‘excellent at motivating or directing employees’ and/or due to their ‘outstanding track record’. This method of advancement by the poor leaders into the executive levels may contribute to the imbalance. For example, the skills that had made the leader successful at the lower level are no longer required to be as dominant or take up as much time. Additionally, the poor leader may not have had the time to develop new skills either through formal training or experience and as such any of the five root causes may be reasons for the imbalance. This research provides examples of each of the root causes. For example:

- Uneven skill development i.e. the PNT leader being promoted as a result of privatization and the new focus on financial performance of the business without having adequate people skills. Traditionally, non-technical leaders come from small financial teams and have limited exposure to the wide range of people seen historically in the large technical teams. Thus they may focus on administrative functions rather than people functions.
- The promoted PNT leader may have a skewed mental model with the belief that financial/business results are most important and people skills are not as important at this level. This may result in the PNT rationalizing their view that people in lower levels require autonomy and hence mandating a ‘hands off’ approach. This, in turn, is interpreted by the followers as poor leadership style 1,1.
- After being promoted the poor technical leader may no longer want to be caught up in the ‘details’ of technical issues. They now have one-sided values by applying themselves to the business and administrative functions rather than ‘people details’ which are time consuming and difficult.

- The PNT leader out of *fear of inadequacy* may avoid technical and people tasks so as not appear intellectually inadequate and retreats to an area of strength, namely business and administrative tasks.
- The PT leader, in an effort to maintain credibility with the workforce, may still get involved with the technical issues as they have a *tendency to be polarized* between the business focus and the technical focus. They may over excel in both to the detriment of people tasks.

The dominant imbalance is that both poor leader exemplars (PT and PNT) are spending too much time on administrative functions to the detriment of people issues. The poor people focus identified in the skills assessment was also observed in the leader style descriptions. The reasons they are imbalanced could be one or more of the five root causes identified by Kaplan and Kaiser (2003). Section 7.3.5 explores how this assessment of skill imbalance impacts the development of leaders. A resultant measure could be developed in future research and may assist ineffective leaders to develop and be supported to have successful careers with reduced risk of derailment.

7.3.3. Perceptions pertinent to engineers as leaders in infrastructure.

The quantitative phase of this research provided details concerning the skills and descriptions of the technical leaders and this was discussed in the previous two sections. This section discusses the perceptions pertinent to engineers as infrastructure leaders as described during the qualitative phase of the methodology. People skills or, lack of them, was raised by expert reviewers as the most important issue for the engineer as a leader. These people skills are not only required for follower interactions but for interactions with their peers and leader or Board members. This was an issue identified even for effective technical leaders. One reason for derailment was their inability to adapt to a new boss. Another area of focus was the need for technical leaders to be able to leave the technical detail — the hallmark of a good engineer — and work on the business, to focus on the ‘big picture’ and to understand the other business. An extension of this observation from a number of reviewers was the need for engineers to be more flexible especially in their world view, to move from a ‘black and white’ world view to understanding that shades of grey do exist. This observation is consistent with the need for engineers to have political savvy

(Brandon & Seldman 2004). The reviewers also commented that engineers are risk adverse and ‘gold plate’ solutions and that they cannot balance business and asset requirements.

An observation from reviewers was that while they acknowledged engineers required improvement in some areas, other professions such as accountants, lawyers and commercial leaders also have ‘issues’ as they advanced into the executive roles. The reviewers highlighted that engineers with their training and experiences have a number of advantages. These include the ability to be objective in problem solving, and articulate often complex business problems. They also provide the board and executive level with the ‘language’ of infrastructure which is technical in nature and this ability to communicate within infrastructure gives engineers the ability to communicate throughout the whole organization especially to a workforce dominated by technical experts.

The other observation from the expert reviewers was that they did not hold the polarised view that no engineers should be in executive roles as observed by Wolmar (2005). Both expert reviewer groups identified GT and GNT exemplars and PT and PNT exemplars. The distribution of the exemplars the experts selected demonstrate this balance, as shown in figure 15. (Badawy (1982) and Goodall (2009) highlighted that experts in leadership need to be supported and developed rather than be marginalized because of their qualifications and backgrounds. In section 7.3.5 the observations from the reviewers regarding what engineers need to do, both if they are to be effective in these executive roles and to change the paradigm, are discussed.

7.3.4. Culture of infrastructure

The previous sections discussed the skills, the skill balance and the perceptions of engineers as leaders of infrastructure. Those sections paint a picture of the culture of infrastructure. The skills weighting and balance create assumptions and artefacts of the culture (Schein 2004). The skill weightings of an ideal leader send a clear message to the infrastructure business regarding both the importance and ranking of the skills. The order of skills required will vary depending upon the level of an organization and its function.

A number of reviewers, although not going into detail, pointed towards cultural survey’s completed by companies which they believed accurately reflected the culture of infrastructure. A tool mentioned several times was the Organization Culture Inventory (OCI). The OCI results from a number of organizations gave a picture of *‘highly oppositional and avoidant culture not*

dissimilar to engineering companies worldwide’ Western Power (2009, p. 29). This oppositional focus highlights that *‘people are expected to be critical, oppose the ideas of others, and make safe (but ineffectual) decisions’* and the avoidance focus is that *‘people are expected to shift responsibility to others and avoid any possibility for being blamed for mistakes’* Yarra Water (2005, p. 4).

The other cultural references discussed by the expert reviewers pointed towards the language of infrastructure as being ‘technical’ and this enabled the organization to move as one. The introduction of the business focus has created tension (Whitmore 2004; Wolmar 2005) but the reviewers focus on the need for strong people and business skills was the perceived way to ease this tension. The focus of OCI work was to work towards the constructive styles and a number of the reviewers highlighted this as evidence of the leaders focussing on the people issues and developing the leader’s leadership style to a more constructive focus..

While the reviewers acknowledge the culture of infrastructure was predominantly engineering they also emphasised the role of the leaders to create change if the culture is to change at all. This observation is supported by Schein (2004). It is this training and development of infrastructure leaders which will be discussed next.

7.3.5. Development of infrastructure leaders

The results of the research demonstrated that technical skills are a requisite for effective leadership as are the four other skills; people, business, strategic and administrative. The primary focus of this research has been based around technically qualified leaders and the changes required for them to be effective within the new privatized infrastructure industry. The infrastructure industry has tried to manage this development by (1) ‘purging’ – removing all engineers from executive roles (Strangleman 2004; Wolmar 2005); (2) placing non engineering qualified leaders into CEO/Board roles (Linn 2000); (3) development of a new industry body, Asset Management; (4) outlining the competency required to lead infrastructure (IAM 2008a); and (5) adopting engineering executive qualifications (CELM 2006). The expert reviewers provided good exemplars of executive leadership with both technical and non-technical qualifications, which demonstrates that purging engineers or replacing all CEO with non-technical leaders has not been a practical solution. Good infrastructure leaders with engineering qualification exist and they are effective.

This research's results in skill ranking and skill weighting provide guidance to industry groups such as Engineers Australia, Asset Management Council and the Institute of Asset Management about which competences are required for executives to be effective. Goh, Coaker and Thorpe (2008) identified a similar opportunity when they examined what Australia CEO's with engineering qualifications believe are the skills and qualities required for career progression into executive roles such as CEO. Goh, Coaker and Thorpe (2008, p. 1), while highlighting the required skills, leadership, communication ability, business acumen, strategic planning and financial management pointed out that *'most universities do not cover this skill set and attributes'*.

Goh, Coaker and Thorpe (2008) suggest that the university courses should be adjusted to reflect the needs of industry to maximize the professional developments programs such as in post graduate courses. This research suggest that not only should the courses reflect industry needs but also the assessments (as used by Engineers Australia, Asset Management Council and Institute of Asset Management) should not inadvertently direct executives into a more 'technical' focus, as may be implicit in the current frameworks as they focus most of the competences on skills that promote engineering heritage. This will be explored in more detail in the following section.

The expert reviewers identified three broad approaches to develop infrastructure leaders, technical and non-technical. These are by (1) formal training such as an MBA; (2) leading functions outside of the leader's regular function; and (3) obtaining a mentor to challenge the leader's existing world view. The common recommendation from the reviewers was for leaders to obtain an MBA. Not all reviewers or their good exemplars had an MBA (<30%) but they pointed to the course as being an adequate postgraduate course to expose leaders to people, business and strategic theory. A new Engineering Management Masters may be suitable in the future (Gola, Jokic & Hartle 2010). One reviewer noted that an MBA was important but, equally important, was to ensure the leader applies their new-found knowledge or the step change opportunity may be lost. Exposing leaders to other experiences was a dominant recommendation from the reviewers (Jaques 1989) describes skills plus experience as wisdom – the application of skills. It is this wisdom that the reviewers noted as an effective way forward for both technical and non-technical leaders to develop their skills. Examples suggested for engineers include having executives' responsible for non-engineering functions such as finance, strategy, human resources, treasury, etc. Equally, non-technical leaders could be given responsibility for operational areas such as a major capital expansion project, a major maintenance capital program,

or leading a regulatory reset submission. Kaplan and Kaiser (2003) suggest this approach to help the out-of-balance manager. They refer to the process as ‘strengthening the weak side’ and ‘moderating the overuse side’.

A mentor was also suggested as someone who could assist in challenging the leader to look for other opportunities and/or help the leader reflect upon their performance and whether or not they are effective in their role. One reviewer raised the importance of selecting a mentor that understood the wide range of skills required and ideally could demonstrate their application. The reviewers reiterated that the leaders’ graduate qualifications do not have to be seen as a negative – formal training, experiences in other function and a mentor will all provide the leader with the support for them to grow and become more effective.

7.3.6. Skill Assessment of leader’s effectiveness

The descriptions of the exemplars by the reviewers provided a view of infrastructure leaders within leader style (LD, LI, and LB) and leader skill (rank and weighting). The reviewer’s leader style descriptions utilized constructs from proven historical measures.

To address the characteristics and skills of good infrastructure leadership the methodology used constructs of leadership characteristics and skills to provide a descriptive framework for use by the expert raters.

The link between leadership and leader effectiveness was not directly assessed. Rather, by seeking descriptions of highly rated and poorly rated leader exemplars, the research rationale was to focus on leadership characteristics and skills in order to (a) see if there were common characteristics and skills of good and poor infrastructure leadership; (b) to compare and contrast the leadership characteristics and skills of highly and poorly rated infrastructure leaders; and (c) to see the extent to which infrastructure leaders with different professional backgrounds (e.g. engineering and business management) rated high or low were similar and different in terms of their leadership characteristics and skills.

A similar methodological approach could be taken to provide a descriptive framework that focussed on the performance indicators (i.e. the outputs) that signify leadership effectiveness. However, the purpose of this research was not to further clarify and explore the performance indicators of effective infrastructure leadership. Furthermore, because of the restricted time that could be reasonably requested from the expert raters a structured examination of these

performance indicators would have been impracticable as an addition as it would have essentially doubled the time required of the raters.

The leader skill description utilized two assessments, skill rank and skill weight. These two assessments may be developed into a practical scale which may assist leaders assess their own effectiveness. The skill weighting assessment is a simple scale from which a leader could gain valuable feedback regarding what is expected of their role and what colleagues perceive is the leader's area of focus. The subsequent assessment of imbalance across the five skills may help the leader identify the areas requiring focus and assess their development over time. The results of forty-six expert reviewers in defining the ideal leader provide a reference point for a leader to compare themselves. If an imbalance were to be identified, the leader can then turn to formal training, experience opportunities and mentoring to help in the development.

The amount of time spent on a particular skill such as business, people, strategic, technical and administrative may also provide a simple guide for both mentors and those they mentor to assess if they are being effective. The research highlighted that a $\pm 30\%$ variance appeared to be acceptable and that ineffective leaders may display significant variance to this $\pm 30\%$ distribution of time spent with the skill groups. In addition this could be developed into a tool to be utilized in the recruitment of executive leaders. The process could involve prompting the candidate to explain why they spend the time they do on each of the five skills and what they have done to strengthen their skills but also ensure they maintain balance and not become ineffective.

This research provides a top down view of the requirements of effective leadership for which future researchers may develop a practical tool or research measure.

7.3.7. Value and limitations of methodology

This research methodology required a design that could explore a range of characteristics for the success of an executive leader in infrastructure organizations. To do this 46 senior executives identified two exemplars of leadership, one good and one poor with whom they had worked who could be described using (1) a standardized descriptive framework based on the constructs of historical leadership effectiveness measures; and (2) a detailed descriptive framework to describe the exemplar's skills and that of an ideal exemplar doing that role. The quantitative phase enabled statistical analysis. The qualitative phase enabled the expert reviewers to describe in their own

words what an effective infrastructure leader needs to be and how technical leaders can become an effective executive leader of infrastructure.

The secondary aim of this research was to explore a practical methodology for systematically accessing the expert opinions of senior executives on the skills and capabilities that characterise good and poor infrastructure leadership. Analysis of the data from the quantitative phases A, B, and C has identified a number of observations which have been discussed in detail in the previous sections. To gain this valuable data, a number of methodological compromises were required to make the approach practical and effective while maintaining robustness.

In order to access an expert group with time constraints and to ensure engagement the process needed to be short and simple. In addition the subject matter had to be relevant — an issue that the experts address on a routine basis. The subject matter, effective executive leadership, was seen by each expert reviewer as an area of interest, especially on how technical leaders could be developed in the new commercial infrastructure business. No prospective reviewer declined to be involved after confirmation that the process would take less than one hour and that it involved a structured interview. This approach demonstrated respect and they therefore agreed to participate in the process. Reviewers saw value in the approach of reflecting on a good and poor exemplar. This made the process practical in that they were not being asked a series of abstract questions which had no relation to their experience and expertise. Asking the experts to nominate the top three statements which describe effective leadership from constructs of proven historical measures reinforced the fact that this research was not a theoretical bottom up approach but a process wanting to extract opinions based upon many years of experience in the industry. A number of reviewers commented on how easy the process was and that they had been very much challenged by selecting the statements. They also complemented the interview approach in that they could ask for clarity when necessary to ensure their selected statement was truly appropriate. Using constructs from historical measures provided credibility to the process as the statements being ranked appeared to the reviewers robust and complete. A number of reviewers highlighted that had the process been to complete even fifty questions using a traditional scale they would have preferred not to be involved especially considering the process had to be repeated for a second exemplar. The semi-structured interview at the end of the process enabled reviewers to articulate their own views. Their thoughts had been stimulated by the preceding structured section and most reviewers wanted to share their own observations knowing that they had already given data based on historical research of the literature.

Although not to utilize the historical measures in full (which would have allowed validation of the measure) was not a perfect approach it appears unlikely that the large number of reviewers would have participated had the research employed first principals. This modified approach has resulted in invaluable data which, when analysed, has described characteristics of effective leadership in infrastructure and also confirmed that descriptions given by the experts match effective and ineffective descriptions from literature.

The effectiveness of the methodology can be summed up by reviewer AE (Industry Professional): *‘I enjoyed this process. I had to really think. It also surprised me how close to the surface my emotions are when remembering a good and a poor leader.’*

7.4. Areas for future research

The findings of this research identified that technical skills are a requisite for effective leadership and that the five skills typology provided sufficient granularity to quantify imbalance of skills as a contributor to ineffective leadership. Within the infrastructure framework, further work could be done to explore if the ideal leader weightings are the same in GOC infrastructure business and if the imbalance is evident for ineffective leaders. In addition to GOC businesses, the infrastructure businesses that have gone through the various transitions of ownership e.g. private to public to private should also be considered as a possible sample group using this methodology. The five skills may be universal and other industries should be examined where the ‘technical’ side of the business is strong at the lower levels and requires change to be effective at the executive levels. Typical examples may include the medical professions (nurses, doctors), law, research and development, consultants, education (teachers) etc.

Another area for future research is to consider aligning the post graduate training (i.e. MBA) and certifications (Eng Exec, IAM) to weightings of the ideal leader skills. Further research is required to align the most appropriate training required for each of the five skills. This may enable the course offering to be more universal and suitable for technical and non-technical leaders.

The development of the five skill scales as a measure of effective leadership requires further research. The additional research could monitor a group of leaders as they progress in their careers. The scale could be developed to be used as part of the recruitment process.

Another area for further research concerns the methodology utilized for this executive expert group. Further research could compare the results of historical leadership measures from first principles and have the expert reviewers select the top three statement constructs from the measure. This may provide support for utilizing this methodology when working with industry experts with limited time availability.

Future research, using a similar group of expert raters and a similar structured interview approach could also usefully explore the best and most appropriate measures/performance indicators that could be used in the infrastructure industry to assess leadership effectiveness.

7.5. Conclusions

This research has determined that technical skills are requisite for effective executive leadership of infrastructure assets. An expanded five skill typology consisting of people, technical, business, strategic and administrative skills was developed from the historical three skill models of Katz (1955) and Badawy (1982).

The research also developed a practical, efficient methodology for working with executive/Board expert sample group who had limited time availability. The methodology, which utilized a structured interview consisting of three constructs from historical measures of effective leadership, three leader ratings (ideal, poor and good) and two skill measures (ranking and weighting), and a semi-structured interview was able to be completed in under one hour. The approach enabled a large sample of experts (46) to provide descriptions of 91 good and poor exemplars of executive infrastructure leadership. The styles were described using the constructs of three historical measures. The leader skill assessment was completed through the skill ranking and weighting across five skills, namely, people, technical, business, strategic and administrative. The reviewers provided an ideal, a good, and a poor executive leader exemplar for the skill assessment. The group of reviewers held positions at executive levels in infrastructure organizations and had either technical or non-technical backgrounds or qualifications. The results from utilizing the three constructs of historical measures in the modified way provided sufficient data for analysis of the exemplar sample (n=91). The results of the analysis confirmed that the description of the good and poor infrastructure leader exemplars had similar descriptions to the effective and ineffective leadership literature and research.

The expert reviewers described effective executive infrastructure leaders as having excellent people skills and if they were to derail it would be because they work too hard or fail to adapt to a new boss. They utilize effective influence tactics and in the majority have a 9,9 GRID® style (Contribute and Commit) or a paternalistic Grid® style (Prescribe and Guide). The ineffective executive leaders were described as having poor people skills and reached the executive levels through a merger or restructure and/or by managing their careers well. In the majority of cases they derail over people skills as they appear either arrogant or to be a bully and they use ineffective influence tactics of legitimating tactics and/or pressure. Their leadership styles are dominated by the 9,1 controlling Grid® style (Direct and dominate) or opportunistic Grid® style (Exploit and Manipulate).

The five skill typology is adequate in describing the skills/function of the executive leader in infrastructure and an effective way to understand the leader's effectiveness. The definition of skills is built upon Katz's (1955) definition which is a broader definition combining cognitive skill experience and application to the task. The five skills provide adequate granularity to identify differences within the description of the exemplars when sample groups are split into good/poor/ideal and technical/non-technical. For an ideal leader the ranking and weighting of the skills has the same order i.e. people (1st), then business, strategic, technical and lastly administrative. The good exemplars had similar skill characteristics as the ideal exemplar. The poor exemplars of leadership have strong administrative/business skills and this may account for why they remain successful. The people skill ranking and weighting are ranked lowest which supports why ineffective leaders derail around people issues. When comparing the ideal skill weighting results with Badawy's (1982) management skill mix (MSM) his model does not accurately reflect the description for infrastructure leaders. The skill weighting varies with the change of levels of the organization as per the MSM but the technical skill weighting is underrepresented and the people skill weighting is over represented.

The weighting and ranking of the skills of an ideal executive leader could be utilized to guide educators and industry groups about the proportion of the time and effort spent developing leaders. This represents an increase of focus upon non-technical skills and would be reflected in changes to the Engineers Australia Executive Engineer certification and the IAM competency framework. The technically qualified leaders should be developed by: (1) focussing more on non-technical skills; (2) broadening their experience by working or leading non-technical functions within the organization; and (3) obtaining a mentor to help in their development. The

non-technical leaders can apply the same development process but by focusing on technical skills and technical functions.

It is recommended that educators develop a technical course for non-technical infrastructure leaders. It should have a framework aligned to the asset management plan structure (Lloyd 2010). Both technical and non-technical educators need to focus on people skills as a priority.

The skill weighting for the good/poor exemplars were compared with the ideal exemplars skill weighting. The resultant skill balance score identified that ineffective leaders had greater imbalance across the five skills than the effective leaders. The poor leaders tended to overbalance and stay in an area of comfort i.e. in the administrative tasks. They spend an inadequate time on people tasks which may be an avoidance strategy. This imbalance may have five root causes previously identified by Kaplan and Kaiser (2003). This is an area for future research. The five skill measures, ranking and weighting, could be utilized as a 360° performance measure for developing and monitoring executive leaders. A measure could be developed to be used as a recruitment aid for potential new executive leaders in infrastructure assets.

This research has demonstrated that technical and non-technically qualified executive infrastructure leaders can be effective. Technical skills are a requisite for effective leadership.

8. References

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Appendix 1: Central Queensland University – Ethics Approval



Information Sheet

1st October 2010

Title of Project: Taxonomy of skills for effective leadership in the management of physical assets.

The project, Taxonomy of skills for effective leadership in the management of physical assets, aims to understand the influence of engineering skills upon the style and effectiveness of senior leaders managing complex assets such as infrastructure. It is expected that where engineering or technical skills are not found within the senior roles then the leadership styles will be less effective. The participant groups will be the executive levels of organisations from directors down to middle management.

Participation will consist of a face to face interview of approximately 30 minutes duration and not in your place of work. The subject matter will relate to leadership, and I will be asking you to comment on the leadership traits of past/current managers.

In order to ensure that your involvement in the project is not released, I will seek your verbal consent, rather than asking you to provide your consent in writing.

In line with CQ University's ethical procedure, I ask that after we have completed the research, that you will post (envelope and postage provided) the completed interview sheets to my supervisor for collation prior to me starting my analysis. This requirement is evidence of your

consent to be part of this research and that you volunteered. If after the interview you reflect and do not want to be part of the program do not post the documents and shred sheets.

No one who is a direct employee of any company for which I hold the office of Director will be asked to participate. Fellow directors, my peers may be asked to volunteer.

You can withdraw from the project at any time without penalty. Non participation will not affect your employment or academic standing.

The survey data will be stored for 5 years in accordance with Central Queensland University's Code of Conduct policy. Consent will assumed by the completion and submission of the survey.

The data will be used in my doctoral thesis, which may include a number of journal articles or conference papers, but you may be assured that neither your name, your manager's name nor your organisation will appear in any publication arising from this project.

If there are any questions relating to the survey please contact Mr Anthony Vaughan, by email at c95009817@student.cqu.edu.au , or by telephone at + 61 402 060 531 or by mail at c/o Patrick Keleher, School of Engineering and Built Environment, CQ University, Rockhampton, Queensland 4702.

Please note:

1. Contact CQUniversity's Office of Research (Tel: +617 4923 2607) should there be any concerns about the nature and/or conduct of this research project.
2. The research findings and discussion of this study will be able to be accessed at the completion of my research at the Library of Central Queensland University and Australian Digital Thesis site www.adt.caul.edu.au

Appendix 2: Interview Questionnaire

Leadership of infrastructure assets

Demographics			
Reviewer		Leader under -review	
Your Level		Leader Level	
		Years know leader	
Sex		Sex	
Years in Industry		Years in Industry	
Industry			
Highest education level		Highest education level	
Base Qualification		Base Qualification	
Non engineer qualifications		Size of technical team	
		% technical engineering	
What type of 'engineer' do you think		Ranking of leader – 1 t o 10 (1 worst – 10 best)	

Positive Behaviours of Leader (rank top 3)		Negative Behaviours of Leader (rank top 3)	
Outstanding track record		Insensitive to others, abrasive, bully	
Outgoing, well-liked		Cold, aloof, arrogant	
Technically brilliant		Betrayal of trust – 'one-upping or failure to follow through'	
Loyal and helpful to Management		Over managing – failure to delegate or build a team	
Willing to make sacrifices		Over –ambitious – always looking for next job, playing office politics	
Ambitious and managed career well		Failing to staff effectively – selecting poor people or recruiting not for the organisation	
Moved up in reorganisation or merger		Unable to think strategically – over attention to detail	
Excellent at motivating or directing subordinates		Unable to adapt to a Boss of a different style	
		Overdependence on an advocate or mentor	
		Pushing themselves too hard	

Influence Tactics (rank top 3 methods)		<i>Inspirational Appeals</i>		<i>Ingratiation</i>		<i>Coalition Tactics</i>	
<i>Rational Persuasion</i>		<i>Consultation</i>		<i>Personal Appeals</i>		<i>Legitimizing Tactics</i>	
<i>Apprising</i>		<i>Collaboration</i>		<i>Exchange</i>		<i>Pressure</i>	

Grid position	<i>9,1</i>	<i>1,9</i>	<i>5,5</i>	<i>1,1</i>	<i>Paternal</i>	<i>Opportunistic</i>	<i>9,9</i>
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Leader skill level rank 1 highest to 5 lowest	Technical	People	Strategic	Business	Administrative
Ideal leader at this level					
Leader under review					

Leader skill focus out of total of 100%	Technical	People	Strategic	Business	Administrative
Ideal leader at this level					
Leader under review					

Appendix 3: Interview Questionnaire Process

Effect of engineering skills on the Leadership of Management of Physical Assets

Survey Questionnaire Guide:

'Using the questionnaire template, make sure you complete the template in front of the participant so that they can see what you are recording and that in no way do you record any information that could identify the results to themselves.'

Introduction.

My name is Anthony Vaughan. I have been involved in engineering and the management of assets for the past 25 years. I am the chief engineer with a global infrastructure company listed on the ASX, and sit as a Director the Boards of a number of our asset companies both here in Australia and Europe. I am currently a PhD student at the Central Queensland University.

Throughout my career I have seen both good and bad leaders with engineering skills. The stereotype is that engineers are too technically focused and lack people skills. The response has been too often to place non-engineering skilled people as leaders of technical teams, especially at senior or executive levels. They are seen as more able to better understand the people and build effective business culture. My observations have seen mixed results; my hypothesis is that non-engineering skills are more of a disadvantage to the leader than developing the 'people' skills in the engineering skilled leader.

The past fifteen years have seen me move into a more business focus around the performance of the physical assets. This has coincided with the development of the thinking behind Asset Management which is the management of value and risk to ensure business performance in infrastructure type assets. The management of these infrastructure assets has seen an introduction of both engineering and non-engineering skills within the senior leadership.

I would like to invite you to participate with this research to better understand if a difference does exist and what has been the effect on technical colleagues. From the research I would hope that

we may be able to identify some of the training support we should be providing these leaders to ensure that they are effective.

The research process is a short simple interview based around two leaders that you believe is the best leader you have worked for or led and an another leader which you believed is the worst leader you have worked for or led. Ideally engineering and non-engineering type leader would be best comparison. This should only take about 30 minutes – the reason of this approach is that I am focusing on the senior levels of organisations including Directors of Boards.

Confidentiality of your responses to this study is assured and you will see that I do not identify you are the leaders you are commenting on. Under no circumstances is it possible that your name or any institutional can or will appear in any publication of this research. If you are uncomfortable with this assurance please do not complete the interview. The process has CQU ethics approval.

Survey Process.

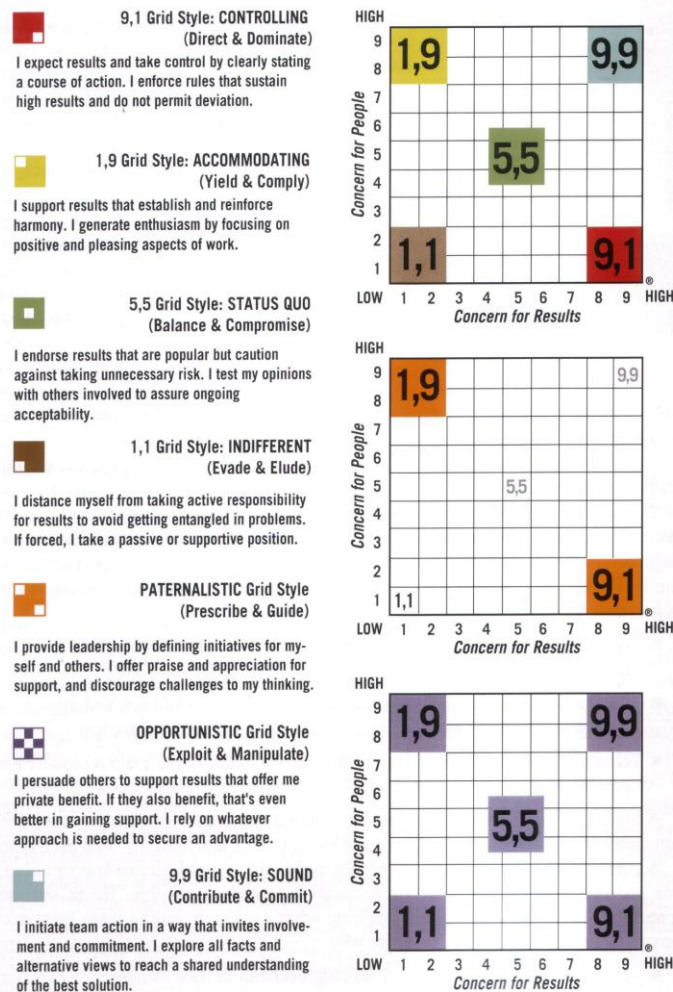
- Think about the leaders that you have worked for or worked with at the senior levels of your organisation.
- Now choose a good and a poor leader, ideally they should be engineering and non-engineering skilled if possible but not mandatory.
- Working with the good leader first lets work through the survey tool:
 - Level refers to the level in the organisation:
 - level 5 is Board/CEO
 - level 4 is Executive team
 - Level 3 is Senior management
 - Level 2 is Supervisor
 - Level 1 is Operational
 - Qualification refers to the discipline of the leader – what is their major of qualification.
 - Size of the technical team refers to the number of employees under the management of that leader
 - Per cent technical engineering refers to the rough percentage of technical personnel within the team above.

- Ranking of leader – thinking about the best and worst leader you have worked for/with how this leader ranks.
- Research shows that leaders especially at the senior levels are often successful or unsuccessful on a small number of behaviours. Looking at the list of positive and negative behaviours rank the top three frequencies of behaviours in each column for this leader. Rank as many as you can, sometimes you may be able to only rank one.
- Research shows that leaders use a number of proactive influence tactics – ‘how did they get you motivated to work’. There are eleven main types, rank the top three most used tactic used by this leader. The following table may better explain the types of tactics.

Proactive Influence Tactics	
The leader :	Tactics type
Uses <u>logical</u> arguments and factual evidence to carry out the request	<i>Rational Persuasion</i>
This will <u>benefit</u> you personally or your career if you carry out the request	<i>Apprising</i>
<u>Appeals</u> to your values and ideals, emotions to carry out the request	<i>Inspirational Appeals</i>
Asks for <u>suggestions</u> to improve the proposal if you carry out the request	<i>Consultation</i>
Will provide the <u>resources</u> and assistance if you carry out request	<i>Collaboration</i>
Uses <u>praise</u> and flattery and confidence in you ability	<i>Ingratiation</i>
Asks for support out of <u>friendship</u> and as personal favour	<i>Personal Appeals</i>
Suggests an exchange of <u>favours</u> at a later stage	<i>Exchange</i>
Uses <u>peer</u> pressure as the reason	<i>Coalition Tactics</i>
States they have the <u>authority</u> to make you comply via the rules, policy, contracts, etc	<i>Legitimizing Tactics</i>
<u>Demands</u> , threats, frequent checking or persistent reminders	<i>Pressure</i>

- Again research using the Grid® method which basically compares the leader’s focus on concern for people or concern for task/results. The work is based on Blake and Mouton is fairly well known in management circles. The scoring looks like this below:

The Leadership Grid®



McKee and Carlson (2003, p. 16)

- It is often difficult to identify the leader's position on the Grid® intuitively so I use the questionnaires for the scoring methodology of the Grid® self-assessment guide to roughly place the leader into one of the styles. I use the six elements of conflict solving, initiative, inquiry, advocacy, decision making and critique. I may not use all six questionnaires if the style becomes obvious to the participant.
- The final two elements of the survey tool examine the managerial skill mix for effective management. Research highlights that the mix of skills will change as the leader operates at different levels of the organisation. The five skills being examined are:

- Technical – basically refers to the engineering based skill of understanding how and why the assets are designed/constructed and operated to meet business needs.
- People – refers to the interpersonal skills used to effectively manage a group of people for the business objectives.
- Cognitive – refers to the intellectual strength but more focusing on their ability to think strategically/conceptual within the organisation – take the ‘big picture’
- Business – refers to the overall skill of understanding how the company works and how it is pursues its objectives for all stakeholders.
- Administrative – refers to the skill s of working through and with the systems within the company to get the outcomes across a number of divisions.
- The participant first ranks from 1 to 5 the importance of the skill displayed by the leader under review and what the ideal leader should have displayed. The second table has the participant allocating out of 100 percent what amount of time the leader spent in each of those skill areas, again they also score the ideal leader.

Process is repeated for the ‘poor’ leader.

Participants are thanked for their participation and it is explained that the results will be used to prepare my thesis for the award of PhD and some aspects of the research maybe published and presented at professional conferences.

Appendix 4: Detailed results from the phase B on the rating top three descriptions

The following three tables provide details around the number of times a statement scored a 1 or 2 or 3 or no score at all by the reviewers while describing their exemplars using the constructs of the three measures of leader style . They are included for completeness and may provide a future researched with a more detail analysis using the methodology of this research.

Leader Influence statements	Good tech exemplar						Good non-tech exemplar						Poor tech exemplar						Poor non-tech exemplar					
	Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	Number Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	Number Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	Number Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	Number Exemplars	
Rational Persuasion	18	7	3	28	36		8	2	1	11	13		4	2	1	7	25		1	2	0	3	17	
Apprising	1	1	2	4	36		2	2	0	4	13		1	4	4	9	25		3	0	3	6	17	
Inspirational Appeals	6	4	5	15	36		0	3	3	6	13		0	0	1	1	25		1	0	5	6	17	
Consultation	6	14	3	23	36		2	3	2	7	13		0	1	1	2	25		0	0	0	0	17	
Collaboration	1	6	11	18	36		1	2	4	7	13		0	0	1	1	25		0	1	0	1	17	
Ingratiation	2	0	6	8	36		0	1	0	1	13		3	1	2	6	25		2	0	1	3	17	
Personal Appeals	0	0	1	1	36		0	0	0	0	13		0	0	2	2	25		1	1	0	2	17	
Exchange	0	0	0	0	36		0	0	1	1	13		0	1	4	5	25		1	0	0	1	17	
Coalition Tactics	1	0	0	1	36		0	0	0	0	13		0	6	4	10	25		1	3	1	5	17	
Legitimizing Tactics	1	3	0	4	36		0	0	2	2	13		12	5	2	19	25		4	6	4	14	17	
Pressure	0	1	3	4	36		0	0	0	0	13		5	5	3	13	25		3	4	2	9	17	
None				2						0						0						1		
Total	36	36	34	108	108		13	13	13	39	39		25	25	25	75	75		17	17	16	51	51	

Leader Derailment	Good tech exemplar						Good non-tech exemplar						Poor tech exemplar						Poor non-tech exemplar					
Positive Statements	Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No. Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No. Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No. Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No. Exemplars	
Outstanding track record	7	5	7	19	36		5	1	3	9	13		3	0	4	7	25		1	1	1	3	17	
Outgoing, well-liked	2	4	6	12	36		3	2	0	5	13		3	0	0	3	25		1	2	0	3	17	
Technically brilliant	4	6	5	15	36		0	1	1	2	13		6	3	0	9	25		1	3	0	4	17	
Loyal and helpful to Management	5	5	5	15	36		1	1	3	5	13		0	1	6	7	25		4	2	2	8	17	
Willing to make sacrifices	0	7	2	9	36		0	0	1	1	13		2	2	1	5	25		0	2	0	2	17	
Ambitious and managed career well	2	3	3	8	36		2	3	3	8	13		6	8	1	15	25		6	3	3	12	17	
Moved up in reorganisation or merger	0	2	2	4	36		0	2	0	2	13		5	7	3	15	25		3	3	5	11	17	
Excellent at motivating or directing subordinates	16	4	5	25	36		2	3	2	7	13		0	0	1	1	25		1	0	0	1	17	
No data				1						0						13						7		
Total	36	36	35	108	108		13	13	13	39	39		25	21	16	75	75		17	16	11	51	51	

Leader Derailment	Good tech exemplar						Good non-tech exemplar						Poor tech exemplar						Poor non-tech exemplar					
Negative Statements	Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No Exemplars		Ranked 1	Ranked 2	Ranked 3	Ranked 1,2 or 3	No Exemplars	
Insensitive to others, abrasive, bully	1	2	0	3	36		1	0	1	2	13		4	4	7	15	25		3	1	3	7	17	
Cold, aloof, arrogant	0	3	1	4	36		3	0	0	3	13		2	5	1	8	25		2	1	1	4	17	
Betrayal of trust – ‘one-upping or failure to follow through’	1	2	0	3	36		0	0	0	0	13		4	1	4	9	25		0	2	1	3	17	
Over managing – failure to delegate or build a team	2	4	3	9	36		2	2	0	4	13		4	3	3	10	25		3	1	3	7	17	
Over –ambitious – always looking for next job, playing office politics	1	2	1	4	36		0	1	0	1	13		4	4	0	8	25		4	2	1	7	17	
Failing to staff effectively – selecting poor people or recruiting not for the organis.	6	0	2	8	36		0	0	1	1	13		2	4	3	9	25		1	6	3	10	17	
Unable to think strategically – over attention to detail	4	2	1	7	36		0	0	0	0	13		1	1	2	4	25		3	3	1	7	17	
Unable to adapt to a Boss of a different style	10	4	1	15	36		0	1	0	1	13		2	1	1	4	25		0	0	1	1	17	
Overdependence on an advocate or mentor	2	0	1	3	36		0	0	1	1	13		2	1	2	5	25		1	0	1	2	17	
Pushing themselves too hard	8	4	2	14	36		4	1	0	5	13		0	1	2	3	25		0	1	2	3	17	
No Data				38						21						0						0		
Total	35	23	12	108	108		10	5	3	39	39					75	75		17	17	17	51	51	