STRATEGIC RISKS TO SUSTAINABILITY IN INFRASTRUCTURAL MEGAPROJECTS

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Master of Commerce in Development Finance

by

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ABSTRACT

The proponents of the infrastructural megaprojects promise much but often fail to deliver. These projects are complex interactions of numerous stakeholders often providing technical solutions to many end-users. The extent to which megaprojects identify and adequately address risks to sustainability is of concern to the societies employing the megaproject framework for investing in infrastructure.

The goal of infrastructural engineering is to design and build infrastructure that supports society. Sustainability in megaprojects is concerned with the delivery of products and services that benefit society over the long-term. Failure to do so can result in social pushback such as protests seeking accountability and a refusal to pay. The result is a burden on society who do not reap the benefits promised to them by the project proponents.

This paper seeks to establish the strategic risks which have an impact on sustainability in megaprojects. The research has emerged from interviews with professionals and documented sources. The study uses a qualitative research approach of grounded theory to investigate how megaprojects can better stay on track to deliver the infrastructure they promised for the benefit of society, both now and for future generations.

A model was developed using a theory building process based on a concern variable and the seven core categories that emerged during data collection and analysis. The model likened the strategic risks to sustainability to those of the semi-generic archetype of *Shifting the Burden.* The model was then applied to the case of the Gauteng Freeway Improvements Project to test for practical adequacy.

Recommendations for further research are to investigate government guarantees, risk allocation, and responsibility as they relate to sustainability. Of importance is the lack of resilience in megaprojects, which prevents stakeholders from adapting to a changing world. Building resilience in mega-projects would allow for better adaption in the face of uncertainty.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

ABBREVIATIONS

Capex	Capital Expenditure
CLD	Causal loop diagram
e-tolls	Electronic tolls
ERM	Enterprise risk management
Gautrain	Gauteng Rapid Rail Network
GFIP	Gauteng Freeway Improvements Project
GT	Grounded theory
ID	Interrelationship diagraph
SANRA	South African National Roads Agency

GLOSSARY OF TERMS AND NOTES

Technical literature	*"Reports of research studies and theoretical or philosophical papers characteristic of professional and disciplinary writing that can serve as background materials against which one compares findings from actual data"* (Strauss & Corbin, 1998, p. 35)
Nontechnical literature	*"Biographies, diaries, documents, manuscripts, records, reports, catalogues, and other materials that can be used as primary data, to supplement interviews and field observations, or to stimulate thinking about properties and dimensions of concepts emerging from data"* (Strauss & Corbin, 1998, p. 35)

Acknowledgements

Thank you to my family and friends, without whose love, support and encouragement this incredible journey of learning and self-discovery would never have been possible. I am especially grateful to my wife and son, Buhle and Noah, for supporting me through the times, both good and bad.

To the MCOM16 class: You are a fantastic group of people and I am the better for having taken this journey with you.

To my supervisor Professor Tom Ryan, thank you for the patience and time spent in teaching and guiding me.

1 Introduction and overview

1.1 Research concern: Sustainability in infrastructural mega-projects

A lack of infrastructure dampers economic development (Ingram & Kessides, 1994). The neo-classical economic growth models relate economic growth to productivity per capita, which is in turn dependent on the physical and technological capital provided by infrastructure (Dornbusch, Fischer, & Startz, 2011). A primary aim of most governments is, therefore, to provide infrastructure for the growth and maintenance of their economies. For these reasons the global megaproject pipeline in 2013 was estimated to be worth $9 trillion (Beckers et al., 2013).

1.1.1 The task of building, operating and maintaining infrastructure

Megaprojects are characterised by being larger than $1 billion in capital expenditure (Capex) (Flyvbjerg, 2014). The task of building, operating and maintaining infrastructure, therefore, requires large amounts of finance to cover the capital expenditure for the infrastructure.

Financing infrastructural development can, however, be risky, particularly in developing nations due to prevailing social, political and economic conditions with the result of undercapitalised infrastructure development (International Finance Corporation, 1999). Alternative finance structures such as project finance, government finance and corporate finance have been devised to deal with these risks with the goal of adequately capitalising infrastructure development (South African Department of Treasury, 2001). Examples of these are the Medupi and Kusile coal fired power stations and the Gautrain Rapid Rail Network (Gautrain).

When establishing infrastructure, the chosen finance structure depends on the project size, type of infrastructure, economic and political context of the territory, and the project owner or custodian. Key components of the finance structures are that the assets are off-balance sheet to allow for the national treasuries of the host countries as well as the other risks to be mostly internalised in the project (International Finance Corporation, 1999). The caveat is that government guarantees are often demanded to mitigate risk for the financiers. The guarantee means that the risks aren't internalised in the project. Both the project and corporate finance

approaches have grown to become established and accepted finance structures for large infrastructural development projects and are used interchangeably. For instance the Gautrain followed a project finance approach, establishing a concession company called Bombela (Gautrain, 2016), while in the case of the Gauteng Freeways Improvement Project (GFIP) or "e-tolls", a corporate finance approach with a government-backed guarantee for the state-owned South African National Roads Authority (SANRA) were used (South African National Roads Agency, 2016).

Figure 1 provides an overview of the three generic finance structures for project finance, where the general finance structure for the building of infrastructure is illustrated. Both the project and corporate finance structures have business entities established for the construction, operation and maintenance of the infrastructure in question. The project companies are organised in a similar fashion to corporations with some important differences: they have fixed project lifetimes, dividends are paid once at the end of the project, and they are capital intensive (Esty, 2004; International Finance Corporation, 1999; Mcpherson, 2014). In the case of the Medupi and Kusile Power Stations, this is the South African state-owned power utility Eskom. These entities become responsible for the infrastructure construction, operation and maintenance, and decommissioning. Equity investors benefit in these projects from contracts awarded by the project company, and debt investors benefit through interest raised from loans to the project company (South African Department of Treasury, 2001).

While the alternative finance structures have designed for addressing financial risks allowing for the successful financing of infrastructural projects, they fall short of addressing sustainability risks. The risks culminate in social dissatisfaction with the project, which can be expressed in several ways.

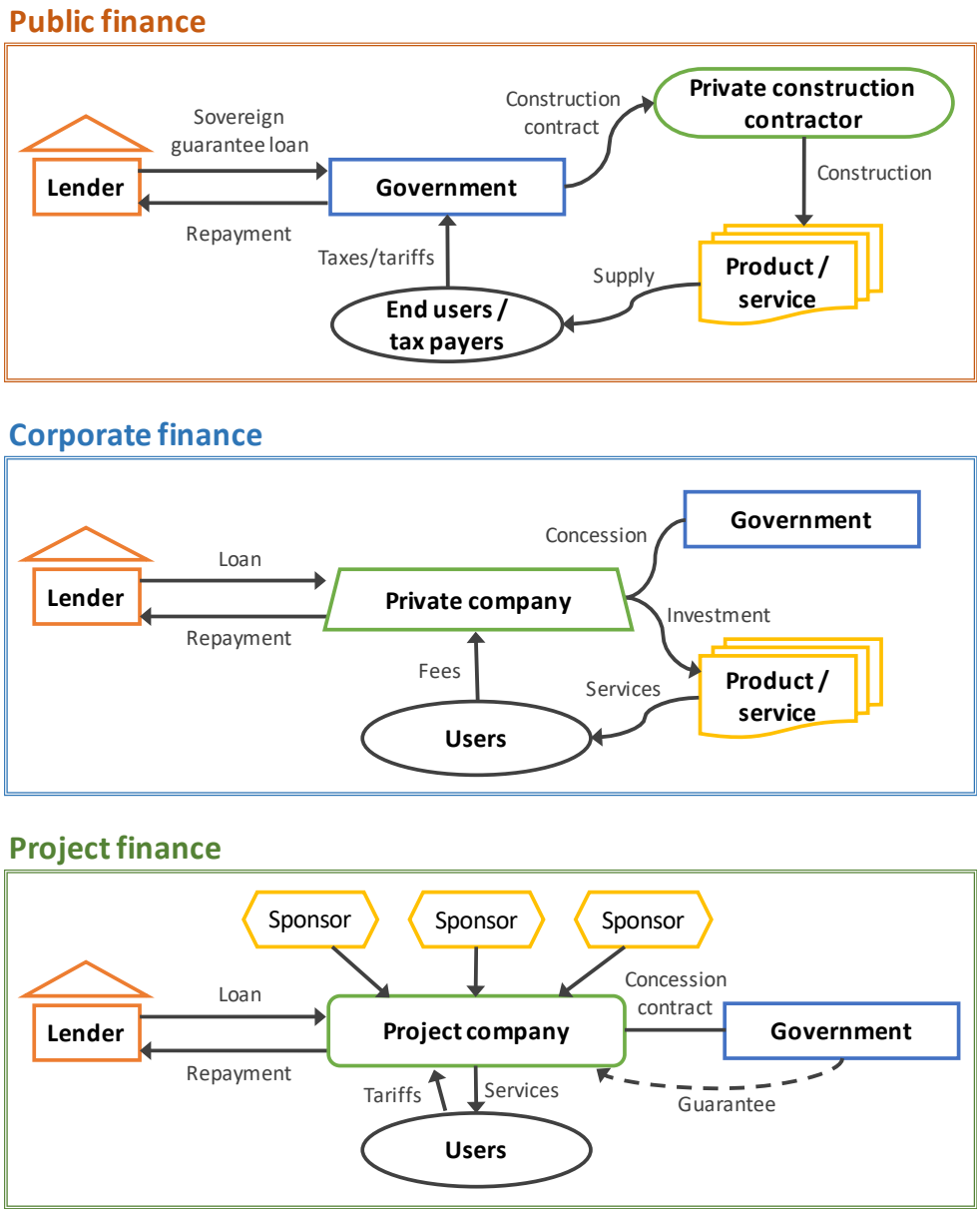


Figure 1: Generic finance structures for the construction of infrastructure adapted from (South African Department of Treasury, 2001, pp. 6–7)

An example is the GFIP project involved the upgrading of the existing Gauteng National Roads Infrastructure Network and the introduction of electronic tolls (e-tolls) to the network (Parrock, 2015). The motivation for the project is that the Gauteng roads network was subject to lengthily traffic delays due to every increasing traffic loads. The e-tolls have, however,

been subject to a public outcry and refusal to pay, despite statutory requirements to do so and threats of legal action against non-compliant road users (Parrock, 2015). Opposition to the project has united society with the formation a civil society organisation, the Organisation Undoing Tax Abuse, with a defence umbrella to battle the tolls in court on the consumer's behalf (OUTA, 2016), which is often divided on racial and income boundaries. The refusal to pay has resulted in considerable reductions in forecast revenue for the SANRA and has affected their credit rating placing pressure on the National Treasury who provided guarantees to financiers (Moody's Global Credit Research, 2016; Parrock, 2015).

Interestingly, SANRA has chosen to adopt the same approach rolling out the same road tax to other nation roads around South Africa meeting robust opposition (Phakathi, 2016). Similar examples of such projects, which have received widespread public pushback on the grounds of strategic sustainability issues in South Africa, are the N2 Wild Coast Toll Road project and Pebble Bed Modular Reactor project (Carnie, 2010; Fig, 2005).

1.1.2 The strategy for project companies and sustainability

The strategy for project companies and the infrastructure they build is usually formulated during the pre-feasibility and feasibility stages of the project. At this point in time, the project company is established with the concessions agreements from the government for the building, operating and maintaining, and decommissioning of the infrastructure. The company also has various equity holders who tend to retain a debt to equity ratio of 80% debt to 20% equity (South African Department of Treasury, 2001). Due to the nature of a significant amount of Capex required for these projects, the shareholders have a considerable capital outlay into the project and are constrained by the concessions agreement.

The sustainability of the project involves some of the original motivating factors for the building of the infrastructure, as illustrated in Figure 2.

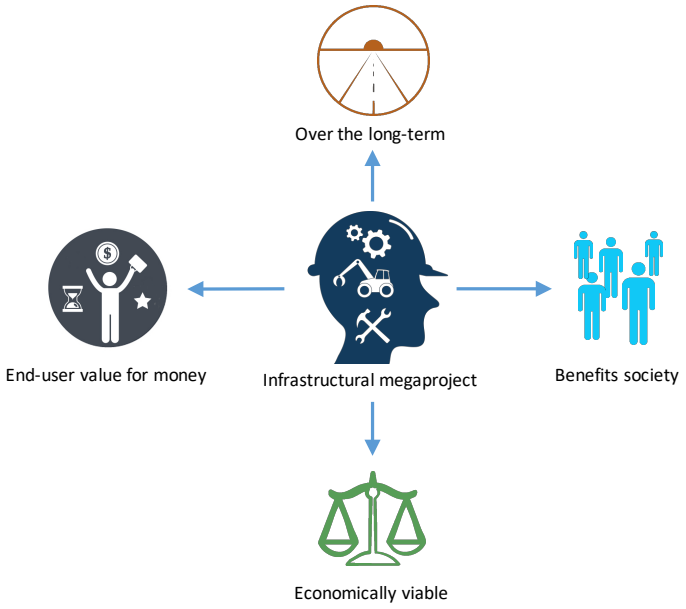


Figure 2: Characteristics of sustainability in megaprojects

The first of these is adding value or the delivery of benefits for the end-users at a reasonable price. The GFIP did alleviate traffic congestion however came at a high price to the road users (Parrock, 2015). The Medupi and Kusile power stations are adding capacity to the electricity network to keep the lights on but inflating the electricity price (Yelland, 2016). The second is the provision of these benefits to the collective or society and not select individuals, excluding people through legal, tacit or pricing barriers. An example of this is the provision of electricity, roads and potable water to the wealthier neighbourhoods but not the poorer. The third is that the benefits be delivered over the long-term or the intended project lifespan (Oil & Money, 2014). The fourth is that the project directly or indirectly assists in advancing the economy. The idea with the Pebble-Bed Modular Nuclear Reactor was that it would produce new technology which could be sold in other markets, training professionals and stimulating industry however the project failed to produce a design (Power, Stephan, Hervey, & Fonseca, 2006; S. Thomas, 2009).

The ultimate effect is the improvement of the life of the beneficiary societies without compromising the compromising the quality life of future generations of those societies.

When this doesn't take place with the examples provided above, the results are unsustainability as the opposite results illustrated in Figure 3.

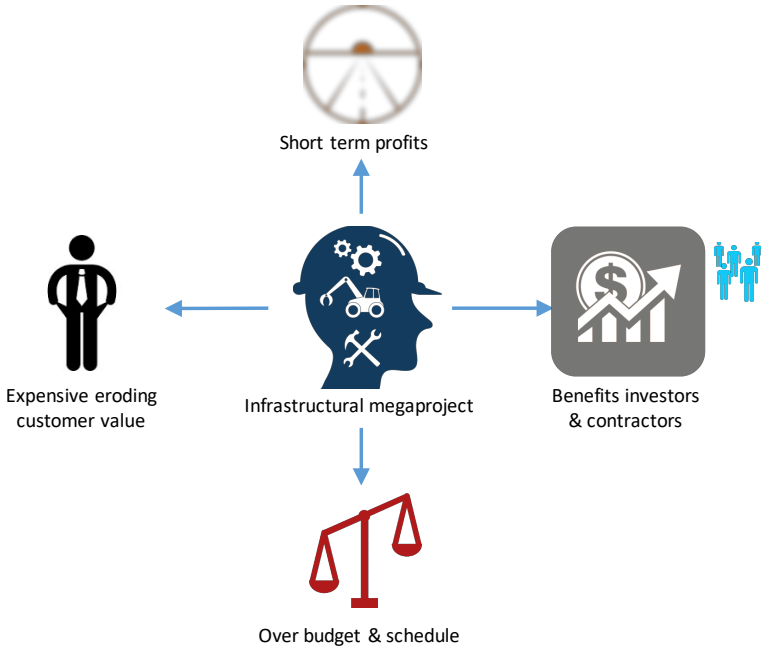


Figure 3: Characteristics of unsustainability in megaprojects

1.1.3 Concerns because of the situation

Some concerns arise in response to the issues infrastructural megaprojects experience, such as the extent to which these projects consistently fail to identify and adequately address risks to sustainability. The frequency with which the project sponsors fail to deliver on time and budget, the value the end user derives for the price paid, the short-term profiteering with unlikely long-term value, and the investors and contractors reaping benefits from the project while society does not realise the promised benefits and covers losses through government guarantees.

This research seeks to study some of these concerns by focusing on the phenomenon of sustainability and its incorporation into strategy risk in infrastructural megaprojects.

The next section focuses on the research purposes or goals, followed by a contextual framework of the research subject, and finally the development of the research question.

1.2 Purposes or goals of the research

The intellectual goal of this research is to understand the strategic level events which affect sustainability in large infrastructure development. This understanding is essential to ensure that sustainability issues are considered in business strategy risks to prevent costly or even disastrous outcomes down the line for the project company. The intellectual goal is useful in that it is "…*identifying unanticipated phenomena and influences and generating new, "grounded" theories about the latter…*" and "…*identifying causal relationships…*" (J. A. Maxwell, 2008, p. 221)

This intellectual goal has a foundation in the practical goal of large infrastructural projects and project companies taking better account of sustainability into their strategic business risks. The purpose is to prevent lengthy and costly delays to their project that have direct impacts on the project costs and revenues; and indirect impacts on their future ability to raise finance and capital. The practical goal is founded on my personal experience as a consultant to, and manager in, such projects.

The practical goal is intimately tied to my personal goals as a Sustainability Advisor and Consultant, to better conduct and use research as a tool and approach to problem-solving to assist clients to take more sustainable decisions in doing business. The research is, therefore, personally applicable to my values and career path.

1.3 Establishing the conceptual framework

The conceptual framework seeks to develop what the researcher thinks is happening at the outset (J. A. Maxwell, 2008). The conceptual framework is discussed further in Section 2.4.1.2. To establish the conceptual framework, I undertook a pilot study coupled with experiential knowledge, thought experiments and concept mapping for the research. (J. A. Maxwell, 2008). The phenomenon of business strategy risk was considered using the following steps:

1. The review of practitioner and public literature relating to the phenomenon;
2. The extraction of relevant data by defining a proposition which stated the relevance of the subject to the concern variable and the predicate of the impact on the concern variable;
3. Categorization of the propositions into major groups; and
4. Establishing the interrelation of the categories using a conceptual framework of the propositions and calculating the degrees of interrelatedness.

I discuss the results of steps 1 to 3 in the following building blocks of my conceptual lens.

1.3.1 Strategy forecasting: Selecting the best strategy

Strategy forecasting refers to selecting the most suitable and best strategy. The forecast is important as once internal resources have been committed, it is costly, time-consuming and disruptive to reallocate resources (Bowman, 1980). The allocation of resources, in turn, has implications for a firm's resilience and adaptation. Businesses that are far sighted with resources tend to be more resilient and can adapt better to changes in environmental conditions since they have given consideration to long-term trends (Cool, Jemison, & Dierickx, 1987). The downside is that this comes at the expense of being less in touch with current trends (Douma, 2015).

Forecasting is undertaken to keep competitors in mind. Managers operate under conditions of imperfect and uncertain information and tend to look to industry peers as a frame of reference in determining their strategies (Mithas, Tafti, & Mitchell, 2013).

Chileshe et al. (2013) argue that more effort should be devoted to forecasting strategies since executing the incorrect strategy will ultimately lead to failure outside of the good fortune that may arise from time and chance.

Berley (2006) observes that forecasting risks is difficult due to the complexity of the world and the number of things that can go wrong. His response is that an enterprise risk management (ERM) system is an essential, if not the only, defence guarding against such

hazards. Berley (2006) promotes the use of scenarios analysis with a risk analysis as an approach to forecasting.

In the case of large-scale infrastructural projects, many scenarios can play out. The examples of Gautrain and GFIP are two examples of such scenarios.

1.3.2 Strategy execution: The ability to execute on the strategy

Strategy execution refers to the implementation of a chosen strategy. There is no "*Vision is nothing without* execution" in the words of Syrett (2012, p. 1). Strategies are established by the executive management and approved by the board of the company but implemented by the non-executive employees. A risk exists that those implementing the strategy do not follow it, particularly if we consider the employees as a self-interested utility maximising agent (Besanko, Dranove, Shanley, & Schaefer, 2013). The implementation, therefore, drives the risk of strategy execution. Classic agency theory has ascribed mitigation of this risk by monitoring or incentivising the self-interested utility maximisation agents (Besanko et al., 2013; Tirole, 1988).

The monitoring approach acts like the proverbial "stick" and ensures that employees work according to certain mandates. However, monitoring creates a culture of compliance to that which is observable and can this be monitored or to what Kim and Mauborgne (1998) refer to as 'compulsory compliance'. For example, a speeding camera is useful and precise at controlling the speed a driver observes at a place. Most drivers obey the speed limit at the point of the camera, and they proceed to break the speed limit afterwards. Due to principles around asymmetrical information and bounded rationality, monitoring is unable to monitor all aspects of strategy execution (Church & Ware, 2000).

The incentives approach acts as the "carrot" and motivate employees to focus on an outcome. The employee will focus on the issue and strive to meet the goal and tends to foster 'voluntary cooperation' (W. C. Kim & Mauborgne, 1998). This can encourage behaviour where employees enter risky behaviour in the short-term to meet a target and obtain their incentive, giving little consideration of the long-term effects. Since strategy focuses on the

long run, it can be counter-intuitive. An example is bank employees taking on riskier loans to meet sales targets, creating a default and liquidity risk at a later stage for the company when they'll most likely not be in the enterprise.

The strategy requires a long-term outlook (Bansal & DesJardine, 2014). Shortened employment periods drive this risk as it is hard to assess strategic performance over shorter periods. It is, therefore, difficult to use the existing tools to foster voluntary cooperation in this situation.

Chileshe et al. (2013) observe that the organisational structure is essential for strategy execution which is discussed further under the category *organisational structure*.

Large scale infrastructural projects tend to hire core permanent staff and then outsource functions to contractors who undertake specialist operations for the company. The contractors relocate to the project for a set period and then once they have completed the task, they leave the company, often physically relocating to a new project. As a result, execution of a strategy can be difficult as the mindset of contractors is that of mandatory compliance driven by the 'contract' in the contracting process.

1.3.3 Market share and the risk and return trade-off

The risk-return hypothesis (Damodaran, 2008; Kaplan & Mikes, 2012) is core to modern economics. If there is a trade-off between risk and reward, and the appetite for this must be established. Obtaining market share leads to less strategic risk since more power is wielded by the firm (Church & Ware, 2000; Cool et al., 1987).

There is a strategic, reputational risk that arises from the spreading of news over new communication platforms which can quickly affect brand (Deloitte, 2013). This makes firms susceptible to attacks via such platforms. A recent case in hand is the campaign by the activist group Boycott Divestment Sanctions South Africa to convince Woolworths Foods to not source products from Israel in sympathy with the Palestinian call for a state and living space (Boycott Divestment Sanctions South Africa, 2015). These attacks are risky as they can

quickly become public relations problems and destroy value that companies have spent considerable resources and time in the building.

Traditional market pressures such as demand shortfall, pricing pressure, and industry or sector downturn are well known and understood risks to business strategies (Mohammed & Sykes, 2012). For instance, the recent decline in demand since the global recession of 2008 has become a considerable economic problem which is referred to as the "great malaise" by Stiglitz (2016) which is a lower demand and affects revenues, expected value or profits.

In infrastructural projects, the risk of disruption and sensitivity to market receptions is much lower. This lowered risk is due to a natural monopoly and the legal barriers to entry provided to these infrastructural services since they are government-backed. The services tend to be essential and needed by the customers, large and costly, take a long time to be built, and require licenses and permits to operate resulting in a scenario where the market cannot easily substitute away from them. The market risk is diminished but may manifest differently where users refuse to pay for the services. Such was the case with the GFIP where the motorists had to use the roads, and the market response resulted in civil society organising users in opposition to the toll fees and widespread refusal to pay the fees.

1.3.4 Competition and market power

The "market power" of the firm affects the risk/return ratio and may be a key factor in explaining the ratio (Cool et al., 1987). Firms with more power can make higher returns with less risk due to their dominance.

From a traditional static perspective of industrial economics, firms attempt to create imperfectly competitive markets to allow them to obtain a greater than competitive market returns (Barney, 1986). These conditions arise by creating barriers by developing unique products or services from which they can then obtain a higher than perfect market return for the product due to a competitive advantage they create (Bansal & DesJardine, 2014). Firms attempt to sustain this benefit through "sensing, seizing, and reconfiguring processes" (Bansal & DesJardine, 2014).

Sustainability adds the perspective of time to the argument, requiring a dynamic view away from the static. Such a view requires larger systems considering the action or reaction of the competitors (Bansal & DesJardine, 2014).

Technology is enabling some firms to compete while its disrupting others (Damodaran, 2008; Deloitte, 2013). Data mining, analytics, mobile and cyber-security are disrupting business models where firms are struggling to grapple with as considerable resources can be devoted to a strategy which can be disrupted quickly by technology.

Large scale infrastructural projects tend to enjoy a natural monopoly, and hence competition is not as important a factor (Church & Ware, 2000). The monopoly firm may take advantage of their monopoly position and various barriers. Competition may, however, erupt from new technologies that the firms were not prepared able to contend with. An example is South Africa's Telkom who as a fixed line operator who had a monopoly over telecommunications sector until cellular phones and satellite technology became available. They have still been unable to adequately compete and required significant government support to remain afloat.

1.3.5 Corporate governance: How decisions are made

The King Report (Institute of Directors Southern Africa, 2009) is the benchmark for good corporate governance in South Africa. The report states that its focus has been on integrative reporting and providing context to the financial results as they relate to the economic externalities and how their plans relating to these externalities moving forward. The absence of risk to a business at a strategic level would, therefore, be a failing of the board which is appointed by the shareholders.

Good corporate governance is discussed by Damodaran (2008) in the context that governance should focus on the value of the corporation and not the individual within the corporation. The individual, therefore, should put the corporation first and the board must ensure that this takes place, which is the basis for agency theory (Bansal & DesJardine, 2014; Tirole, 1988).

Corporate governance and sustainability are linked through stakeholder theory (Michelon & Parbonetti, 2012). Michelon and Parbonetti (2012) view corporate governance and sustainability disclosure as a function of similar board attributes, and that disclosure is a part of the dialogue between company and stakeholders. Corporate governance is closely tied to organisational structure and performance but was categorised as a separately since it deals with culture and not merely structure as is the case with organisational structure.

1.3.6 Organisational structure and the commitment of resources

Organisational structure is relevant where it deals with the commitment of resources. Once committed, reallocation of resources takes time and is costly (Cool et al., 1987). The board does not have control over the organisational structure under the principles of the separation of ownership and control even though they are accountable for risk concerning King III.

The allocation of resources also affects the resilience of firm and the ability for it to adapt. Adaptation tends to involve luck and be costly according to Cool et al. (1987). Firms, however, in more recent times have been making efforts to ensure that they can adapt due to the disruptive nature of new technological companies. In some cases, these companies are establishing accelerators which allow them to be at the forefront of innovation and disruptive influences. An example is Barclay's investment in an Accelerator where they invest in start-ups that are focusing on blockchain and cognitive technology as these are major areas of disruption which threaten their business (Barclays, 2015).

Certain aspects of organisational structure are important and traditionally focused upon such as company efficiency to lower costs for a given quantity reduce the risk of a strategy not yielding the intended results (Cool et al., 1987) and ensuring the correct operating systems are in place to lessen the risk of strategy execution (Taylor, 2012).

In the case of infrastructural projects, the firms organise themselves into different entities for different phases of the project. The development of the service requires a construction component which is usually administered by sponsoring companies who are also shareholders in the firm (South African Department of Treasury, 2001). The operating entity

then focuses on operating the infrastructure built for a fixed period. As a result, the organisational structure is a complete commitment to a path and strategy where the entity essentially does not change its organisational structure.

1.3.7 Internal capability within the organisation

Internal capability refers to the ability of the personnel or the quality of the human capital in the firm. Decisions include all fundamental business-model decisions, strategic partnerships, acquisitions, product and price models, target group definitions, entry into markets, and short-, medium- and long- term investment strategies (Damodaran, 2008). If the firm doesn't invest in the right personnel, it is an apparent risk to the capability of the business to execute on their strategy or even on the ability of the strategy itself.

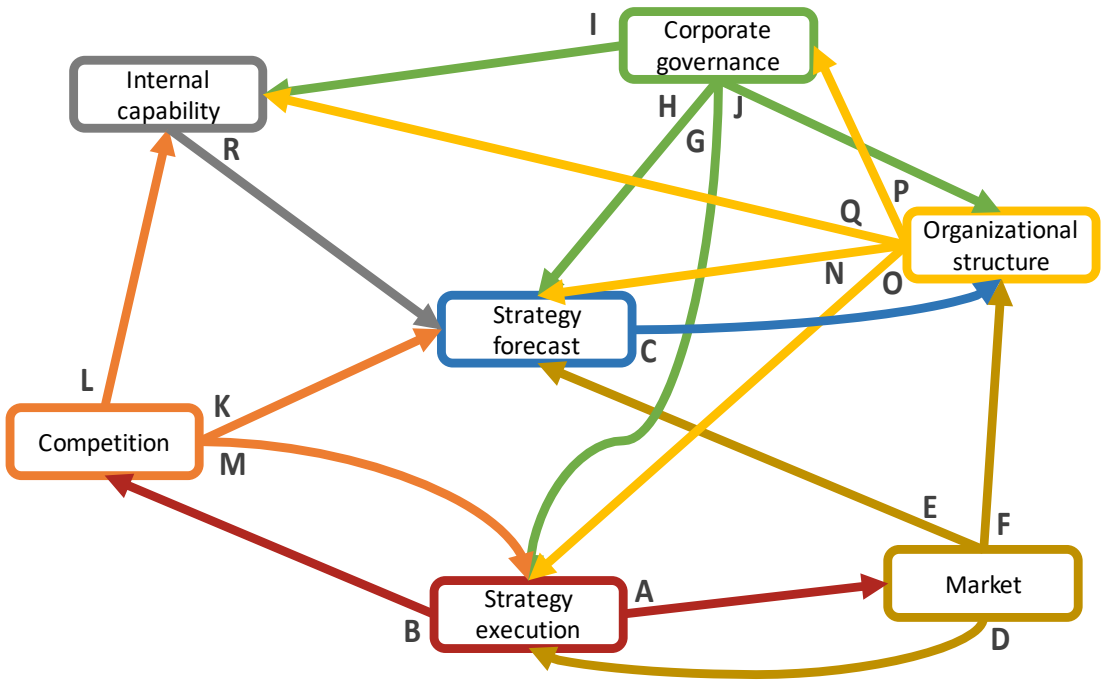
A strategy with high expected returns requires an increased risk (Kaplan & Mikes, 2012). The risk-taking firm is the one that achieves the return. Businesses that are unwilling to take risks don't make the returns and will die out (Damodaran, 2008). It is hard for firms to build internal capability and often outsource with the downside of information leakage (Hoecht & Trott, 2006).

Most of the strategic work is undertaken during the planning and design stages in the infrastructural projects. At this point, there is a fair amount of outsourcing and firms compete for tenders based on their internal capabilities. Once the concessions company is established, they must deliver according to the provisions of the concessions agreement. Their internal capability is usually technical in nature and requires strategic input as far as it relates to meeting the contractual requirements. Since the concessions company has government support, it is often a natural monopoly with no competition and little to no strategic capability is invested since it may be too late at this point to address in any strategic risks. The design process may, however, produce strategic risks based on technical inaccuracies or failures. Designs based on inadequate information are a technical failure as the internal capability should be able to detect such mistakes.

1.3.8 Construction of the conceptual framework

A conceptual framework presenting the relationship between the building blocks or categories of this conceptual framework was constructed. The linkages in the diagraph have been described in Figure 4. This allows for a breakdown of the description of the relationship in a step-by-step manner which is easier to follow than written paragraphs on the relationships.

Inter-relation becomes important when considering sustainability and strategy from a dynamic long-term perspective (Bansal & DesJardine, 2014). A focus on individual categories tends to lead to a short-term view on performance which is counter the concept of sustainability that has a precise temporal dimension in the theory (Bansal & DesJardine, 2014). The instrumental view is argued by Gao and Bansal (2013) as presenting social and environmental issues as being separate from the remainder of strategic problems and, therefore, are a distraction from such matters. Gao and Bansal (2013) go on to argue that an integrative perspective is needed which is at the heart of business sustainability.



Ref	Nature of the relationship	Ref	Nature of the relationship
A	A firm's strategy can influence the market's response and behaviour	C	The strategy itself will drive the organisation of the firm, systems and allocation of resources
B	A firm's implementation of strategy generates a response from competitors	D	The response and demands of the market affect the ability to execute on the strategy

Ref	Nature of the relationship
E	Market conditions will influence the outlook and hence the strategy
F	Market influences organisational structure as the firm organises itself to server the market.
G	Correct culture to implement the strategy
H	The manner in which the company is governed influences the people who forecast the strategy
I	The manner in which a company takes decisions and the values it holds will influence the type of staff it has and the ability of them to perform within that environment.
J	The structuring of the organisation, allocation of resources and systems is influenced by the way decisions are made and how the culture the firm chooses to adopt.
K	A part of choosing a strategy involves looking at what the competition is doing and what the firm believes they can do
L	Outperforming the competition requires the internal to compete with them
M	Competition act as a barrier to strategy execution
N	The current organisation of the company influences the forecast strategy
O	Correct allocation of resources to implement the strategy
P	The organisation of the company influences how corporate governance is practised throughout the company
Q	The organisation of the companies influences whether they can leverage their current human capital
R	The internal capability in return influences the forecasted strategy

Figure 4: Conceptual framework

1.4 Development of research question

The research question is *how can sustainability issues be used in business strategy risk evaluation for large infrastructural projects?* The question has been developed in line with the research concern and has been guided my research purpose and the conceptual framework developed.

The concern variable from this research question is *sustainability as it occurs in business strategy risk*.

1.5 Research design and conclusion

The study has been designed based on Maxwell's interactive model of research design (J. A. Maxwell, 2008), which has five components, as illustrated in Figure 5.

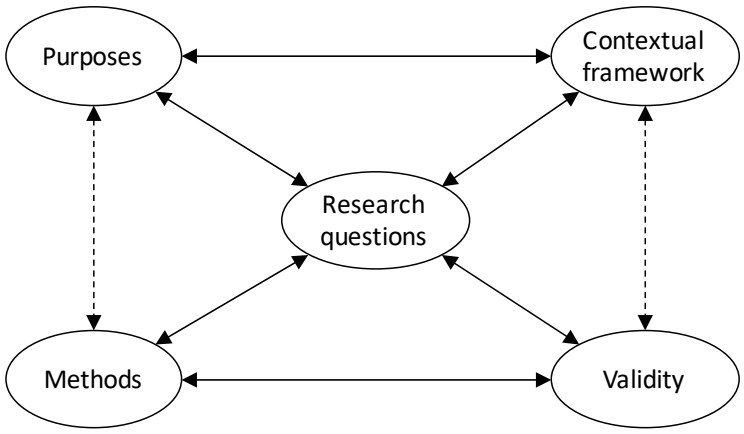


Figure 5: Research design framework used for this research (J. A. Maxwell, 2008, p. 217)

Chapter 1 presented the research design and addressed the three design dimensions of the purposes or goals of the study, the conceptual framework or lens and the development of the research question, as presented in Figure 6. These focused on the first three components of Maxwell's (2008) research framework.

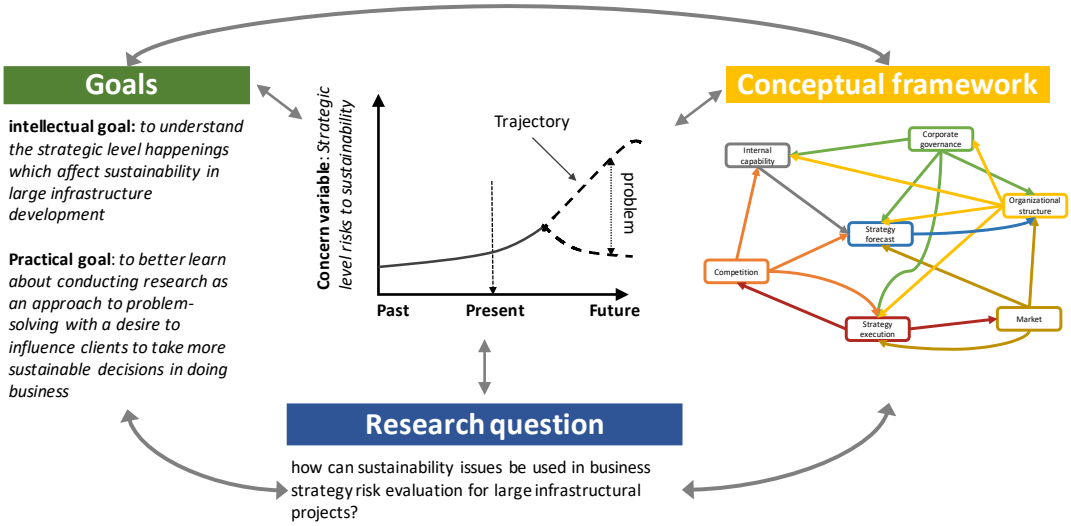


Figure 6: Research focus adapted from *(Ryan, 2016)*

Chapter 2 will continue with the application of the research design framework addressing the components of research method and validity. Chapter 3 presents the results of the data collection and analysis provided in Chapter 2, with a discussion of the results. The literature review is presented in Chapter 4 as the recommendation with grounded theory is that a detailed literature review only be done after research results (Strauss & Corbin, 1998). The theory building process is then followed in Chapter 5, and the report is finished off with Chapter 6 where we discussion the theory.

2 Research methodology

2.1 Introduction

Following from Chapter 1 where the research question with both the goals and conceptual framework were established, Chapter 2 proceeds to determine the research method and validity for the research question based on Maxwell's research design framework as illustrated in Figure 7. Chapter 2 begins with the philosophical position of the research followed by the research approach adopted based on philosophical stance. The approach to data collection and analysis and is then laid out and a discussion on the threats to validity concludes the chapter.

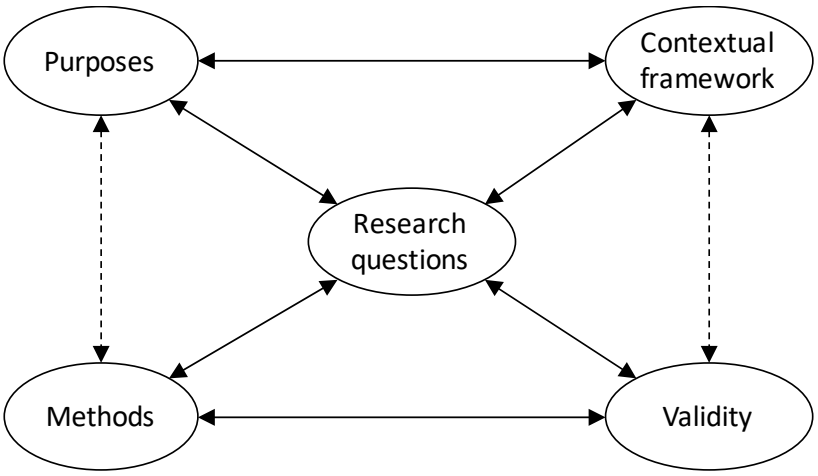


Figure 7: Areas of focus (in green) from the research design based on (J. A. Maxwell, 2008, p. 217)

2.2 Philosophical approach: Critical realism

The philosophical approach in this research is critical realism. Roy Bhaskar provided the foundational work for critical realism, arguing that there is a natural reality outside of ourselves which exists, or a "realism" (Elger, 2010). He argued that our knowledge of that natural reality is always influenced by our subjective perception of it and because of this subjectivism, a theory of what exists, or ontology, is necessary for research. Knowledge can,

therefore, be regarded as transitive because it changes with our perception of reality, even though the reality itself does not change (Sayer, 2000).

When describing this ontology, Bhaskar explains it as being stratified, meaning that the relationship of the natural reality of things and scientific knowledge feature three key elements: the 'real', the 'actual', and the 'empirical' (Elger, 2010; Sayer, 2000). The 'real' refers to what occurs external to ourselves, regardless of whether it is observable and whether we understand it. The 'real' involves "*the 'realm' of objects, their structures and powers*" (Sayer, 2000, p. 11). The 'actual' is what happens when the powers of the 'real' or the objects are activated, and they produce some event or change (Sayer, 2000). The 'empirical' occurs when we experience the 'actual', regardless of whether we are aware of the 'real' or 'actual'.

An important aspect of critical realism deals with our experience of events. When an event happens, it may not be observable to us and therefore there may, or may not, be a 'real' or 'actual' that we are unaware (Elger, 2010; Sayer, 2000). Every time the event occurs, there may be a previously unexercised 'real' which is now being exercised (Sayer, 2000, p. 12). As a result, we cannot assume to know the cause of events and there is no regular successive cause and effect of events, and hence no 'laws' can be applied to explain the cause and effect of events (Elger, 2010; Sayer, 2000).

The implications for research are that causation does not have anything to do with the number of times it occurs (Sayer, 2000). Collecting data at regular intervals with repeated results will not help establish causation. As a result, the method for data collection, analysis and interpretation changes. Critical realism rather seeks to build processes, structures, powers and casual mechanisms to understand an observed event in its particular context of space and time, which is context (Sangera, 2004; Sayer, 2000).

The future is, therefore, open and things may happen differently at any point in time (Sayer, 2000). No single law can be applied, and the same mechanism can produce different outcomes according to the context. Meaning must, therefore, be understood within a context and will always have an interpretive or hermeneutic element (Sayer, 2000).

Figure 8 illustrates the stratified ontology. In this research, the effect or event will be experienced by the researcher as the 'empirical' and provides the research problem. The researcher, as well as other persons, experience the event. Beneath the 'empirical', there is the 'actual' which is the underlying mechanism and conditions that provide the context. Beneath the 'actual' is the 'real' which is the structure. The research is an attempt to identify the structure and mechanisms which have resulted in the experienced effect within the specified concept which is done through the research process of grounded theory.

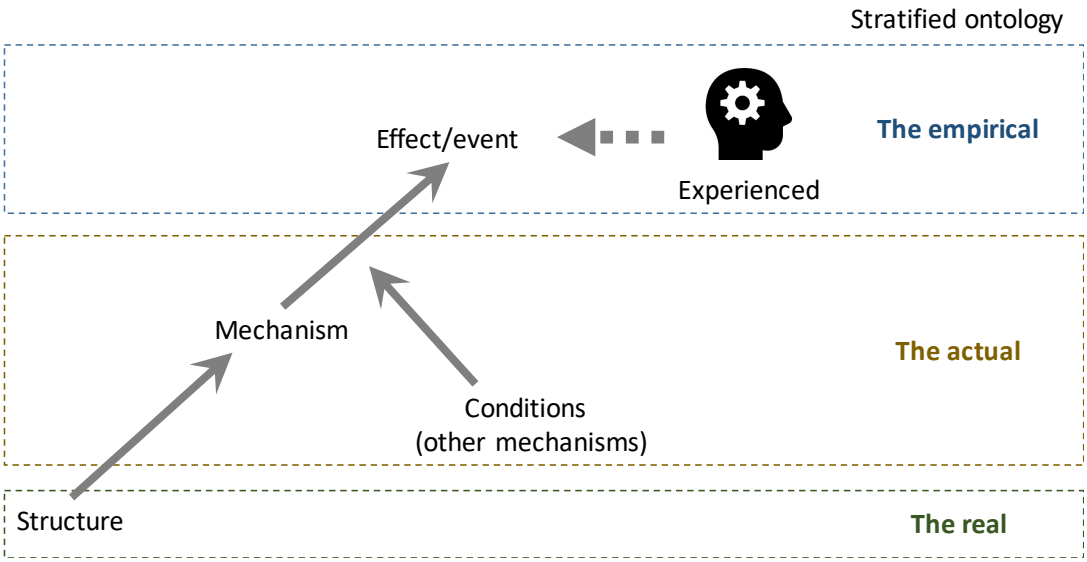


Figure 8: Critical realist's view of causation, adapted from (Sayer, 2000, p. 15)

2.3 Research approach: Grounded theory

Grounded theory (GT) refers to a research approach which involves the gathering and analysis of data in a systematic fashion to establish a theory (Strauss & Corbin, 2008). A 'theory' is a "*set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena*" (Strauss & Corbin, 2008, p. 15). The grounding of the theory takes place by

building the theory on the data which is systematically collected and analysed. GT is based on the context of the phenomena for which the data is collected (Lawrence & Tar, 2013).

GT is a qualitative research approach in the social sciences (Vincze, 2010), with critical realism as one of the philosophical foundations (Kempster & Parry, 2011). Qualitative research refers to any research for which findings are not produced by quantitative statistical procedures (Strauss & Corbin, 1998). GT aims to build theory from collected data so that it is consistent with the 'empirical' data. It is useful for interpretive studies, especially where there is uncertainty for researchers in the collection and analysis, and helpful for understanding the underlying causal mechanisms of the 'empirical' (Kempster & Parry, 2011; Lawrence & Tar, 2013). There are well-structured data collection and analysis approaches to ensure that the theory remains close to the data source (Strauss & Corbin, 1998). GT is also useful in that it allows for the processing and coding of a large volume of data from different types of sources.

GT is useful for research into hybrid disciplines as the style of analysis does not depend on any single disciplinary perspective (Lawrence & Tar, 2013). The development of theory is one of the components that distinguishes it from most other qualitative research methods, where the theory in GT emerges from the data as it is collected, coded, integrated, abstracted and ultimately constructed (Lawrence & Tar, 2013). Most other qualitative techniques only perform the analysis post data collection while GT does it at the same time. The theory seeks to explain the relationships and events from the experiences of the people and processes from where the data is collected (Lawrence & Tar, 2013). Kempster and Parry (2011) note that grounded theory is a very useful method to understanding social interactions which is a major component in sustainability and megaprojects.

GT relies on the theoretical sensitivity of the researcher, as a quality that allows them to have insights or find meaning in the data (Lawrence & Tar, 2013). According to Strauss and Corbin (1998), theoretical sensitivity is that which makes the researcher more familiar with the subject matter and nuances that may lay within and tends to arise from literature, professional experience and personal experience. This sensitivity is important as it allows for

better insights, meaning and ability when conceptualising (Strauss & Corbin, 1990). However, it also introduces a personal bias from the researcher. In this research, my theoretical sensitivity began in my professional career working on large infrastructural projects as an environmental consultant and manager. I had further exposure working in a construction firm on a megaproject in South Africa.

Integration is the process in GT where the data becomes the theory. The theory evolves during data collection and analysis (Strauss & Corbin, 1998). The categories in theory must be brought to the same level of conceptual abstraction, and this is achieved through the processes of coding and categorization. In each stage, following the reduction sampling the research goals are revisited, concern variable reconsidered, and research question reformulated.

To facilitate the development of substantial categories, many data points will be necessary to reach a point of saturation as well as continuous comparison. These steps are performed during the steps of data collection and coding, revised conceptual framework and review of the research focus. The research approach of GT is iterative and involves the following actions: (1) data collection; (2) coding; and (3) theory building (Strauss & Corbin, 1998).

As discussed earlier, a hallmark of GT is that the data is collected and analysed concurrently (Jonker & Pennink, 2010; J. A. Maxwell, 2008). It is important that this is done in a manner that ensures that the resulting theory is well grounded in the data. This is achieved through the appropriate application of specific procedures in data collection and analysis (Strauss & Corbin, 1990). These methods allow for some flexibility as and are used as a rule of thumb to allow for adaptation to the requirements the particular research may have (Lawrence & Tar, 2013). Too much rigidity in a procedure during data collection and analysis can stifle creativity and impair the analytical process.

Three levels of analysis are described for GT by Lawrence and Tar (2013, pp. 31–32): *"(a) to present the data without interpretation and abstraction, the participants tell their own story; (b) to create a rich and believable descriptive narrative using field notes, interview*

transcripts and researcher interpretations; and (c) building a theory using high levels of interpretation and abstraction." This study makes use of the second and third type of analysis where the concern is with the experience of practitioners when dealing with context.

GT uses the process of coding to build theory (Strauss & Corbin, 1998). Coding involves the "*analytic processes through which data are fractured, conceptualised, and integrated to form theory*" (Strauss & Corbin, 2008, p. 3). It is a technique useful for systematically dealing with large amounts of data allowing for a creative process where alternative meaning can be ascribed to data. Theory building is based on the concepts which are identified, developed and related during the coding process (Strauss & Corbin, 1998). In this study, *open coding, axial coding* and *selective coding* are used, which will be inductively generated during the research (J. A. Maxwell, 2008).

Open coding involves the analysis of the data collected. The process followed is the labelling and categorization of data which helps identify concepts and discover both their properties and dimensions (Strauss & Corbin, 1998). The process of continual comparison takes place in open coding which is a fundamental part of GT. Three questions are recommended during open coding (Lawrence & Tar, 2013): "*what is this data a study of?... what category does this incident indicate?... what is actually happening in the data?"*

Axial coding refers to the process where the main categories are related to their sub-categories and is a rebuilding of the data (Lawrence & Tar, 2013). Axial codes are categories that describe open codes with the aim to elevate the data to higher levels of abstraction (Lawrence & Tar, 2013). The important part of axial coding is adding structure or the conditional context to which the category is situated (Strauss & Corbin, 1998). Axial coding helps give structure to fractured data collected during open coding.

Selective coding involves integrating and refining the theory. An aim in selective coding is to reach the point of saturation for the established categories in which no new properties, dimensions or relationships emerge during this process (Strauss & Corbin, 1998). The

researcher reduces the data into concepts and relational statements which can be used to explain what is happening (Lawrence & Tar, 2013).

Beyond coding, two further processes to be utilised are constant comparison and theoretical sampling. Together, theoretical sampling and constant comparison are cyclical processes which help ensure that the analysis is well-grounded in the data and focused rather than haphazard (Lawrence & Tar, 2013).

Constant comparison is an analytical process which allows the researcher to build and clarify categories by examining all the related data and variations (Lawrence & Tar, 2013). It is achieved by the researcher using a limited number of codes and applying them to large sets of data which are then assigned to categories according to the fit. The purpose is to verify the data and develop it to become more general as opposed to the context to which the data was collected.

Theoretical sampling takes place during the data collection and involves searching for emerging categories that characterise the narrative. In this process, the data collection is led by the emergent theory where the researcher collects data in line with the theory to allow for checking and further development of the categories (Lawrence & Tar, 2013). Theoretical sampling aims to reach a point of 'saturation' to ensure that no new insights emerge outside of the existing categories.

In this study, the process of continual comparison will be employed in the cyclical approach. Each cycle will involve the steps of theory building which involves (Carlile & Christensen, 2005; Jonker & Pennink, 2010): (1) The data will be collected through purposeful sampling of the phenomenon; (2) The propositions will be formulated and categories coded; (3) Associations and the interrelation of the categories will be established. Theoretical sampling will be applied at the end of the last data collection research cycle to verify saturation.

During the data gathering and analysis, memo writing will be used to keep a record of the process (Lawrence & Tar, 2013). The memos will be kept through the data collection and

analysis process and used to assist the researcher in keeping the data grounded, and research focused. Rigour will be applied to the record keeping by continually performing actions such as analysing the goals, developing explanations, keeping a record of emerging concepts, stopping and reflecting to spark off new ideas, refining codes, formulating and showing the relationships of key categories (Lawrence & Tar, 2013). This list is not exhaustive, but the memo writing allows the researcher to perform the analysis and keep a record of the analysis.

The sources of data will include field data such as reports, documentation and studies; interviews with practitioners; experiential knowledge; and existing literature.

The interviews will be undertaken with experienced professionals from different disciplines on their professional experience as it relates to the concern variable. Interviews will take place in person or via telephonic conversations and will comprise open-ended questions using the ethnographic techniques described by Spradley (1979). Notes on the interview will be kept and submitted to the interviewee for confirmation of the proceedings of the interview and their records.

Other data sources will be used such as practitioner journals; professional blogs and opinion pieces; in-house company and practitioner-based research; civil society organisations; Internet searches; government agencies; and case specific documentation. Experiential knowledge will be collected and stated as such.

The collection of data will involve the coding of the data into propositions. Where relevant, memos and observations will be kept maintaining track of insights as they emerge. The propositions and memos will be used in the analysis and theory building, with a focus on continual improvement. The propositions will be captured into a proposition log, with an exert included in a separate document to allow for validation of the findings.

The theory building is discussed in Chapter 5.

2.4 Research process

The research process will involve data collection and analysis over four cycles. Within each cycle, there are different steps as illustrated in Figure 9. Following these four cycles, the literature review and theory building process will be entered which are discussed in Chapter 4 and 5. As discussed earlier, the coding is a process which takes place throughout the cycle.

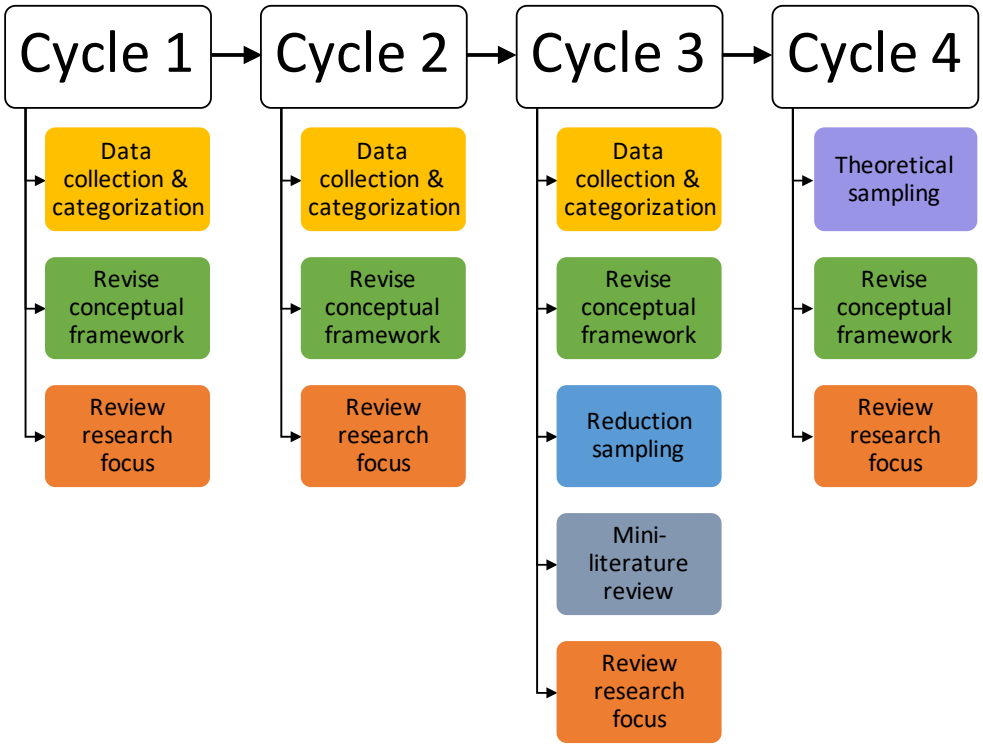


Figure 9: Four research cycles with the respective steps

2.4.1.1 Data collection and categorization

This step involves the collection and categorization of data collection. The data is collected according to the concern variable and propositions are made. The propositions are then placed into categories as a part of the open coding process. The outcome is a proposition log with a set of propositions and categories.

2.4.1.2 Revision the conceptual framework

The revision of the conceptual framework involves the construction of an inter-relational diagraph of the categories in which the inter-relatedness of the categories is mapped using directed links between each category, allowing for constant comparison to be carried through the analysis. It is in place to review the categories to ensure that the categories are distinct to act as their own concept and to build up a relationship map to get a holistic sense of the relationships which are emerging from the data.

This step is performed using memo writing, where the inter-relational diagraphs and axial codes are stored in a separate log for use later once sufficient data points have been collected and a clearer picture is formed.

2.4.1.3 Review of the research focus

At this point, the research goals, question, conceptual framework and concern variable are reviewed. This is to ensure that the study is properly directed towards the intended problem and to allow concepts which have emerged from the data to be carried forward. This is recorded in the proposition log and carried forward.

The theoretical sensitivity of the researcher is an important aspect in this step as there is reflection and insight being called upon.

The goals comprise my personal goals as a researcher, my career goals and my intellectual goals. This helps to guide what I would like to achieve from the research, assist in addressing biases by identifying the intellectual goals and ensuring that these drive the research. The research question is the focus of the research as is formulated from the goals. It defines what problem is to be answered by the research which is of fundamental importance. The conceptual framework provides a map of all categories coded during the research cycle and how they link to each other providing a context to the categories. The concern variable is derived from the goals, research question and conceptual framework and guides the data collection, formulation of propositions and categories.

The process with the steps described above will be carried out for cycles 1 and 2. During cycle 3, two new steps will be performed.

The first of these is reduction sampling which is a process which reduces the categories to between five and nine core categories. The purpose of the process is the move the categories up the ladder of abstraction to the point where each category is on the same level of abstraction as this is important when undertaking theoretical sampling. Categories are organised according to their level of abstraction followed by the revision of the ID.

2.4.1.4 Axial coding using reduction sampling

The reduction sampling is the axial coding process where the main categories are related to their sub-categories and is a rebuilding of the data. The categories are related to each other by working through the logical statement of "category x is a part of y" and ensuring that the categories are distinct. The categories are arranged along the ladder of abstraction by building a map of which categories are a part of other categories with the goal to arrive at between five to nine distinct categories.

Following this an inter-relational diagraph is then once again constructed for these categories and the theoretical sensitivity of the researcher is once again called upon to interpret and analysis the emerging structure and story from the data.

2.4.1.5 Verifying and developing the concepts with the mini-literature review

The mini-literature review is then performed on the categories which emerged from the reduction sampling process. The review conducts a concept analysis of each category to situate it within the existing academic literature. The literature review seeks to establish a key concept for each category and verify the antecedents, attributes and outcomes for this concept as it relates to the core category. This assists in building up well rounded rich categories to verifying the extent to which selected category during the coding process represents the ideas in existing academic research behind this concept. This is necessary since these core

categories will be subjected to a concept analysis during the literature review process and used during the theory building process.

2.4.1.6 Theoretical sampling

Following the mini-literature review and development of the concepts, the process of theoretical sampling will then be performed. This will involve collecting propositions and verifying whether any new categories are coded and whether the existing categories properly reflect the propositions from the data (Strauss & Corbin, 1998).

During the earlier sampling, the idea was to generate as many categories while during theoretical sampling, the idea is to develop, densify and saturate the earlier collected categories (Strauss & Corbin, 1998). Effective theoretical sampling requires that each category is fully developed. To achieve this, the theoretical sampling will involve collecting at least six propositions for each core categories on which the mini-literature review was performed.

Theoretical sampling is guided by analytical questions such as (Strauss & Corbin, 1998, p. 203) *"What would happen if...? When? How? Where?"* Care will be taken to be sufficiently structured to ensure that focus remains on the research problem, however, flexible enough to prevent unevenly developed categories (Strauss & Corbin, 1998).

2.5 Threats to validity

It is difficult but necessary to prepare controls for threats to validity in qualitative research (J. A. Maxwell, 2008). The approach adopted is to identify the major types of threats to validity and then describe the planned controls to address the threats as far as practically possible.

2.5.1 Internal validity or credibility

Internal validity, also referred to as *credibility*, refers to the level at which the conclusions are appropriately drawn from the research; and the level at which other plausible explanations have been ruled out (Christensen, 2006).

Christensen (2006) recommends that the best approach to address this is to study the subject matter through a number of lenses. This is not entirely possible in this research due to the limitations of the scope as a mini-dissertation. A lens of industrial organisation has, however, been applied to this study adding a viewpoint.

Additional steps to address internal validity adopted are: (a) asking open-ended questions in interviews; (b) allowing the data to lead the findings of the study; (c) triangulation by interviewing candidates from a diverse range of disciplines and different types of data sources (J. A. Maxwell, 2008); (e) thorough referencing; and (f) continual comparison (J. A. Maxwell, 2008).

2.5.2 External validity or transferability

External validity, or *transferability*, refers to the applicability of the relationship between the phenomena and outcomes from the research context to other contexts (Christensen, 2006). Christensen (2006) points out that external validity can only be established through categorization when the "*categories of circumstance are mutually exclusive and collectively exhaustive*" (Christensen, 2006, p. 53). To achieve this, the categories must be unambiguous and saturated which is the purpose for using the approaches of open coding, axial coding, selective coding, reduction sampling, and theoretical sampling for arriving at the research categories.

2.5.3 Dependability

Dependability refers to being able to account for variability in the conditions around the study and the design of the 'actual' study (Jonker & Pennink, 2010). Dependability is provided for by transparently presenting the research methodology, maintaining progress writings during coding, categorization, sampling; as well as keeping records of the data collected.

2.5.4 Confirmability

Confirmability refers to objectivity and whether the results of the research can be confirmed by another party (Jonker & Pennink, 2010). The research findings can be confirmed by presenting a trail of the raw data collected during the research process. Interview notes were provided to the interviewees in writing as a part of transparency and ensuring the accuracy of the data collected.

2.5.5 Researcher bias

As a sustainability practitioner, who has worked with infrastructure development and at engineering, construction and procurement companies, I have a bias towards sustainability and the way in which it is applied in large infrastructural development projects. I have observed sustainability practices at various stages on different types of infrastructural development projects which have informed my opinions.

I have kept a research log with the progress of the study which included the goals of the study as well as my personal and intellectual goals. This helped to continually evaluate the researcher's stance in addresses bias as a threat to validity (J. A. Maxwell, 2008).

2.6 Conclusion

Chapter 2 laid out the research method which included the research approach of grounded theory based on the philosophical perspective of critical realism. It then provided a detailed description of the data collection and analytics to be adopted except for the theory building process which has been left to Chapter 5. Lastly, the threats to validity were discussed. Chapter 3 now proceeds to discuss the actual data collection and results obtained.

3 Data collection and results

3.1 Introduction

Chapter 3 presents the results of the data collection and analysis according to the method presented in Chapter 2. The chapter begins with an overview of the types of sources for which data was collected followed by a description of each data collection and analysis cycle. A discussion of the results as the research progressed through the cycles is provided which is followed by a discussion of the threats to validity.

3.2 Data sources, collection and records

Data was obtained from interviews and document research. The interviews were conducted in person and over the phone. Initially, the interviews were planned and submitted for approval to the University of Cape Town Ethics Committee before the interviews commencing. An introduction letter was created and sent to the respondents before the interview. To remove my bias, the questions were framed in an open-ended format and involved the respondent speaking and me taking notes. During the interview, if a relevant point was made, I would record it and ask for clarification if necessary. After the meeting, I submitted my notes from the interview and sent it to the respondent for their review and comment.

Document research was found from online sources by performing keyword searches for the research in search engines such as Google Scholar; Google and DuckDuckGo. Attention was paid to the type of source when filtering through the results to ensure that poor quality sources and academic journals were excluded at this point. The relevant source was captured into a word document from which the propositions were formulated. In this way, the source could easily be revisited, and a thorough record kept.

All propositions were captured into a proposition log along with the impact, chosen categories and any insights. During the cycles, notes were taken on observations and at the end of the cycle, the identification of the goals, concern variable and research question were revisited.

3.2.1 Cycle 1

In cycle 1, the data collection and categorization involved the collection of 83 propositions from 25 unique sources, two of which were interviews. The remainder of the sources was documentation. The open coding in cycle 1 brought about 21 categories as summarised in Table 1.

Table 1: Categories from cycle 1

Categories	No. of Propositions Cycle 1
Beneficial ignorance	1
Black swans	1
Competition	6
Complexity	4
Conflicting interests	10
Corporate governance	2
Cost custodian	1
Globalization	1
Guarantees	2
Internal capability	14
Organisational structure	12
Lock-in	3
Market	6
Performance measurements	1
Product/service value	3
Programmatics	1
Rent seeking	2
Risk allocation	1
Strategy execution	6
Strategy forecasting	5
Temporal horizon	1
Total	**83**

Two interviews were conducted in cycle 1: The first with an environmental consultant with extensive experience in the infrastructure arena (Respondent 1); and the second with a public relations specialist who has a background in journalism and public relations for large organisations (Respondent 2).

Respondent 1 noted that shortcomings include not engaging with stakeholders when planning the project. Also, not dealing with uncertainty or "control risks" around end-user value. They pointed out that a key differentiator to sustainability is the product or service value offering to

the customer. Respondent 1 also brought up the concept of resilience and the ability to respond to risks, particularly uncertainty.

Respondent 2 noted that a conflict of interest and rent seeking behaviour was a major problem in the megaproject arena in South Africa. Parties would create projects that are aligned with their interests and not those of society focusing on short-term benefits and not the end-users. It was pointed out that this approach didn't create end-user value because the objective was not to deliver end-user value.

The concept of a conflict of interest was noted from both the interviews and documentation that parties in megaproject have conflicting interests. Megaprojects have sponsors who are usually the government and interested commercial parties. The government has an incentive to see the project built to create the impression of delivery services. Engineering and construction companies have an interest to see the project built to generate revenues. Investors have an interest in funding the project to make profits.

These stakeholders then engage in many actions to forward their short-term interests. The first is *optimism bias* where there are over optimistic to sell the project. The second is *beneficial ignorance* where they argue the logic that the project is too complicated to plan upfront and if they did nothing would ever happen. The third was noted in research cycle 2 and is *strategic misrepresentation* where they misrepresent the facts and lie to allow the project to go to realise their gain.

Respondent 3 brought up the issue of government guarantees and the financiers. He noted that in a traditional commercial finance deal, the investors would take a risk and gain a reward by investing in a commercial project. Since there is the risk of failure, they are thorough in ensuring that the finance can build and operate the business for which the finance is being provided. In the case of some megaprojects, there is a transfer risk of failure onto the government that is required to provide a guarantee as the lender of last resort. It is then much easier for investors to back a project without taking the risk of failure.

The respondent also noted that the society had had little to no control or say in addressing that risk. This proved to be an important observation, given that the claim that the risk of projects is internalised by the government providing off-balance sheet guarantees is, essentially, an accounting technicality. By putting up the guarantee, the public (who have no control of the risks) end up paying for the project via taxation if it is unsustainable.

3.2.1.1 Review of research focus

At the beginning of the research, the *intellectual* goal was to understand how to incorporate and monitor sustainability when dealing with business strategy risk in large infrastructure development with the purpose of ensuring that sustainability issues are considered in business strategy risks to prevent costly or even disastrous outcomes down the line for the project company. At the end of research cycle 1, the goal has been shifted slightly with the realisation that in this context the consideration of business strategy risk should not be undertaken separately from business strategy. The costly outcomes seem to be originating from the lack of consideration of sustainability in business strategy opposed to business strategy risk. Secondly, the application was applied to large infrastructural projects, which after considering practitioner literature should rather be referred to as mega- or major projects.

In this research cycle, I became more aware of the different stakeholders involved through the project life-cycle of a megaproject and how much their opinions differed. It became apparent that care should be taken to obtain data from different type of stakeholders as they each have different perspectives. I noted that some of the non-technical text data were getting their information from the same set of sources and were essentially public relations promotions. I therefore increased focus on triangulation to ensure that data points were confirmed from unique primary sources

3.2.2 Cycle 2

In cycle 2, the data collection and categorization involved the collection of 58 propositions from 10 unique sources, two of which were interviews. The remainder of the sources was

documentation review. The open coding in cycle 2 brought the total number of categories to 27 categories.

Two interviews were conducted in cycle 2: The first with a management consultant with a background in financial risk at investment banks (Respondent 3); and the second with a credit risk analyst at a development finance institution (Respondent 4).

Respondent 3 noted that a risk to sustainability in megaprojects is the risk vetting process. Assumptions can take place in megaprojects and they fall through the risk vetting process. Investors such as banks are meant to ensure that the business model is sound and that the operating company is capable. Instead, they ignore this and obtain a government guarantee thereby transferring the risk. The investors are, therefore, taking little risk for high rewards.

Respondent 4 noted that public consultation upfront should have taken place. When the project is over budget, it affects the sustainability. This is also the case with the operating cash flows of the project. There should be a profit, and the service should not require subsidisation.

During this cycle it was observed that megaprojects are large by nature and require CAPEX. They also usually require government license for operation and seek protection through legal barriers. As a result, these are natural monopolies and should be viewed as such. Natural monopolies tend to be governed by regulatory bodies who set pricing and attempt to protect the consumer. Competitive market forces do not drive monopolies. They control and seek to maintain control of market share. This is achieved through setting up legal, technological and cost barriers to entry. There is a deliberate attempt to increase average costs to allow for higher price applications with the regulatory bodies. They are protective in nature and aim to ensure that they can maintain their market share.

A dichotomy was noted with strategic risks in the risk and reward trade-off. Far from holding back the business, strategic risk management is about augmenting strategic management and getting the full value from your strategy. Effective strategic risk management is built around

a clear understanding of how much risk your business is prepared to take to deliver its objectives and a timely and reliable evaluation of how much risk it is taking.

3.2.2.1 Review of research focus

Based on the outcomes of cycle 2, the intellectual goals have been refined to view sustainability from a societal perspective. The experience in the data indicates that environmental phenomenon is technically addressed in the project, and if they are of fundamental importance, they'll stop the project before it commences. Most of sustainability in the data is referring to the social aspect of sustainability.

In this cycle, a fair amount of time was spent considering sustainability as I collected data from a wider variety of sources. There was a temptation to lead some of the categories, but care was taken to allow them to emerge. For instance, the lack of an environmental category as a strategic risk presented the temptation to search for one however this course of action was not pursued. This resulted in some surprises such as the realisation that the data considered environmental sustainability to be a technical issue and focused on social sustainability. I became more aware of the need to carefully examine and remove my bias from the process.

3.2.3 Cycle 3

In cycle 3, the data collection and categorization involved the collection of 49 propositions from 16 unique sources, with all sources being documentation. The open coding in cycle 3 brought the total number of categories to 33 categories as summarised in Table 2.

Table 2: Categories from cycles 1-3

Categories	No. of propositions			
	Cycle 1	Cycle 2	Cycle 3	Total
Accountability			3	**3**
Beneficial ignorance	1			**1**
Black swans	1			**1**
Competition	6	2		**8**
Complexity	4		1	**5**
Conflicting interests	10	4	9	**23**
Contractual requirements		1		**1**
Corporate governance	2			**2**
Cost custodian	1			**1**
Economic viability		3	3	**6**
Executive politics			1	**1**
Globalization	1		1	**2**
Government ability		6		**6**
Government guarantees	2	2		**4**
Guarantees			1	**1**
Internal capability	14	13	5	**32**
Organisational structure	12			**12**
Lock-in	3	1	1	**5**
Mandate			2	**2**
Market	6	2		**8**
Optimism bias			2	**2**
Performance measurements	1	2	8	**11**
Product/service value	3			**3**
Programmatics	1			1
Regulator		3		3
Rent seeking	2			2
Responsibility		3		3
Risk allocation	1	5	4	10
Social license		3	3	6
Strategic misrepresentation			1	1
Strategy execution	6			6
Strategy forecasting	5	6	1	12
Temporal cycles	1	2	3	6
Grand Total	83	58	49	190

3.2.3.1 Reduction sampling

The axial coding was undertaken in cycle 3 in which categories were reorganised and further organised into different categories.

The total 33 categories from the open coding were analysed, and some categories were found to overlap. These were then joined and reorganised into 27 categories, with one new

category. The category of *temporal horizon* and *temporal scale* were combined to form temporal cycles. The extra category of lock-in was created as it was a result of a decision which had implications over a temporal horizon. The categories of *value* and *product/service value* were combined into *product/service value*, as value has a broad meaning and would be higher up the abstraction ladder. The categories of *strategy execution* and *strategy forecasting* were merged to make a single category of *strategy* because there was overlap in the categories and the sources suggested that strategy execution was not an issue of strategy at all but rather organisational structure. It was realised that what was meant was *strategy*. The category of *cost custodian* was merged with *risk allocation* because there was one proposition relating to cost custodian and it is a part of risk allocation. The category of *temporal cycles* was changed to commitment as it referred to the commitment which a decision takes. The category *organisational structure* was changed to *project organisation* due to the nature of the structure of megaprojects which are not single companies but joint venture companies.

Following this, the samples were then subjected to reduction sampling to organise the samples on the same level in the ladder of abstraction. Reduction sampling involved working through the vertical direction of the ladder of abstraction following a methodology of linking the categories with each other by asking the question “Is category X a part of category Y, and is category Y a part of category X”. If X were a part of category Y, then a source link from X to the target of Y was established. A total of seven categories emerged from the process. This categorization process was undertaken twice, the first results producing 12 categories and the final process into a further seven categories as illustrated in Figure 10

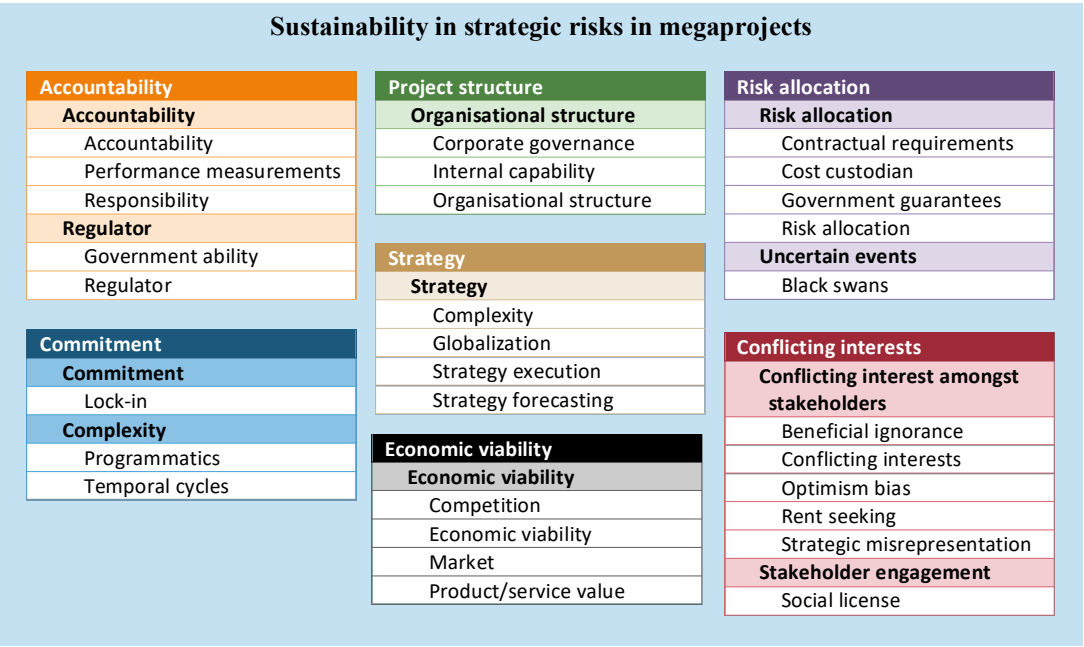


Figure 10: Results of the reduction sampling arriving at the seven core categories

An inter-relational diagraph of the seven categories was then constructed which is presented in Figure 11.

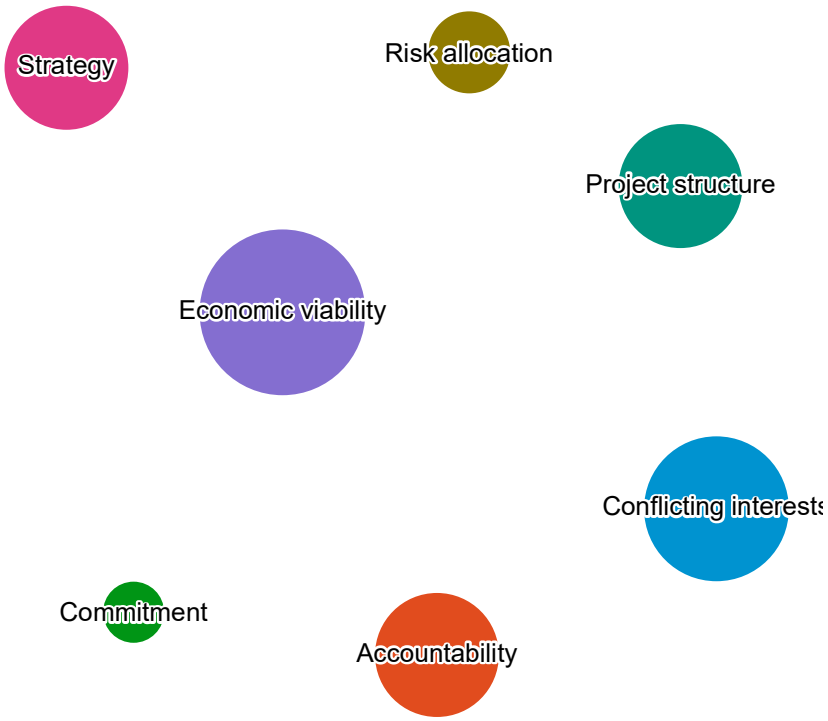


Figure 11: Conceptual framework of the seven categories at the end of cycle 3.

3.2.3.2 Mini-literature review

The mini-literature review was conducted then conducted from which important excerpts are provided below. An important insight emerged from the mini-literature review which was the concept of transparency as it relates to accountability and conflicting interests. Conflicting interests tend to be an issue when they are undisclosed and there has not been transparency, while accountability is increased through transparency. This did not change the pattern of the findings which were the same as the existing categories.

Accountability for decisions and actions

The key concepts in the category of accountability are the existence of relationships between stakeholders as well as referees who should hold a party or the parties responsible with repercussions for their actions.

From the literature, accountability includes concepts such as responsibility, ethics and obligation (Lehtonen, 2014). It is an important aspect of good decision-making (Bruzelius, Flyvbjerg, & Rothengatter, 2002). In megaprojects, there is often a deficiency of mechanisms for implementing accountability in both measuring performances as well as rewarding or punishing (Bruzelius et al., 2002).

Some stakeholders try to escape accountability by arranging matters in a way that they can shirk responsibility for their actions or decisions (Giddens, 1999). This is done through an approach of 'organised irresponsibility' as a part of risk management where the stakeholder is responsible but not held accountable because of the burden of proof or determine who was damaged and how they should be paid (Giddens, 1999).

Accountability in itself is complicated because question such as "who can be held accountable since no single person is in control" are difficult to answer (Lehtonen, 2014). For this reason, (Bruzelius et al. (2002) recommend accountability be increased by both public and private sector working together and increasing transparency to the public.

From the literature review, the key takeaways were that accountability must assign responsibility by increasing transparency, referees must work together, and there must be repercussions for actions.

Conflicting interests amongst stakeholders

The key concepts in this category are that stakeholders act in the short-term for their objectives and not in the long-term for the benefit of the project objectives.

Conflicting interests arise when different stakeholders have their individual objectives and goals in a project outside of those of the general goals and objectives of the project. A decision must then be made by the stakeholder whether to act in their interests or general interests. This is like the principle agent problem. However this includes stakeholders who

are a collective such as the community (Lehtonen, 2014). The conflict takes place when there is a transaction between parties, and there is a potential benefit or loss for the stakeholders.

Kutsch and Hall (2010) found that hidden agendas or undisclosed conflicting interests amongst stakeholders tended to obscure determining risk allocation amongst stakeholders. Conflicting interests are characterised by hidden information where one stakeholder will have knowledge of their interests that another doesn't, and they do their best to keep it hidden from the other stakeholders (Kutsch & Hall, 2010). The disclosure or transparency of the conflicting interests is, therefore, important and Lehtonen (2014) recommends that accountability is used to address some of these issues.

The outcome of conflicting interests is opportunistic behaviour by parties acting in their self-interests. This is sometimes to the detriment of society at large creating the scenario of a social trap (Platt, 1973; Schelling, 1971).

The key takeaways are that the disclosure of the conflicting interests, removal of hidden agendas and implementation of accountability with transparency are important when dealing with conflicting interests.

The economic viability of a project

The key concept here is that megaprojects must focus on the economic case to be sustainable.

The literature indicates that economic viability requires a regulatory regime with proper economic rules in place (Knight, 1990; J. Maxwell, Jennifer, Briscoe, Stewart, & Suzuki, 1997) as this allows for the assignment and enforcement of property rights. With this in place, the economic objectives must be established which will be the criteria against which economic profitability can be measured (Knight, 1990; J. Maxwell et al., 1997). Economic profit differs from accounting profit as it takes sunk costs and externalities into account (Beria, 2006). Things like externalities are difficult to value according to established and required accounting methodologies, especially since they can involve estimations of

downstream value. They are, however, important in the context of megaprojects and are a part of the objectives.

Economic viability will require that the project is economically profitable. This begins with a suitable market and adequate demand for the product or service (Beria, 2006; Knight, 1990). Costs must be established so that a price can be set, for which after financial investment and costs, an economic profit can be achieved (Bruzelius et al., 2002). Relevant externalities and sunk costs must be considered, and the economics of the project can then be established.

Projects which are usually on-budget and on-schedule, are also profitable and economically viable (Bruzelius et al., 2002). To assess economic viability, an economic evaluation is undertaken, incorporating both variable and fixed costs.

The outcome of economic viability is that value or benefits for some stakeholders according to the economic objectives of the project (Knight, 1990; J. Maxwell et al., 1997).

Key takeaways from the literature are that economic viability ensures the delivery of value to all stakeholders, and include externalities which are difficult to account for.

The project structures

The key concepts relating to this concept are that the organisation and role of stakeholders influence their ability to perform and management risks.

Most infrastructural megaprojects have a hybrid structure due to their size and complexity (Aramo-Immonen, 2009). This complexity in the structure influences information and communication flows between parties difficult. Mutual trust is, therefore, important in megaprojects which are typified by a fragmented diversified organisation which required collaboration, alliance, partnership and similar ideas (Aramo-Immonen, 2009).

The key takeaway is that megaproject structures require trust and collaboration amongst the parties involved.

The allocation of risks in megaprojects

The key concepts are that the allocation of risks affects the strategic view and actions of the risk custodian.

The allocation of risks has to do with the assignment of risks to responsible parties. Before the allocation of risks, there is a conceptualization, identification and categorization of the risks; and in some cases also the assessment and quantification depending on when the 'actual' risk allocation takes place (Iossa & Martimort, 2011; Kardes, Ozturk, Cavusgil, & Cavusgil, 2013). Risk allocation involves negotiations between parties at the point at which they enter into contracts to define who the custodian and responsible party for risks will be. The responsible party then attracts the liability as laid out in the mutual party agreement and within the applicable laws (Bing, Akintoye, Edwards, & Hardcastle, 2005; Chou, Ping Tserng, Lin, & Yeh, 2012).

Literature suggests that risks should be allocated to parties who can handle them to meet the value for money requirement because that party is best suited to deal with the risk (Chou et al., 2012; Iossa & Martimort, 2011; Kardes et al., 2013). A further motivation is that if rewards are to be shared, so should the risks. This is in contradiction with the findings of the research which suggest that all parties attempt to avoid and transfer risks as far as possible.

The key takeaways are that risks should be allocated to the parties who are best positioned to mitigate them as they are the most likely to be successful. If stakeholders are to share in the rewards, they should also share in the risks.

Strategy for achieving the objectives

The key concept is that a clear plan aligned to the objectives of the project is necessary for a successful strategy.

Strategy focuses on the long-term and addresses the overarching policies for reaching the strategic goals. For a strategy to be put in place, vision and mission must be established (Davis, 2014) (Kardes et al., 2013). Once these have been defined, the strategic goals of the project can be established. The strategy will then lay out the steps to be taken for the objectives to be achieved.

Strategy focuses on four key questions: what, why, how and when. Put differently; it has a subject (what), reason (why), method (how) and timeframe (when) (Eweje, Turner, & Müller, 2012). To achieve this, decision-makers must be in place and aligned with the goals because these internal resources will implement the strategy (Lundrigan, 2015).

The outcome of strategy is a plan laying out the steps for implementation and success. These then allow for the measurement of performance towards these objectives (Goold & Quinn, 1990), and by association the vision and mission of the project.

The key takeaway is that strategy must be built upon clear objectives with measurable criteria and properly lay out how these will be realised.

Commitment to a course of action

The key concept behind commitments is that megaprojects act over long temporal cycles and decision made early on lock-in stakeholders into a course of action.

Literature suggests that decisions made early in the project lock stakeholders into a course of action (Cantarelli, Flyvbjerg, van Wee, & Molin, 2010). Lock-in is characterised by the creation of a 'path dependency' or a path that must be followed even though it is not the best path to be followed (Cantarelli et al., 2010). Lock-in can be framed both positively and negatively, however, in megaprojects it is mostly negative (Cantarelli et al., 2010).

Negative lock-in results in vulnerability as the project is no longer resilient to dynamics, uncertainties and risk (Cho, 2014). An important aspect of resilience and responding to risks and uncertainties is establishing the temporal scales within the project system (Longstaff et al., 2010).

The key takeaway is that negative lock-in creates vulnerability and increases risk.

3.2.3.3 Review of research focus

The practical goal was originally founded in assisting major-project companies in taking better account of sustainability in their business strategy to prevent schedule and costs overruns and prevent downstream abilities to raise finance.

In practice, this problem does not seem to exist for the project companies under the current state of the world because they have an inherent moral hazard. The consideration of sustainability in the project strategy may result in the project simply not materialising and then would result in a loss of all the staff and project sponsors. The loss arises from initial investment into the project at the pre-feasibility and feasibility stages with lost future revenues should the project not materialise. If the government guarantee remains in the place for the project, a return will be realised, and finance can be sourced.

The sustainability of such infrastructural projects is largely rooted in the value they offer to the end-user. Poorly considered projects put a long-term strain on the economy as losses are absorbed by the government who raises their finances from taxation. The logic is in linked with Ricardo's irrelevance proposition applies since the borrowing today to pay for the project is repaid by the tax payer. This has a direct impact on the resilience of the society as they're burdened infrastructure they do not need and does not add the value that society requires.

The practical goal, therefore, has been reconsidered. The practical goal has shifted to the consideration of sustainability in the project's business strategy with the practical application

of maximising the marginal value which society may obtain from this large-scale investment. The benefit of society being the major aim of sustainability in this context.

The goal at the end of cycle 2 was reworded from the benefit of society to the development of society. The goal was further refined from the development of society to the development of end-users over the long-term who constitute society (who are a subsection of society).

The intellectual goals were refined from cycle 3 to view sustainability from a societal perspective but incorporating it from the functionality, it brings to the end user in the long-term which is the goal of infrastructure.

The research question entering cycle 3 was *what sustainability issues are of strategic importance to lessening risks in infrastructural megaprojects?* After research cycle 3, as well as the reduction sampling and mini-literature review, it became clear that the goals and research focus are on social sustainability of megaprojects. The research question was, therefore, altered to *what strategic risks threaten the sustainability of infrastructural mega projects?*

The concern variable was altered from *sustainability as a risk to strategy in megaprojects* at the end of cycle 1 to *strategic risks to sustainability in infrastructural mega projects.*

The mini-literature review and reduction sampling proved very useful in organising the categories and resolving overlaps. In some instances, the categories required proper development and more comprehensive categories emerged at the end of the process.

3.2.4 Cycle 4

3.2.4.1 Theoretical sampling

Theoretical sampling was undertaken on the seven core categories with no new categories or insights being identified. Each category was concentrated upon with propositions being collected. A total of 44 propositions were collected in cycle 4 and no new categories

emerged. This suggests that the categories have reached the point of sufficient saturation that no new insights were to be gained.

The total count of propositions at the end of cycle 4 was 234 propositions with no changes to the seven core categories.

3.2.4.2 Review of research focus

The conceptual framework remained unchanged with the same connections between the core categories. The research goals and questions also remained unchanged from cycle 3.

I had found categorizing difficult in cycles 1 and 2 as categories overlap and can be interpreted from different perspectives. A fair amount of time was spent selecting categories in attempt for them to make sense and be distinct. The reduction sampling assisted in better arranging the categories, arrange the concepts into the same level of abstraction and arrive at distinct categories. The literature review and concept analysis of the categories helped to better develop the categories by understanding the antecedent, attributes and consequences of each concept. These steps assisted in develop rich clear categories. Following the theoretical sampling in cycle 4, I felt satisfied that the concepts collected had emerged from the data. Further discussion of the research results follows.

3.2.5 Discussion of the research results

A discussion has been provided in each cycle to allow the reader to view how the categories research focus emerged during the data collection and analysis. The final conceptual framework for the research has seven categories. These are presented in Figure 12, which shows both the categories and sub-categories with the speculated relationships. The relationships are explored in Chapter 5.

The first is *accountability* referring to parties or persons acting being held responsible for that actual through actual consequences. Major components of this category had to do with the who holds parties accountable, whether they are held accountable, and how this is measured.

The second is *conflicting interests* referring to the conflicting interest which different stakeholders in megaprojects may have. This dealt extensively with the conflicting interests amongst stakeholders in their attempts to maximise their benefit versus the long-term delivery of the social benefits of the project.

The third is *economic viability* referring the 'actual' sound economics behind the project. This includes fundamental issues such as the product or service benefiting the end-user, at a suitable price point, and which makes overall economic sense based on sound economic principles including welfare economics.

The fourth is *project structure* referring to how the project with multiple stakeholders is structured for the planning, building and operating of the project. This includes their ability to execute, the way they do so through corporate governance and how they position stakeholders.

The fifth is *risk allocation* which refers to the attempt by stakeholders to allocated risks to various parties through the process of risk management. This includes attempts by parties to shirk responsibility through risk allocation, the role of government guarantees in supporting this behaviour, and contractual requirements inefficiently allocating risks early in the project with the result that these parties are unable to address them.

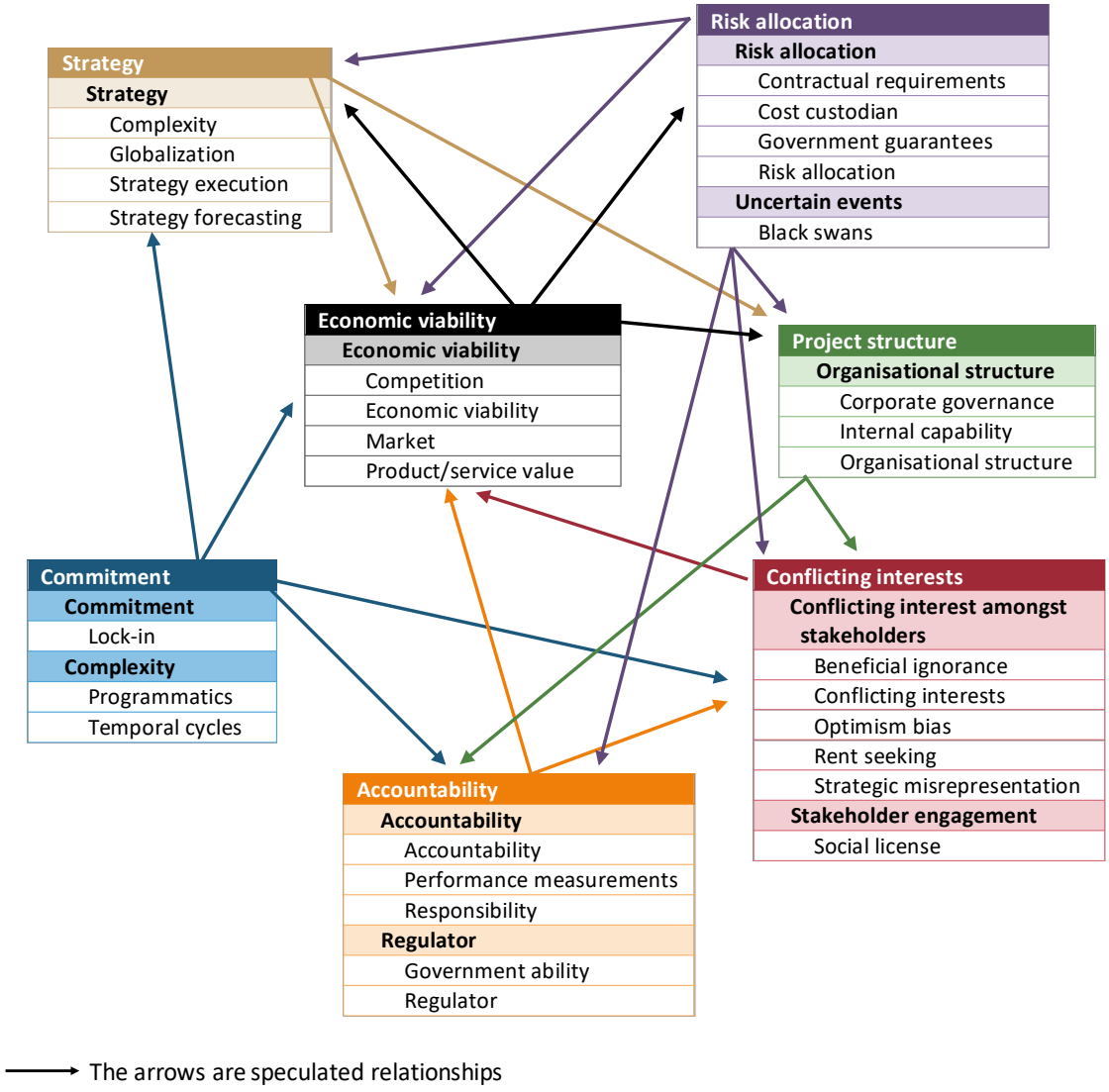


Figure 12: Research results

The sixth is *strategy* which refers both the formulation and execution of strategy within the project. This acknowledges the broader global context within megaproject finance and various players, as well as the complexity of these projects and difficulties in strategizing.

The seventh is *commitment* referring to course of action in which decisions in megaproject commit the project and stakeholders to a course of action for a long period of time resulting in a lock-in and little flexibility.

3.3 Evaluation of threats to validity

The research was conducted in a manner to allow the data to reveal itself. At times, this was challenging to the researcher as there was the temptation to apply their perspective or opinion. It also made coding more difficult categorising propositions and forming their links in the conceptual framework. Mitigating my bias through diligent note taking, reflecting and ensuring that the ideas emerged from the data was important in allowing the ideas and concepts to be pieced together using the research process.

3.3.1 Internal validity or credibility

Some different literature sources have been consulted as data sources including interviews, expert journals and writings, publications by relevant parties and textbooks. Sources were sought from the perspective of different players in megaprojects including government, construction companies, consultants, concession companies, civil society, investors, and legislation. Interviews were conducted with four professionals from varying fields including sustainability; public relations and communications; risk management; and financial analysis.

Problems encountered with internal validity is the use of 'expert' opinions as marketing and promotional material. I found and excluded several sources that were borrowing ideas from a single author and then rewriting them to market their expertise in the field. The credibility in these sources was also questionable as their opinions were not based on their observations. I tackled this problem by excluding such sources.

3.3.2 External validity or transferability

Sources were taken which addressed megaprojects in some countries including but not limited to Canada, U.S.A, United Kingdom, Australia, South Africa, and Denmark. Some of the sources used datasets which covered megaprojects from multiple projects around the

world and others are consultants to clients to implement projects in these arenas. The interviews were held with professionals with experience primarily in Africa and Australia. The variety of sources from various geographies and backgrounds help to validate the transferability of the study.

Megaprojects are complicated with numerous role players and project specific peculiarities. The research begun by focusing on large infrastructural projects which was too generic. It was therefore changed to on infrastructural mega-projects for the purposed of being more precise. There will however be limitations based on context such as particularities to certain legal and cultural contexts.

3.3.3 Dependability

The research methodology was followed closely step by step with a record of progress being kept. Records of the research were kept, including a copy of all the source articles. The variety and type of sources lend to the credibility of the research.

Keeping memos is difficult and time consuming, requiring rigor and discipline. I found that I needed to revisit the memos and I worked through the research cycles updating my findings. My lack of experience as a qualitative researcher also meant that more time needed to be spent on each step interrogating the reason for performing the action. I hold a degree as Master of Science for which I utilised a quantitative research approach and therefore this research is a new tool which I am seeking to add to my skillset.

I found with the interviews that some respondents had emotions relating to the topic at hand and the open interview setting allowed them to explore these. I attempted to be as factual as possible relating their comments back to concern to combat this, but it was clearly an aspect in the interviews which I did not anticipate when planning the research.

3.3.4 Confirmability

A copy of the data, proposition log and progress of the research has been kept. The results can, therefore, be confirmed from these sources. Notes from the interviews were submitted to the respondents to allow them to confirm the notes taken from the interview. When compiling the propositions, the question was asked what the impact of the proposition was on the concern variable to ensure that the research systematically referred to the concern at hand.

3.3.5 Researcher bias

As an environmental consultant, my bias is towards environmental sustainability and a tendency to view sustainability from this angle. As a result, I have not specifically defined sustainability but informed respondents about three core elements of sustainability being: environmental, social and economic.

I have chosen to take an ego-centric view towards sustainability, which is to view the utility of sustainability from the perspective of people rather than an eco-centric perspective which views it from the perspective of ecology. This was based on my observations from the data that this is how sustainability is viewed in this context even though it is in opposition to the views taught to me.

I noted some bias in the sources in the literature where practitioners had information from the same source. To offset this, I took cognisance of his influence in the data and exclude sources where it was clear they were multiple repeats of a source already captured. I furthermore conducted four interviews and referred to my personal experience have been used as sources and as well as.

The research concern stems from y experience in a construction firm working with large projects. I therefore had therefore had ideas entering the research, some of which were challenged by the opinions in the data and respondents. While difficult, a specific attempt was made to fall back onto the research method of allowing the insights to emerge from the data and not allowing my bias to influence the outcomes.

3.4 Conclusion

The data was collected and analysed according to the research methods. As with most qualitative research, the data collection was not without challenges, and a certain level of flexibility was required. These issues were discussed as well as the insights gained during the process.

The outcome of the process is seven core categories which have emerged and now will be carried forward to the literature review process in Chapter 4.

4 Literature review

4.1 Introduction

The literature review aims better understand the theoretical framework for the situation of concern. This is achieved by reviewing the theoretical parts as well as their relations in creating the whole. In the application of GT, the literature review is conducted following the data collection phase which is different to most other research methods and facilitates the review of the technical literature (Strauss & Corbin, 1998). The reason for this is the literature can "*hinder creativity if it is allowed to stand between the researcher and the data*" (Strauss & Corbin, 1998, p. 53). Technical literature can, however, be used as an analytical tool in theoretical sampling, while non-technical literature can be used as data sources.

A three level approach has been adopted for the literature review as illustrated in Figure 13 (Ackoff, 1999). This approach seeks to answer three fundamental questions of 'why', 'what' and 'how' (Ackoff, 1999)? The 'why' is considered under the parent discipline and is established as level 0. The 'what' is the focus discipline as level 1 and is the subject discipline. The 'how' considers the core categories established in the research and comprises level 2.

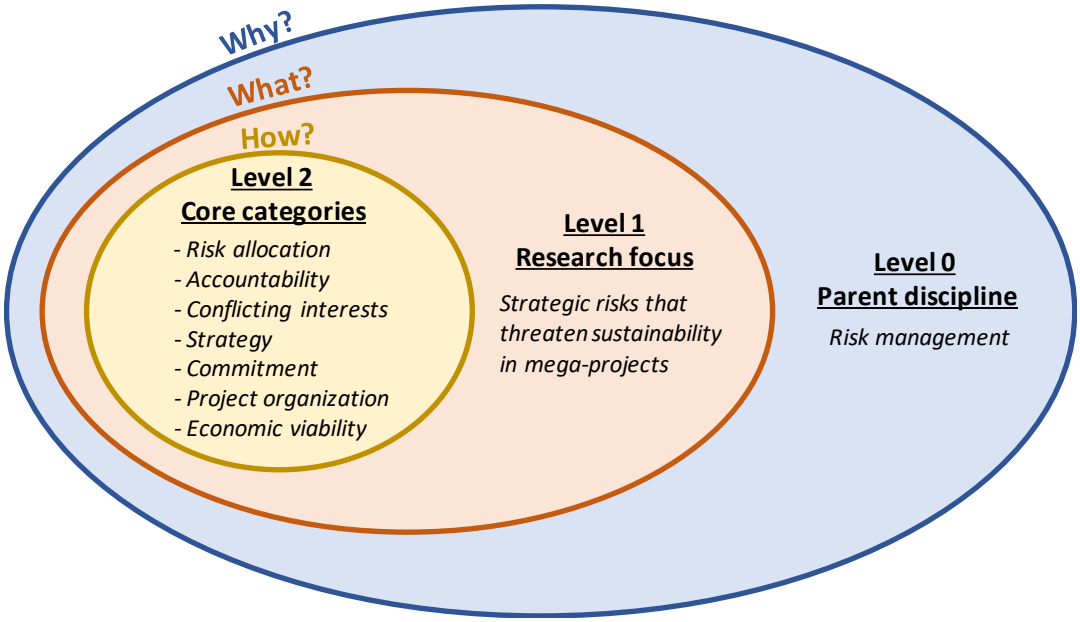


Figure 13: Literature review process

At each level in the literature review, a concept analysis was performed (McGhee, Marland, & Atkinson, 2007; Medin & Smith, 1984). This was performed to introduce discipline and rigour in reviewing the literature to ensure that adequate breadth was covered. The concept analysis involved identifying the main concepts and then establishing the main antecedents, attributes and consequences of the concepts in a similar manner as performed by Beck (1996).

4.2 Level 0: Risk management

The research question at the end of cycle 4 described in is *what strategic risks threaten sustainability in infrastructural mega projects?* The subject of this question is strategic risks for which the parent discipline is risk management which is the selected as the parent discipline within which the research falls.

Risk refers to events that may have a significant negative impact on an object (Hopkin, 2013), while the discipline of risk management in megaprojects is concerned with the

"*systematic process of identifying, analysing and responding to project risk*" (Irimia-Diéguez, Sanchez-Cazorla, & Alfalla-Luque, 2014).

It is worth highlighting the difference between risk and uncertainty, where risk is thought of as a *known uncertainty* while uncertainty is thought of as an *unknown uncertainty* (Williams & Baláž, 2012). As discussed later, strategy and sustainability in megaprojects both deal with the long-term which is characterised by increased levels of uncertainty.

In the application of risk management, risks are categorised during the identification phase (Kardes et al., 2013; Krane, Rolstadas, & Olsson, 2010; Sanderson, 2012). Once categorised, the categories are assessed for the probability of their occurrence exerting a negative impact on the project objectives (Turner & Zolin, 2012). The allocation of risks, as well as decisions made in response to the risk assessments, are performed by the project stakeholders (Davis, 2014; Purdy, 2010).

The level 0 literature review focuses on three key concepts relating to risk management and sustainability in megaprojects: risk categorisation, project objectives and stakeholders (refer to Figure 14)

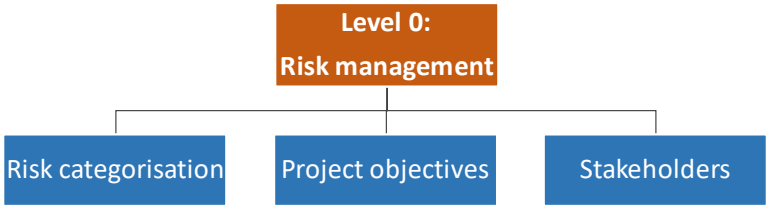


Figure 14: Level 0 literature review key concepts

4.2.1 Risk categorization with a view to allocation

Risk categorization involves the grouping of risks into chosen categories to allow for better allocation, assessment and treatment thereof. Prior to the categorization of the risks, the project objectives and stakeholders must be known as the risks will allocated to certain stakeholders and will be assessed according to the project objectives (Irimia-Diéguez et al.,

2014; Kardes et al., 2013). The categorization process often follows the same process, format and categories as previous projects taking into account previous knowledge and other relevant information (Eweje et al., 2012; Kardes et al., 2013).

During this process, risks are separated from uncertainty. Uncertainty is further separated into that which arises from imperfect knowledge and that which arises from an unknown future (Williams & Baláž, 2012). The former may be corrected through further investigation and studies while the latter must be managed in another manner.

The categorization process itself generally takes place according to certain attributes such as the responsible parties, contractual requirements, operational requirements, previous knowledge and others (Irimia-Diéguez et al., 2014; Kardes et al., 2013). An important aspect is that risk management is a dynamic process as risks emerge and change over time (Kardes et al., 2013).

The outcome of the categorization is the risk register which is often referred to as the base document for risk management (Krane et al., 2010). The risk register contains *inter alias* the risk categories, and risks or risk categories are then allocated to stakeholders (Irimia-Diéguez et al., 2014; Krane et al., 2010).

4.2.2 Achieving the project objectives

The project objectives are derived from three main aspects of the project: the mission, vision, and goals of the project (Baccarini, 1999; Davis, 2014; Kardes et al., 2013). These aspects record the purpose and desired outcomes which will become the project objectives (Baccarini, 1999).

Baccarini (1999) views the project objectives through the inputs and outputs into the project. The inputs are described as the resources and activities required to provide the project outputs; while the outputs are described as the tangible results. Turner and Zolin (2012) take a similar approach describing project inputs and project outputs but also defining project

outcomes. The difference in their description is that the project output is the 'actual' product to be delivered, while the project outcome is the capabilities that the output creates, as well as the impact on the long-term performance.

These three categories focus on the business objectives of the project. The other objectives, namely the economic, social, and environmental objectives are included in the outcomes and impacts categories described by Turner and Zolin (2012).

It is from the project objectives that the overall project success factors are defined (Baccarini, 1999; Davis, 2014) which allows for the formulation of the general performance measures as well as the project management success factors (Baccarini, 1999). The project management success factors should not be confused with the project factors, former which focus on the functional aspects and the latter on the general strategic purpose.

Once the project objectives have been defined, the project risks can be identified and assessed according to these objectives (Irimia-Diéguez et al., 2014; Krane et al., 2010). The project objectives are, therefore, an important aspect of strategic risk management as they are the object of the strategic level risks which are the risk that may prevent the project from achieving its mission, vision and goals (Krane et al., 2010).

4.2.3 Stakeholders as actors and decision-makers

Before project stakeholders can be in place, a suitable project context is required with the necessary political and legal structures. These are an important part of the risk management as their absence increase the uncertainty around the project.

Stakeholders help determine the project objectives and measure the project success. However, they also have their own objectives and don't unilaterally act in the best interests of the project (Purdy, 2010; Wang & Huang, 2006). As a result, stakeholders will often have hidden agendas and undisclosed conflicting objectives which conflict with the those of the project (Kutsch & Hall, 2010; Wang & Huang, 2006).

The stakeholders take a number of forms such as individuals, organisations or agents with different roles and responsibilities in the project (Davis, 2014). It is useful to divide stakeholders into those who are internal and external to the project which assists in defining their roles and responsibilities. For instance, some internal stakeholders will determine their risk appetite and exposure and take project decisions on these issues, in some cases even cancelling projects (Kutsch & Hall, 2010). Stakeholders, therefore, take decisions with several theories being posed around taking decisions. Further discussion on decision taking by stakeholders is provided for in Section 4.4.3.

Some consequences of stakeholder involvement in risk management are that stakeholders attempt to allocate risks based on their interests and not those of the project (Irimia-Diéguez et al., 2014; Krane et al., 2010; Kutsch & Hall, 2010). This is contrary to the principles of best practice where risks are allocated to those who are best positioned to deal with them.

4.3 Level 1: Strategic risks that threaten sustainability in megaprojects

The level 1 literature review is based on the research focus for which three key concepts have been identified: sustainability and sustainability in megaprojects, megaprojects, and strategic risk. The literature review then focuses on a further three key sub-concepts for each of these key concepts as illustrated in

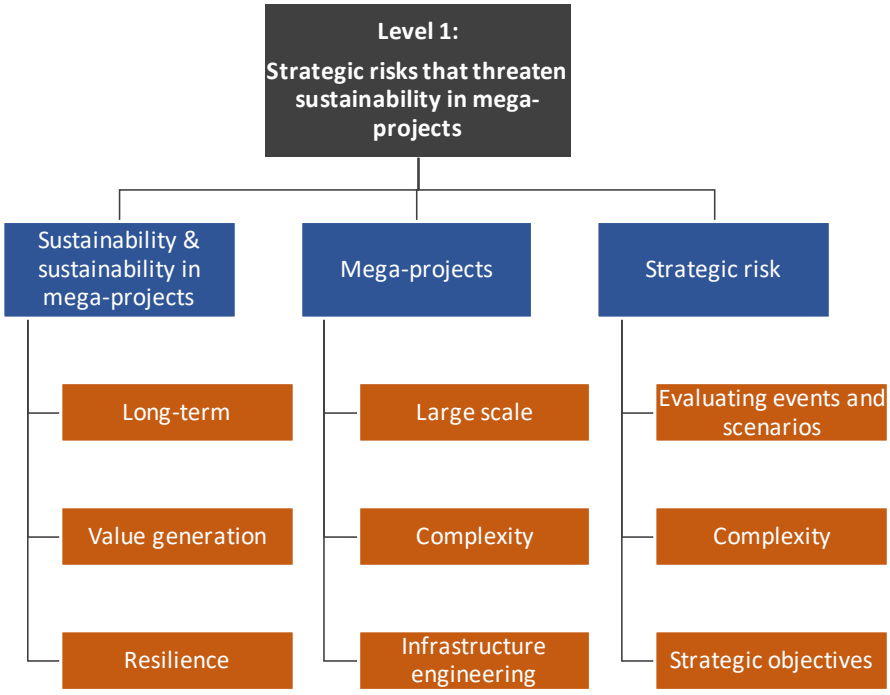


Figure 15: Level 1 literature review key concepts

4.3.1 The concept of sustainability

Sustainability is a difficult concept to define. It was originally proposed in its modern form by the Brundtlant Commission, who defined it as (Brundtland, 1987, p. 41) "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* Three key concepts taken from this commission were the idea of people having needs; these needs being limited by the state of technology, social organisation and the environment's carrying capacity (Brundtland, 1987); and a long-term temporal horizon in relation to human generations.

It's application to megaprojects is no exception. In defining the concept of sustainability in megaprojects, a few definitions have been provided:

(1) by the Asian Development Bank as (Asian Development Bank, 2010, p. 4) *"The probability that human, institutional, financial, and natural resources are sufficient to*

maintain the outcome achieved over the economic life of the project and that any risks need to be or can be managed";

(2) by the African Development Bank as (Asian Development Bank, 2010, p. 4) "*The likelihood that project results will be maintained over the intended useful life of the project";* by the World Bank as "*The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realised)";* and

(3) by the Organisation for Economic Development as (Asian Development Bank, 2010, p. 4) "*The continuation of benefits from a development intervention after major development assistance has been completed. The probability of continued long-term benefits. The resilience to risk of the net benefit flows over time.*"

For the purposes of this research, the definition chosen is (3) by the OECD as it acknowledges the concepts of societal needs being met over time with the purpose of development and resilience to risk. There are three underlying concepts in this definition: (1) that it *adds value* to end-users; (2) that it does so in the *long-term*; and (3) that it is *resilient* to risks (Asian Development Bank, 2010; Brundtland, 1987).

Sustainability has an environmental, social and economic aspect, commonly referred to as the three pillars or triple bottom line (Amasuomo, Hasnain, & Osanyinlusi, 2015). The economy is based within society and is the basis on which people in society make a living. Society is based on the environment and is the basis of natural resources used for people's survival and economic activities. The relationship is illustrated in Figure 16.

The importance is that sustainability has an anthro-centric focus which is contrary to many environmental proponents who adopt an eco-centric approach. The anthro-centric approach is focused on humans and their continued survival.

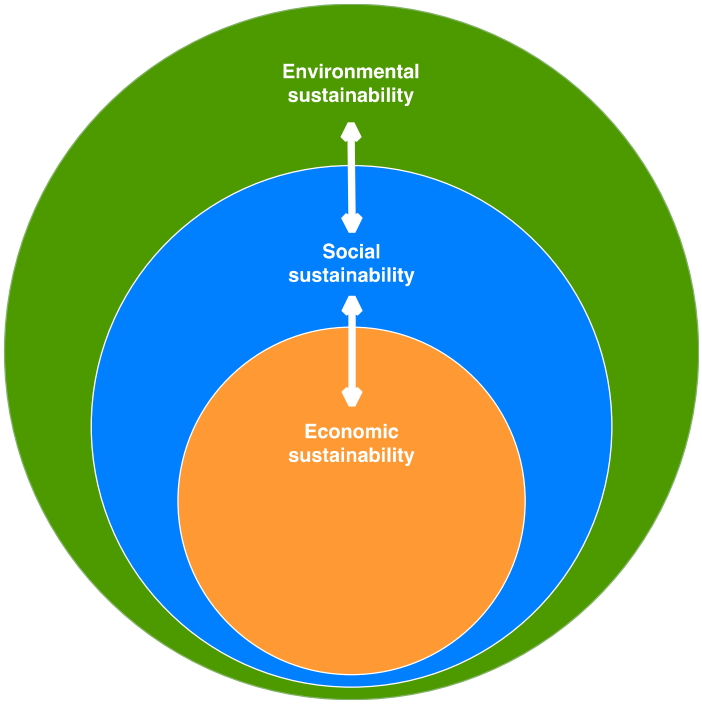


Figure 16: The triple bottom line

4.3.1.1 Sustainability in megaprojects

Sustainability in megaprojects is a growing field of interest, particularly as the understanding of sustainability grows. Before sustainability can be put in place, the applicable sustainability criteria and performance indicators must be formulated, as well as the methods for assessment and evaluation, and an appropriate legal framework with policies and regulations for their enforcement (Amasuomo et al., 2015). For instance the Asian Development Bank (2010) has set their own criteria as follows: The demand for the project product or service, financial viability, funding policies and procedures, monitoring, and political will. It is interesting to note that none of these criteria relate to environmental factors but focus around the social and economic factors.

Sustainability in megaprojects typically has the continuation of benefits from the project which should last the whole project lifespan (Asian Development Bank, 2010). It is desirable for projects to have resilience to risks as a number of uncertainties will likely transpire

especially over the long-term and since all eventualities cannot be planned for, the ability to respond to these events is required (Asian Development Bank, 2010).

The results of megaproject sustainability require some attention. The most obvious benefit is the value end-users will derive from the product or service (Oliomogbe & Smith, 2013). This should lead to knock on effects such as improved welfare, better safety, better political performance due to product delivery, improved safety and a number of other factors (Oliomogbe & Smith, 2013).

From an economics perspective, the product or service will provide a capital base driving down-stream economic growth (Oliomogbe & Smith, 2013). This will improve the local economy and allow for an increase in business in the economy (Oliomogbe & Smith, 2013). It has also been noted that sustainability in megaprojects tends to increase the value of land in the economy where it is physically being implemented (Oliomogbe & Smith, 2013).

In considering the bio-physical environment, sustainability facilitates a lessened and controlled impact with the ultimate effect of a preserving important components of the environment (Oliomogbe & Smith, 2013).

4.3.1.2 A long-term view

The long-term is a relative concept and depends on the phenomenon in question. Long-term in relation to sustainability is dealing with ensuring that development is not done at the cost of future generations. It is, therefore, working with the lifespan of human beings and more precisely generation gaps. In the case of megaprojects, Koopmans and Rietveld (2013) define the long-term as being greater than 30 years.

The long-term view is a broad level view (Priemus, 2010) because it is associated with a high level of uncertainty and, therefore, detail must be excluded. In the case of megaprojects, the long-term would be for the life-time of the project which includes the product or service being provided by the project. Another attribute important to the long-term is that it is

associated with strategy (Eweje et al., 2012; Priemus, 2010). Godet (2000) lists the long-term as being an important part of the strategic perspective in planning strategy.

Since the long-term has a high level of uncertainty, it has the result of creating vulnerability. This vulnerability is to uncertainty because there are more unknowns being dealt with (Eweje et al., 2012; Koopmans & Rietveld, 2013; Priemus, 2010) as well as a vulnerability to ambiguity because of the contemporary lens through which events are viewed (Eweje et al., 2012).

4.3.1.3 Creating value for end-users and society

Generating value is an important driver of economic performance as people are willing to pay for it. Osterwalder, Pigneur, Bernarda, Smith, and Papadakos (2014) spend some time looking at the value proposition which products or services can generate for customers. Their view is that customers have jobs that they perform. When performing these jobs, value is created when a 'pain' (need) is relieved or a 'gain' (want or aspiration) is created. Bocken et al. (2013) talks of value being created through new opportunities for customers where a product or service moves into a new market; or a new product or service is created offering better benefits.

Value generation has the feature that it solves a problem for the customer as it focuses on the customer's needs (Osterwalder et al., 2014). The customer tends to get excited about the product or service as it addresses an emotional or social aspect of customer jobs and aligns with their measures of success (Osterwalder et al., 2014). For value to be created, it needs to be able to differentiate from and outperform the competition, and be difficult for the competition to replicate (Osterwalder et al., 2014).

If the value is generated, the customer will use the product or service (Chan, Ip, & Cho, 2010), usually because it has relieved a 'pain' or generated a 'gain' for the customer (Osterwalder et al., 2014). The value of the product or service will usually get traction in the market proving to be profitable and scalable (Osterwalder et al., 2014).

4.3.1.4 Resilience to a changing environment

The concept of resilience has its roots in ecological systems and is described by Holing (2001, p. 394) as "*The adaptive capacity; that is, the resilience of the system, a measure of its vulnerability to unexpected or unpredictable shocks. This property can be thought of as the opposite of the vulnerability of the system."*

Prior to resilience being demonstrated, a system needs to experience external stresses generally which are uncertain or unexpected events (Giezen, Salet, & Bertolini, 2015; Majoor, 2015; Priemus, Bosch-Rekveldt, & Giezen, 2013). In order to be resilient, there must be options which can be taken (Giezen et al., 2015; Priemus et al., 2013) as well the flexibility and adaptability to take these options (Priemus et al., 2013).

Resilience is about the adaptive capacity of the system and is opposite to vulnerability (Holing, 2001). A subject is regarded as being resilient when they can take both reactive and proactive actions (Priemus et al., 2013), where they are able to change, adapt or transform by self-organizing when an event occurs (Majoor, 2015).

In being resilience, an organisation is able to stay committed to their mission or goal; however, they are able to manoeuvre changing other aspects such as the solution they are providing (Priemus et al., 2013).

The outcomes of resilience are that there is space within which to manoeuvre in the future (Giezen et al., 2015; Priemus et al., 2013) and the organisation is able to cope with changing uncertain circumstances (Priemus et al., 2013). As a result, resilience should remove likely indefinite delays or stalemates because of the ability to change and adapt solutions towards the final goal (Priemus et al., 2013).

4.3.2 The concept of megaprojects

Megaprojects in the modern world came into existence at the turn of the 20th Century (Parrock, 2015). The characteristics which define them are that they are public; involve lengthily construction; expensive; complex; and are custom designed as one of kind (Flyvbjerg, 2014; Lehtonen, 2014; Mišić & Radujković, 2015; Oliomogbe & Smith, 2013; Parrock, 2015). A commonly referred to definition of megaprojects is (Flyvbjerg, 2014, p. 1) "*… large-scale, complex ventures that typically cost US$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people*."

These objectives of megaprojects initially began with building public infrastructure, providing employment and stimulating local economic activity (Parrock, 2015). Many modern infrastructure needs and requirements for development fall within the definitions of megaprojects. They have, however, extended into the private sector for large similar projects such as oil and gas, or Internet communication technology projects. This study focuses on public infrastructure megaprojects, where public infrastructure comprises "… *the basic physical and organisational structures required for the operation of a society or enterprise*" (Amasuomo, Hasnain, & Osanyinlusi, 2015, p. 49).

A notable feature of megaprojects is their growing popularity as a vehicle for service delivery in a number of applications both inside and outside of the infrastructural sector (Flyvbjerg, 2014). This trend is likely to continue with a McKinsey Global Institute study suggesting that US ($) 57 trillion is necessary for global infrastructure to keep pace with global growth between 2013 and 2030 (Dobbs, Manyika, Roxburgh Michael Chui, & Lund, 2013).

These projects have also been the subject of a fair amount of criticism for failing to meet the 'iron triangle criteria' of project management as they are often over budget, late, and don't meet project specifications (Lehtonen, 2014). In fact, a reported nine out of ten megaprojects come in over budget (Flyvbjerg, 2014; Flyvbjerg, Morris, Pinto, & Söderlund, 2011).

Megaprojects have the outcome of building large-scale projects. Their scale and length often impact on millions of people (Flyvbjerg, 2014) with high social, economic and environmental impacts (Kardes et al., 2013).

4.3.2.1 The scale of megaprojects

The large scale is the defining attribute of megaprojects. The large scale refers to both the large capital expenditure, time horizons, and the number of stakeholders involved.

The high capital expenditure is necessary for the costly infrastructural builds (Flyvbjerg, 2014). Such projects focus on solving complex problems which are costly infrastructural builds necessitating the need for projects of this nature (Flyvbjerg, 2014).

When speaking of large-scale, this means US $ 1 billion capital or larger in capital expenditure (Flyvbjerg, 2014; Parrock, 2015). This capital expenditure also has high levels of sunk costs as it is building the infrastructure (Cantarelli et al., 2010; Flyvbjerg, 2014), which leads to a situation of lock-in to the proposed solution once construction begins (Cantarelli et al., 2010).

The large-scale of the projects comes with multiple stakeholders who all have varying interests (Flyvbjerg, 2014; Parrock, 2015). This results in complex interfaces, both in engaging stakeholders and providing technical solutions. The planning occurs in the long-term (ten or more years) and there are long lead-times (Flyvbjerg, 2014; Parrock, 2015). These factors of many stakeholders, long lead, and lock-in culminate in heightened risk and uncertainty for these projects.

4.3.2.2 Complexity due to scale

(Vidal et al., 2011, p. 719) "*project complexity is the property of a project which makes it difficult to understand, foresee and keep under control its overall behaviour, even when given reasonably complete information about the project system.*"

The complexity in megaprojects is preceded by the large scale (Flyvbjerg, 2014), and risks which drive the structure of the project to treat the risk (Bosch-Rekveldt, Jongkind, Mooi, Bakker, & Verbraeck, 2011).

The complexity is associated with uncertainty with some referring to it as the "edge of chaos" (Bosch-Rekveldt et al., 2011; Lessard, Sakhrani, & Miller, 2014; J. Thomas & Mengel, 2008). The interdependent relationships between people, organisations and the environment, acting as systems are difficult to understand (Bosch-Rekveldt et al., 2011; Lessard et al., 2014; J. Thomas & Mengel, 2008). As a result, there are knock-on effects in these systems and numerous risks that arise from the complexity (Bosch-Rekveldt et al., 2011; Lessard et al., 2014; Vidal et al., 2011).

4.3.2.3 The engineering of infrastructure

Infrastructure engineering began as civil engineering and involved the design and building of infrastructure that supports society (Rodgers, 2009). It has, however, expanded in modern times to include other infrastructure essential to society such as electricity and as supply for energy needs and ICT infrastructure for communications. Infrastructural engineering can, therefore, be thought of as "… *the basic physical and organisational structures required for the operation of a society or enterprise*" (Amasuomo, Hasnain, & Osanyinlusi, 2015, p. 49).

Infrastructural engineering is preceded by several inputs. The engineers consider available technologies and the cost thereof (Hubka & Eder, 2012). This is in accordance with the specific purpose and expected benefits from the engineering project (Hubka & Eder, 2012) (Cross, 2005). Specifications need to be provided to the engineers according to which the solution is designed (Cross, 2005) and designed are done within the limitations provided by regulations (Abraham, 2005).

The engineered solution itself has an underlying strategy or concept on which it is developed and the product is created (Cross, 2005). The design strategy looks at innovation in planning products, generates and evaluates alternatives for the product (Cross, 2005). The engineered

product ultimately is designed to meet human needs (Hubka & Eder, 2012), however, the designs are limited by costs (Makovšek, Tominc, & Logožar, 2012).

The outcome of the engineering process is the product or solution which is communicated through the product drawings (Cross, 2005).

4.3.3 Strategic level risks

Strategic risks are defined by Frigo and Anderson (2011, p. 1) as "*Both internal and external events and scenarios that can inhibit an organisation's ability to achieve its strategic objectives…*". The strategic objectives, in turn, refer to (Frigo & Anderson, 2011, p. 1) "*…high-level goals, aligned with and supporting its mission*."

From a risk management perspective, strategic risk management involves (Frigo, 2009, p. 7) "*involves evaluating how a wide range of possible events and scenarios will affect the strategy and its execution and the ultimate impact on the company's value*." Therefore, scenario building is a useful tool to assist in managing strategic risks.

Strategic risks cover the full range of risks including financial, product, market, reputation and supply chain. It is for this reason that strategic risk management is closely related to enterprise risk management, however, strategic risks are focused on strategic decision-making and a part of the strategizing.

Strategic decision-making is important in finding overall value from the project. Taking risks is how companies seek out opportunity and their competence lies being able to effectively deal with the risks that competitors are unable to (Damodaran, 2007). Damodaran (2007) identifies some differentiating characteristics of organisations that are able to exploit strategic risks: they have better information; act faster; have knowledge from experience; have resources; and are flexible. These are notably many of the characteristics of resilience discussed in Section 4.3.1.4.

4.3.3.1 Evaluating events and scenarios

Evaluating events or scenarios is important in strategic risk management. The evaluation cannot take place as with typical risk management due to complexity and uncertainty when considering the long-term. It difficult to think in a causal tree manner as there are too many unknowns. As a result, a process of scenario planning is often employed (Amer, Daim, & Jetter, 2013; Godet, 2000; Schoemaker, 1995).

The evaluation requires that the internal and external events and causal mechanisms be identified (Frigo, 2009; Frigo & Anderson, 2011). Knowledge and previous experience are heavily relied upon for understanding how the cause and effect relations occur in the scenario (Amer et al., 2013; Eweje et al., 2012; Frigo, 2009). Scenarios consider the probability of events occurring and the impact thereof (Godet, 2000; Krane et al., 2010; Sanderson, 2012). They employ a conversation process where other people's opinions, often experts from various fields, into a conversation on how a hypothetical event would effect a variable and together how the scenario would play (Amer et al., 2013; Godet, 2000; Heijden, 2011).

The outcome is a set of alternative imagined futures with a range of possibilities (Amer et al., 2013; Godet, 2000; Schoemaker, 1995). These are applied to how this would play out in the business strategy and allows for a decisions to be taken on how business execute their strategies (Frigo, 2009; Frigo & Anderson, 2011; Sanderson, 2012). Businesses are then able to respond to changing events by monitoring key variables which they know to drive the outcomes in the scenarios.

4.3.3.2 Complex problems

Strategic problems are complex problems (Godet, 2000). Complexity is discussed as a concept in Section 4.3.2.2.

4.3.3.3 Strategic objectives

The concept of strategic objectives in megaprojects are the same as those of the project objectives discussed in Section 4.2.2.

4.4 Level 2: Core concepts

The level 2 literature review focuses on the categories arrived at through the research methodology. The literature review is an important step in the theoretical sampling process described in Chapter 5. The seven core categories and one key concept for each category were addressed in the review as illustrated in Figure 17.

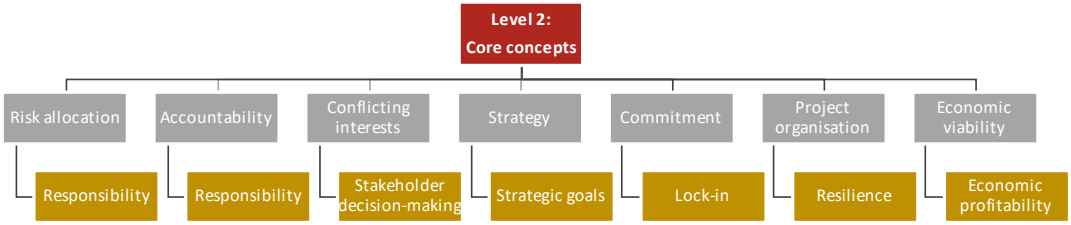


Figure 17: Level 2 literature review key concepts

4.4.1 Risk allocation and responsibility

Risk allocation refers to (Lam, Wang, Lee, & Tsang, 2007, p. 485) "*the definition and division of responsibility associated with a possible future loss or gain".* Risk allocation deals with assigning responsibility and usually occurs at contract negotiations (Lam et al., 2007).

The word responsibility is associated with modernity with the word only coming into the English language in the late eighteen century (Giddens, 1999).

Kermisch (2012) defines various types of responsibility:

- Role-responsibility *"is linked to a specific position to which particular duties are attached."*
- Causal-responsibility *"refers to the cause, understood in a quasi-mechanical sense, of an event."*

- Capacity-responsibility *"refers to the capacity of an agent to fulfil his responsibilities. Being responsible for his/her own actions implies having the capacity of understanding, reasoning and controlling the conduct."*
- Liability-responsibility *"is the legal facet of responsibility. It is a retrospective form of responsibility that answers the questions of who will have to be punished, who will have to explain the unwanted event, and/or who will have to pay compensation for the damages."*
- Virtue-responsibility *"is used in the sense of moral responsibility developed by John Ladd, as a form of responsibility which refers to moral deficiency and not just to fault"*

Often responsibility means different things to different stakeholders based on these definitions. For instance, a contractor in a megaproject may not view themselves to have a virtue responsibility but legally have a liability-responsibility.
Accountability is a key component of responsibility (Bruzelius et al., 2002; Giddens, 1999) where a responsible party should be able to take decisions and have discernible consequences of those decisions (Giddens, 1999). These may be in the form of exposure or liability (Kermisch, 2012; Lam et al., 2007; Ng & Loosemore, 2007), culpability (Giddens, 1999; Kermisch, 2012), and blame (Kermisch, 2012).

Being responsible makes it acceptable for people to take risk and realise reward (Giddens, 1999). In Douglas' cultural theory, risk is about the process of responsibility and blame viewed through the lens of the cultural process they've selected (Kermisch, 2012).
Giddens (1999) criticises modern risk management discipline and responsibility. His argument is that responsibility doesn't necessarily lead to accountability referring to the concept of *organised irresponsibility* referring to risks that organisations are responsible for but are certainly not help liable for. He further argues that uncertainty in manufactured my firms through the risk management process creating a problem where risk, responsibility and decisions change by the process of risk management and are not actually driven by external stakeholders and events. This argument is relevant with regards to government guarantees

where Bruzelius et al. (2002) argue that only partial and not total sector government guarantees should be granted so that there is accountability to parties for their actions.

4.4.2 Accountability and responsibility

Accountability refers to a party being responsible for an action and having a liability because of those actions. Responsibility, as it relates to risk allocation, has been discussed in Section 4.4.1.

Being held accountability means that responsible party will have discernible consequences of a decision that they've taken (Bruzelius et al., 2002; Giddens, 1999). Accountability, therefore, requires that there be a referee who will assess the responsible party and take then necessary actions based on the decision (Kermisch, 2012; Lam et al., 2007; Ng & Loosemore, 2007).

In order to hold parties accountable, the proper expectations of parties must be in place as well as a clear indication of the regulatory regime to be utilised (Bruzelius et al., 2002). Additionally, the means to measure stakeholder's actions and performance are necessary. Proper checks and balances must in place to verify actions and performance (Bruzelius et al., 2002). Performance measure with indicators involve data collection and analysis for evaluation and must be reliable and verifiable (Bird et al., 2005; Jasch, 2000) to allow for accountability towards the set success criteria (Bird et al., 2005; Keeble, Topiol, & Berkeley, 2003).

Accountability for actions is necessary as a part of the tacit social contract which exists is why some communities actively participate to show that agreement with them is necessary for the project to be successful (Owen & Kemp, 2013)

Bruzelius et al. (2002) recommend that government should take better action when it comes to responsibility and accountability by not providing total sector guarantees and keeping an arm's length to private players in the megaproject. Bruzelius et al. (2002) also recommend

the involvement of third parties such as risk capital to increase accountability. If a third party has a vested interest in a project or the actions of a stakeholder, it increases their obligation.

Accountability is improved by transparency because the more people that know about actions, the more likely the correct people will be aware of them and obliged to take action (Bruzelius et al., 2002). Transparency involves laying things bare and reveals actions making the stakeholder the subject of scrutiny by parties, provides evidence and affects stakeholder's relationships (Roberts, 2009).

4.4.3 Conflicting interests and stakeholder decision-making

Stakeholders take decisions on the project, but they are not necessarily driven by the project objectives but also their own. As a result, conflicting interests arise.

The classic economic theory on decision-making argues that stakeholders take a decision to maximise their utility (Eweje et al., 2012). However, this is a simplification of a more complex process performed by humans. Eweje et al. (2012) describe decision prospect theory as being the more relevant decision-theory relevant to megaprojects. Prospect decision theory involves two steps for the decision maker: (1) the framing of prospects into opportunities and threats; followed by (2) the valuation of the gains or losses (Eweje et al., 2012; Salet, Bertolini, & Giezen, 2013). In complex situations such as megaprojects, decision-making is undertaken with the strategy to also influence other parties or the course of action of the project towards their benefit (Mok, Shen, & Yang, 2015). For instance, a stakeholder may try to influence the decision to adopt a certain technology as they have an interest in the intellectual property of that technology and once adopted, will receive royalties over the long-term for the use of that technology.

Therefore, prior to making a decision, stakeholders will consider the context, as well as their existing information, knowledge and experience (Eweje et al., 2012; Salet et al., 2013). They will have diverse interests and priorities (Mok et al., 2015) and also take into consideration the timeframes within which the decisions must be made (Eweje et al., 2012).

The consequences of decision-making within the context of conflicting interests is that often a social trap occurs (Platt, 1973; Schelling, 1971). The social trap is described as dealing with the micro-motives of stakeholders in taking decisions and how their small seemingly insignificant decisions can have far-reaching implications for society (Platt, 1973; Schelling, 1971). Often with the conflicting interests at hand, ambiguity arises as stakeholders strategically try positions decisions and also try to conceal their interests and motives (Lehtonen, 2014). Since numerous decision is taken often with a number of stakeholders, complexity within projects tends to arise (Salet et al., 2013).

4.4.4 Strategy and strategic goals

Strategy is underpinned by concepts such as *long-term goals* and *major policies* towards those goals (Besanko et al., 2013). A commonly referred to definition for strategy is (Chandler, 1962, p. 13): "*the determination of the basic long-term goals and objectives of an enterprise, and the adoption of the courses of action and the allocation of resources necessary for carrying out these goals."*

Strategic goals are a core concept of strategy and entail (Aaltonen, 2007, p. 20) "*an explicated key content in the strategy reflecting the desired future state of the organisation or its relationship to its environment*". Strategic goals are referred to interchangeably with long-term goals, and in the case of megaprojects, would be akin to the project goals or objectives.

Goals are built upon the mission and vision of a person or group of people (Davis, 2014; Kardes et al., 2013). The process of building goals requires that a direction is established and a process of discovery be engaged with (Aaltonen, 2007). This allows for a future position or state of being to be established, given the intent of the party.

Strategic goals have a long-term focus (Goold & Quinn, 1990) with a specific intent and prioritisation towards the future position or state as set out the strategy (Aaltonen, 2007). These goals are competitively set (Goold & Quinn, 1990), and allow for a party to undertake

decisions and measure performance using indicators and milestones (Aaltonen, 2007; Goold & Quinn, 1990).

It is necessary to aligning the goals of agents in an organisation for strategic performance as the principal agent problem is one of the differing goals (Aaltonen, 2007; Besanko et al., 2013).

In megaprojects, the selected strategic goals and chosen solution commit the project to a solution and path, which is discussed more in the following Section for the core concept of commitment and lock-in.

4.4.5 Commitment and lock-in

Commitment in the context of megaprojects refers to the lock-in which occurs when decisions are made. This lock-in results in a commitment to a course of action for a specific period.

Prior to lock-in occurring, stakeholders in megaproject start with a decision-making process (Cantarelli et al., 2010). The decisions create a path that will be followed (Cho, 2014). When lock-in occurs, there is a path dependence that results as the set of decisions that must follow a particular course of action for a specific period of time until there is a result (Cho, 2014; Longstaff et al., 2010; Strambach, 2010).

Lock-in is characterised by decisions which are rigid and cannot be revised (Cantarelli et al., 2010). The decisions tend to be "tunnelled" meaning that a particular chain of events must be followed and there is a closure of any alternative decisions which can be taken (Salet et al., 2013).

While path dependence can be positive and negative (Cho, 2014; Strambach, 2010), in the case of megaprojects the literature refers to negative path-dependence which results in sub-optimal decision-making (Cantarelli et al., 2010).

The outcome of negative lock-in is that it creates a vulnerability since there are no alternative decisions which can be switched to in a time of need (Cantarelli et al., 2010; Cho, 2014). Positive path dependence has the opposite effect and generates resilience (Cho, 2014). Due to the locked-in nature of path dependence, decision makers tend to fall back on self-justification because they are forced to accept the results and cannot alter them (Cantarelli et al., 2010).

4.4.6 Project organisation and resilience

Resilience assists organisations in being able to cope with changing circumstance (Priemus et al., 2013). When a megaproject is organised, and committed to long-term solutions, they are less able to respond to adverse events are less resilient.

Resilience in organisations requires a focus on customer problems that they have chosen to solve (Gulati, 2013). In order to achieve this, a customer-centric and not product centric focus is required, as well as an organisational structure with permeable boundaries which is able to respond to customer needs (Gulati, 2013).

In order to achieve this, organisations must have conversations with their customers where they focus on customer intelligence gathering and analysing data on their customer (Gulati, 2013).

Further discussion on resilience and megaprojects is provided for in Section 4.3.1.4.

4.4.7 Economic viability and economic profitability

Economic viability refers to the economic outcome of the project. It is measured against the economic objectives, which include accounting profitability and other externalities that are not directly measured. In megaprojects, a major component of economic viability for the stakeholders is the accounting profitability of the project so that the private stakeholders make a profit and the project is not a burden on the public stakeholders.

Producing a profit requires the ability to meet a project budget, project schedule, product specifications (Hoon, Walewski, Sleeper, & Sadatsafavi, 2014; Lehtonen, 2014). Further factors are increased outputs and low operating costs (Nadejda, Anthony, Lucile, & Antonella, 2012). Economic profitability would, however, require that the profit and positive externalities are greater than the costs and negative externalities. Prior to profitability, there is the context of the market dynamics or industry structure (Lamari & Prévost, 2014).

Profitability does tend to have a short-term focussing on the micro-success view opposed to the macro-success view which would be concerned about the operations and functions (Lehtonen, 2014). In megaprojects, there is the tendency to focus on the construction phase and not consider the operating phase as a part of the project. Ample time for project development is also necessary to produce profits (Merrow, 2003)

For economic viability to be in place, there must be the supply of a product or service for which there is adequate demand (Frischmann, 2005). The price of the product/service is important and the ability to offer a product at an affordable price requires competent operations (Hoon et al., 2014).

4.5 Conclusion

A three-tier literature review was performed. This approach was useful in establishing the context of the study within in its broader subject, followed by a focused review of the research subject matter in general and then each category coded during the data collection.

The literature review was conducted in Chapter 4 as the grounded theory approach adopted and for the reasons discussed in Section 2.3.

The parent discipline was defined, and three core concepts discussed from relevant literature. Risk management as the parent discipline is an important aspect of megaprojects. The categorisation of risks is often lead by the final allocation of the risks since the risk owner

will have contractually be responsible and need to treat those risks. The risks being addressed are those factors that may prevent the project objectives from being met. Different stakeholders have specific parts in the project objectives are and allocated risks accordingly. These stakeholders manage the risks and make decisions based on the risks.

The research focus was discussed by breaking it three sections. Sustainability in mega-projects was defined and discussed. It was found that this concept focused on long term value or benefits for society. This is important when addressing the issues of the risks to achieving these. Resilience was noted as an important aspect of achieving sustainability. Mega-projects were defined and their nature of having a large scale and being complex. A focus was placed on engineering since infrastructural engineering projects are being considered. Strategic level risks were noted to present opportunities and be complex in nature. As a result, event and scenario planning are utilised when considering these. It was noted that strategic levels risks focus on strategic level concepts.

The level 2 review was necessary for the theory building process. A concept analysis was performed for the seven core categories which will be carried into Chapter 5.

5 Theory building

5.1 Introduction

Chapter 5 involves the theory-building process of the research. The chapter begins by defining theory and highlighting important concepts related to it. It then describes and records the theory-building development process. The theory is the key contribution of this research, and the process explains how it is built from the data and literature. The chapter ends with the scientific model built in the theory-building process.

5.2 Theory definitions and concepts

A theory is a "*set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena*" (Strauss & Corbin, 2008, p. 15). Theories are developed to explain behaviour and are derived to provide a "*... statement of what causes what, and why*" (Christensen, Carlile, & Sundahl, n.d., p. 2). A theory, therefore, seeks to establish a cause-effect relationship and provide an explanation for this relationship.

Theory, therefore, is driven by the need to understand, or as referred to by Gergen (1978), is the *assignment of meaning*. To provide meaning, there must be understanding, and hence, theory must also be understandable. In order to assign meaning, context is also necessary as a theory relies on circumstances (Christensen & Raynor, 2003)

In terms of critical realism, theory seeks to establish the 'real' and 'actual' as the causal mechanisms behind the 'empirical' experienced by the observer. Further discussion regarding critical realism and these concepts has been provided in Section 2.2.

The building blocks of a theory are the coding process that takes place during data collection, as described in Chapters 2 and 3. During this process, concepts are identified, developed, and related to each other. The literature review described in Chapter 4 was necessary to establish the theoretical base for the research area as well as each category coded during the data

collection phase. This process involved selecting a key concept underlying a category for which the antecedents, attributes, and outcomes were reviewed in the existing literature.

5.3 Theory development

The theory development in this research has utilised the process described by Tsoukas (1991). The process involves taking the current managerial situation and an existing scientific situation and then building a scientific model through a seven-step process, as illustrated in Figure 18.

Step 1 begins by framing the core category labels as a variable. The concept analysis performed in the level 2 literature review is used to identify a suitable variable based on existing research. These core variables are necessary for the modelling process. Step 2 then involves constructing a conceptual framework from the core variables as a means of establishing the relationships between these variables. Once this has been performed, generic and semi-generic archetypes are identified in steps 3 and 4 to identify a suitable archetype that best explains the management situation. These archetypes are established scientific situations and are determined by examining the nature of the concern variable and management situation (D. H. Kim & Lannon, 1997; E. Wolstenholme, 2004; E. F. Wolstenholme, 2003). Once the archetype has been selected, step 5 then interrogates the generic archetype to lead to a better understanding of its structural aspects in preparation for step 6, which involves conferring the generic archetype structural aspects onto the core variables with their relationships established in steps 1 and 2. Step 7 then finalises the model and presents a theory as a causal loop diagram.

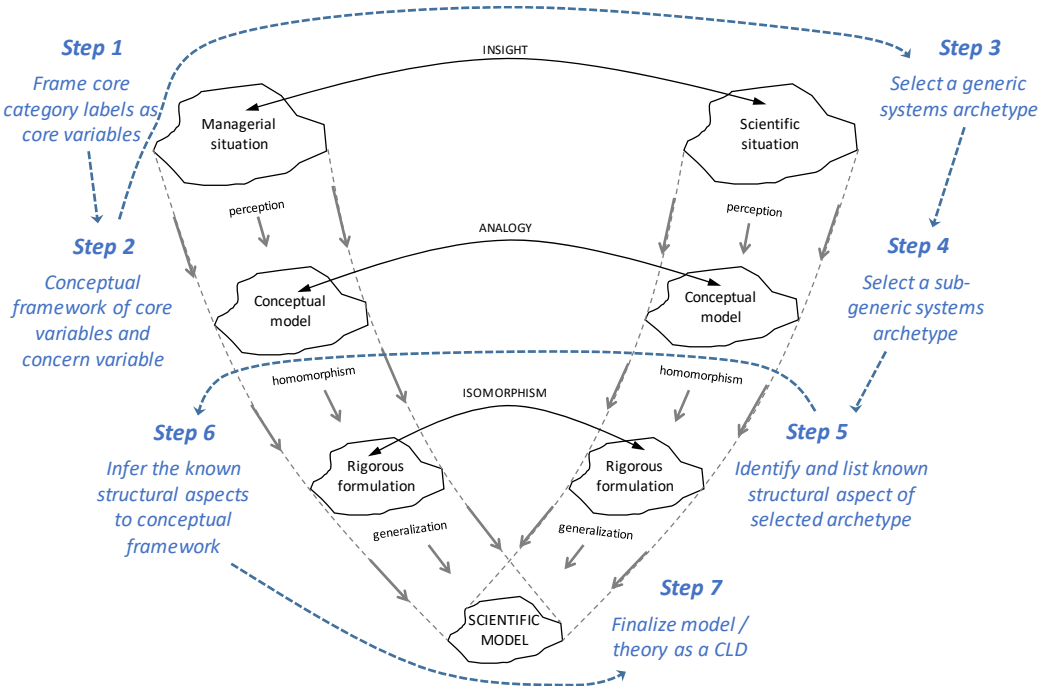


Figure 18: Theory building process adapted from (Tsoukas, 1991)

5.3.1 Step 1: Frame core category labels as core variables

The core categories were framed into variables based on the concept analysis performed during the literature review. The concept analysis involved selecting a key concept for each core category and then using existing literature to establish the antecedents, attributes and outcomes for each concept. The core categories and corresponding variables are outlined in Table 3.

Table 3: Core categories as variables

#	Core category	Variable
1	Accountability	Severity of consequences of a stakeholder's actions
2	Conflicting interests	Amount the stakeholders have to gain from their decisions
3	Economic viability	Economic profitability
4	Commitment	Time taken to adapt to changing circumstances
5	Risk allocation	Amount of risk exposure for stakeholders
6	Strategy	Commitment to future position with product/service
7	Project organisation	Focus on product delivery rather than end-user value

Core variable 1 is the s*everity of the consequences of a stakeholder's actions* and refers to stakeholders having substantial consequences when being held accountable for their actions. Core variable 2 is the *amount the stakeholders have to gain from their decisions* and refers to the process of assessing the gains and losses of stakeholders when taking a decision with conflicting interests amongst the various stakeholders. Core variable 3 is the *profitability of the project* and refers to the 'actual' economic profitability as a part of the economic viability of a megaproject. Core variable 4 is the *time taken to adapt to changing circumstances* as it relates to resilience based on the 'actual' organisational structure of the project. Core variable 5 is the *amount of risk exposure for stakeholders* and refers to the exposure or liability that a stakeholder may have due to the allocation of risks. Core variable 6 is the *degree to which strategic performance indicators are being achieved* as a part of performance indicators in measuring the strategy of the project. Core variable 7 is *the number of alternatives indicating the degree of resilience* as a part of lock-in which occurs because of committed decisions.

5.3.2 Step 2: Conceptual framework of core variables and concern variable

Following this, the core variables were then mapped into a conceptual framework using an inter-relational diagraph to establish the links between the variables as presented in Figure 19. Variables with a high number of outgoing connections were classified as drivers while variables with a high number of incoming connections were classified as outcomes. The main connections between the variables were those from drivers to outcomes. The links directed from outcomes to outcomes were not considered important as they are not the main drivers of behaviour in the system. The links directed from the drivers to the outcomes were considered as important as they drive behaviour.

The process established two main driving variables being the *severity of consequences of a stakeholder's actions* from the core category of accountability, and the *amount the stakeholders have to gain from their decisions* from the core category of conflicting interests. Two of the main outcome variables established are *economic profitability* from the core category economic viability and *strategic risks to sustainability,* which is the concern variable.

Following this, the search for established system archetypes was considered.

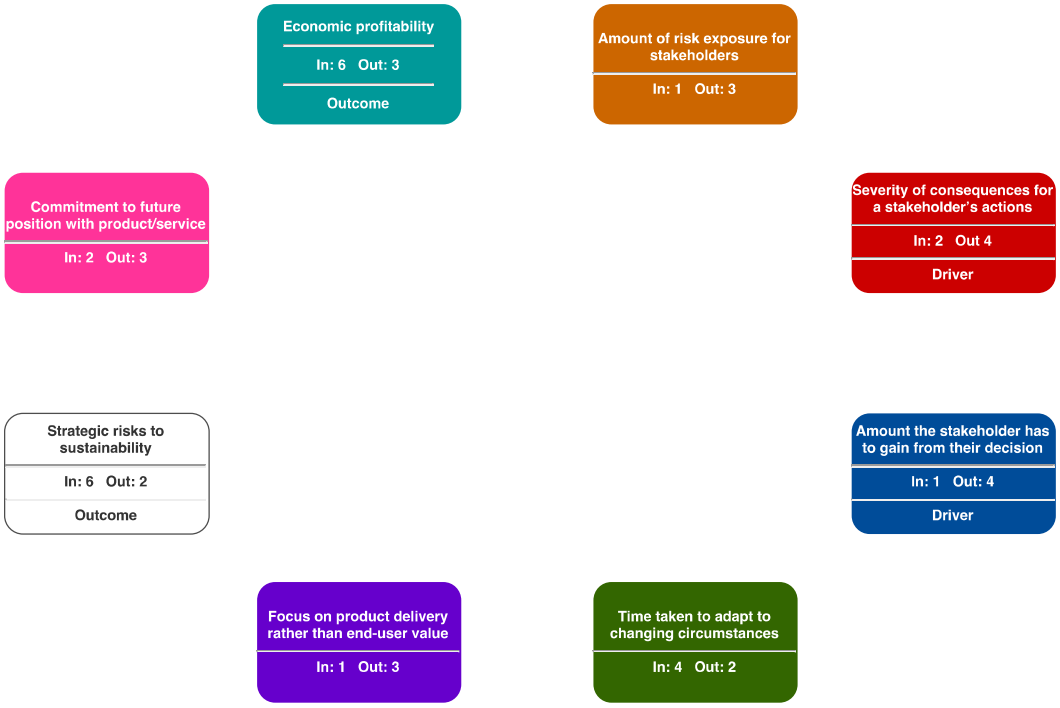


Figure 19: Conceptual framework of the core variables

5.3.3 Steps 3 & 4: Select a generic and semi- generic system archetype

A search of existing systems dynamics models and archetypes was consulted to relate the model to archetypes (Wolstenholme, 2004; E. F. Wolstenholme, 2003). The search began by classifying the concern variable which is *strategic risks to sustainability in megaprojects*. Using Kirkwood's (2013) description of variables, the concern variable was considered to be a goal-based variable. This is important as the feedback loops in the system drive the core variable to behaviour in the pattern.

The goal-based variable has two generic archetypes described by Wolstenholme (2004) which are the *Out of Control* and the *underachievement* archetypes. These archetypes differ in that the archetype for *underachievement* is characterised by the goal being for the variable

to have a set performance but never reaching that performance. *Out of Control,* on the other hand, would be where the goal is for the variable to remain within certain limits of performance but then performing out of these limits.

The concern variable has to do with the strategic risks which affect sustainability. Strategic risks are a variable which aims to be kept under control and, therefore, this variable is considered to fall within the *Out of Control* archetype. There are three established semi-generic archetypes for *Out of Control* which are *fixes that fail*, *Shifting the Burden* and *accidental adversaries* (Braun, 2002; E. Wolstenholme, 2004).

Wolstenholme (2004) provides semi-generic archetypes based on the concern. Using Wolstenholme's (2004) paper, as well as Braun (2002) and Goh, Brown, and Spickett (2010), the semi-generic archetype Shifting the Burden was chosen as the most suitable archetype from the out-of-control generic archetypes.

5.3.4 Step 5: Identify and list known structure aspects of the sub-system archetype

Shifting the Burden, as depicted in Figure 20, has to do with symptomatic and fundamental solutions to the problem symptoms. The symptom of the problem occurs, and the symptomatic solution is initiated to fix the problem. This short-term fix is initially effective; however, it has a side-effect which occurs. The problem symptom resurfaces because the solution only addressed the symptom of the problem and not the fundamental issue. This is balancing loop B1.

The long-term fundamental solution is one which is not so easily recognised as it has a delayed impact on the problem symptom. The side effect has a negative effect on the long-term solution, which escalates the problem symptom, which reinforces loop R1. The fundamental solution addresses the problem symptom but has a delayed effect in the system, which is part of the reason it wasn't initially identified.

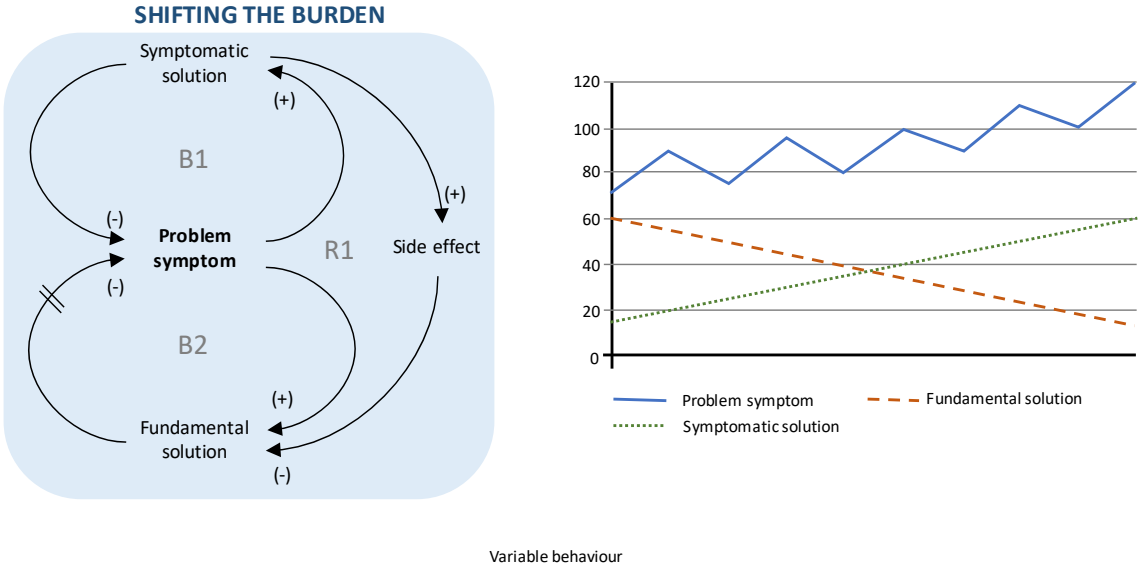


Figure 20: Shifting the Burden semi-generic archetype and the behaviour of the variables over time *(Braun, 2002)*

Shifting the Burden indicates how the short-term symptomatic solution doesn't fix the problem in the long term. The problem, therefore, continues to resurface, and the problem symptom is clearly *Out of Control* as the archetype would suggest. The behaviour of the problem symptom over time is, therefore, one that steadily rises over time; however, in the short term, it increases and decreases with the implementation of the symptomatic solution, as illustrated in Figure 20.

It is important to note that the archetype does not capture the entire workings of the concern variable. As a result, other variables may be at play outside of the archetype exerting an influence, as described by (E. Wolstenholme, 2004).

5.3.5 Steps 6 & 7: Inferring the known structural archetype and finalising the model

The core categories were fitted to the Shifting the Burden archetype, which is illustrated in Figure 21. There are two workings in this model.

The first is that of the Shifting the Burden archetype. The problem symptom of the strategic risk to sustainability is *a lack of lasting social benefit* from the megaproject. When the problem symptom occurs, the symptomatic solution is to focus on the risk owner and his treatment of the risk. The risk owner is forced to deal with the risk and acts to try to subdue the problem as soon as possible. This has the side effect of the project stakeholders' looking at the problem symptom and the treatment of it and taking decisions for their own benefit by weighing up the gains they can get from their decisions. Their actions are, therefore, not focused on risks to sustainability but rather on their gains and losses.

As they continue to gain, the significance of the consequences of their actions lessens. The correct allocation of risks, as well as accountability, is the issue here as the stakeholders should have meaningful consequences in the risk-and-reward trade-off of their decisions. As time ensues, the stakeholders can be bolder in this cycle.

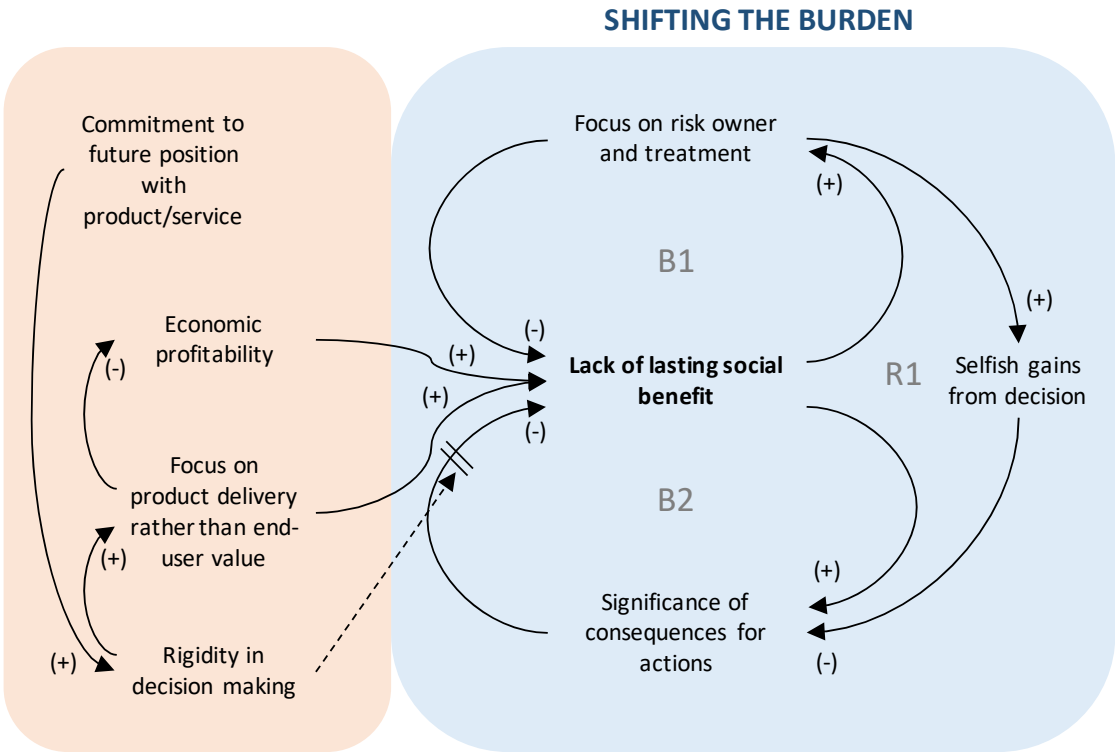


Figure 21: Inferred structure

Outside of Shifting the Burden, there are other forces at play which affect the problem symptom.

These begin with the strategic commitment of the project to a product or service. This commitment results in a lock-in, which creates rigidity in decision-making, for the project is then committed to a particular product and course of action.

The rigidity means that the megaproject is delivery-focused rather than end-user-focused, and thus the economic profitability of the project is adversely affected. The declining economic performance and focus on product delivery rather than end-user value increases the symptom of the lack of a lasting social benefit.

5.4 Theory application

The causal loop diagram shows that there are three core components in Shifting the Burden, with a fourth core component shaping the context within which these components act. These four mechanisms at play which are described below.

The concern variable is strategic risks to sustainability in the context of megaprojects. The lack of sustainability or problem symptom presents itself as a lack of lasting benefits for end-users or for society. This usually expresses itself in some form of social discontent which may be a risk of social action or public outcry against the megaproject's product or service.

5.4.1 Mechanism 1: A symptomatic solution to a problem

Mechanism 1 is illustrated in Figure 22 and is loop B1 in the Shifting the Burden archetype.

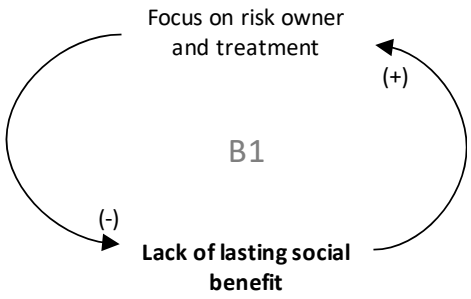


Figure 22: Mechanism 1

Loop B1 involves the focus on risk treatment as a symptomatic solution to the problem symptom of a lack of lasting social benefit. This is a balancing loop where the problem symptom occurs, the symptomatic solution is applied, and it relieves the problem symptom. The symptomatic solution, however, does not address the fundamental problem and, therefore, the problem symptom reoccurs, and the symptomatic solution is reapplied. In the research case, there is a lack of a lasting social benefit, which society expresses in some manner. The immediate response is to focus on the risk owner and the treatment of the risk, who takes some type of measure to address the action that society has taken in expressing the problem symptom. This measure is, however, not lasting.

5.4.2 Mechanism 2: A side effect

Mechanism 2 is illustrated in Figure 23 and is loop R1 in the Shifting the Burden archetype.

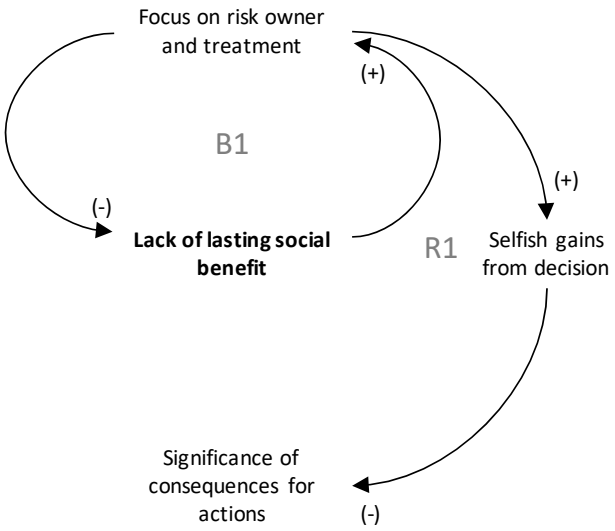


Figure 23: Mechanisms 1 and 2

Loop R1 involves stakeholders focusing on their benefits as a side effect of the problem symptom and is a reinforcing loop. The side effect occurs as a result of the loop B1. In this case, the side effect is that the stakeholders notice that there is a fundamental problem and the solution is not addressing it. They attempt to get the most out of the situation and project as they can at this current point as they want to see their benefit from the situation and, therefore, take decisions for their selfish gain. It is fairly easy to do at this point as there is some disruption due to the loop B1. The side effects, however, prevent the fundamental solution from taking place, which is a longer and more difficult solution but is what is needed to solve the problem symptom.

5.4.3 Mechanism 3: A fundamental solution to a problem

Mechanism 3 is illustrated in Figure 24 and is loop B2 in the Shifting the Burden archetype.

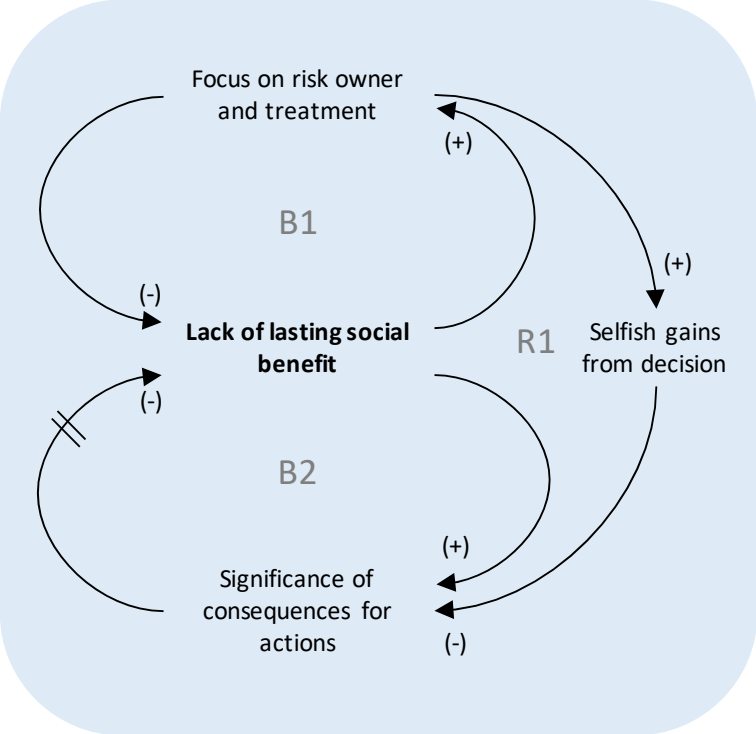


Figure 24: Mechanisms 1, 2 and 3

Loop B2 involves the solution to the fundamental problem and is a balancing loop. The fundamental solution to the problem symptom is there being significant consequences of a stakeholder's actions which caused the lack of a lasting social benefit. In this case, it is meaningful accountability to a party or the parties who are responsible for the action which has significant consequences that address the fundamental problem as the fundamental solution. This differs from the risk owner who is often negotiated at the forming of the contract and results in a breakdown of the risk/reward concept; this results in parties taking irresponsible actions since the results will not directly affect them, or the consequences are not sufficient.

5.4.4 Mechanism 4: Issues affecting resilience

Mechanism 4 is illustrated in Figure 25.

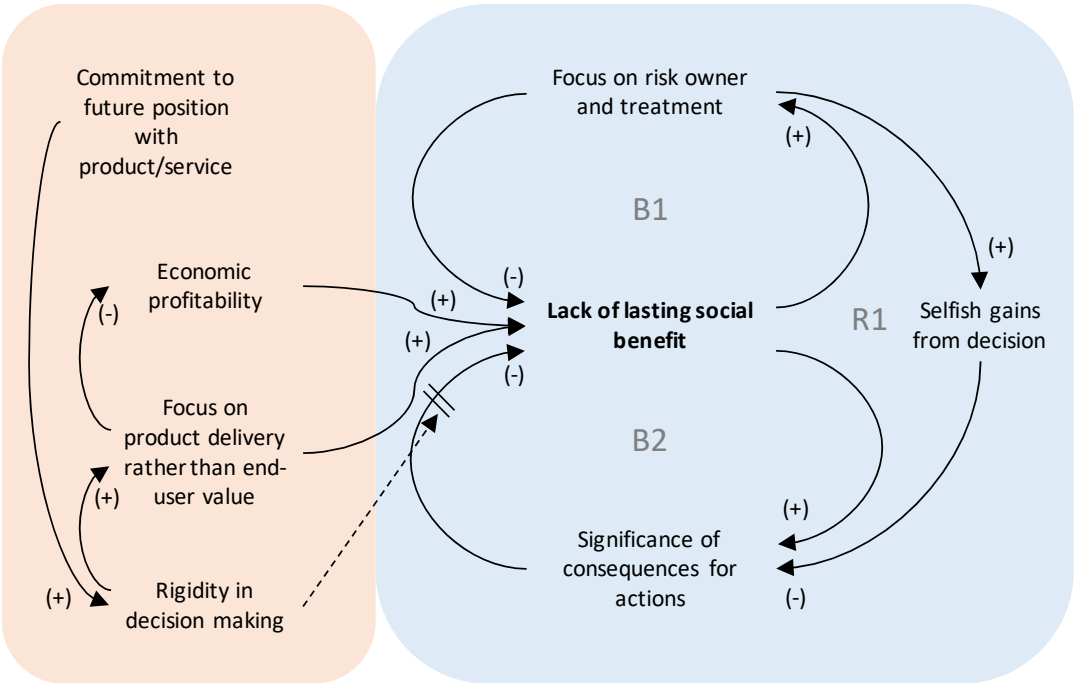


Figure 25: Mechanisms 1, 2, 3 and 4

Outside of shifting the burden, the context is set by the nature of megaprojects and by commitment to a particular solution. Once the solution or product has been selected, it introduces rigidity to decision-making, as the project has committed to a particular course of action. This rigidity locks parties into a particular course of action for some time and introduces a delay to the loop B2, as the number of options is now limited by the committed path. The rigidity forces parties to focus on the delivery of a product as a solution and not on the end-user value or benefit. End-users, therefore, do not see the economic benefit they hoped for. The lack of value to the end-user and of economic profit results in the problem symptom, which is the absence of a lasting social benefit.

5.4.5 Summary

The result of the CLD is that there is an increase in the lack of the lasting social benefits and sustainability of the megaproject. The response is an escalated focus on the risk owners and their treatment, while the stakeholders continually try to maximise their benefits while they

can. Meaningful accountability to the fundamental root of the problem lessens, and the rigid context of the chosen path of the project leaves the project vulnerable and without the resilience to generate and choose alternative courses of action.

5.4.6 Application to the GFIP

In cases such as the GFIP, the problem symptom was a public outcry, and the public refused to pay the high price for the toll roads questioning the value added at that price point (Parrock, 2015).

5.4.6.1 Mechanism 1

The response to public outcry was to fall back on general risk management principles. The risk was allocated to the SANRA, which is a state-owned entity and is responsible for the Gauteng Freeways (Parrock, 2015). Those parties formed a committee to look into the issue to try to appease the public. This solution was a symptomatic solution.

5.4.6.2 Mechanism 2

While the committee was holding hearings and engaging with the public, the SANRA continued with their tolling roll-out and charging of customers at the same price (Parrock, 2015). The solution being implemented would not solve the fundamental problem, and the side-effect was that the SANRA tried to force implementation on the tolling system and charge the public to ensure that they could collect their tolls. They even went as far as to threaten the public with various legal tools (BusinessTech, 2016). Behind the SANRA's actions were the payments required that had to be made to investors. If they were not made, the SANRA would possibly have a downgraded credit rating, and the government would be forced to follow up with the guarantee they had put up (Parrock, 2015).

5.4.6.3 Mechanism 3

The underlying problem is the lack of sustainability of the GFIP. The fundamental solution is significant consequences for parties involved in the project who should ensure the sustainability of the project. This would include the SANRA, who ignored the risks that the

end-user would not be willing to pay, the investors, who were leaning back on the government guarantee and failed to anticipate the lack of sustainability, and the government treasury, who put up a guarantee for a project which was not sustainable.

5.4.6.4 Mechanism 4

The SANRA and government treasury had committed to a product or service that locked them into a course of action for a long period of time. This rigidity made them vulnerable, being unable to respond to a shock such as the public outcry, and action in the form of actual payments withheld, as the debt to the investors and government guarantee meant that the risk had been allocated to SANRA and the government, and indirectly society and the end-users, as it was expressed that the tolls had to be paid in one way or another. Parrock (2015, p. 76) pointed out that: "*As of December 2013, SANRAL had R41 billion of debt, which is all guaranteed by the government*." The reported amount of unpaid toll fees on this project stood at R7.2 billion at the end of August 2016 (Steyn, 2016). The rigidity means that the SANRA focus on the delivering of the product or service which they wanted or had committed to, not on value for the end-user. As a result, the end-user has refused to pay, affecting the economic profitability of the project. Both the delivery of a service which doesn't add value and the lack of economic profitability results in the lack of a lasting social benefit.

5.5 Practical adequacy

As referred to earlier, the context of a theory must be understood to have meaning and avoid unexpected results (Christensen & Raynor, 2003). Some explanation of the context is, therefore, provided. The question remains as to how useful the theory is in practice or how effectively it can produce a change in a particular context? To assess this, the practical adequacy of the theory is discussed, which discusses how the theory relates to the constraints and opportunities of the context to which they are proposed (Sayer, 2000). Four criteria are used to evaluate the practical adequacy (Kempster & Parry, 2011).

5.5.1 Fit

Fit refers to how well the theory relates to the ‘real' world situation. The theory has been drawn from real world data and provides a description of it. The data was collected according to a research context, question, and concern variable, making it relevant. A rigorous GT research method was entered where the data was collected, coded, constantly compared, checked for relationships and recorded in memos. Steps were taken to ensure research validity.

5.5.2 Understanding

Understanding refers to whether the theory can be understood and how well it explains the situation. The theory is understandable and provides context. Explanations and descriptions of the theory are provided as it relates to megaprojects. A description and explanation of the 'empirical' problem experienced are provided, as are the underlying mechanisms at play. Evidence to support the explanations and aid in building context has been provided from the 'real'-world data and literature.

5.5.3 Generality

Generality refers to whether the theory can be applied in other contexts. The theory, data and context have been provided, as have the philosophical underpinnings and methodology utilised. This allows readers to understand the model and context to which it applies and to assess whether the theory is applicable to their own context.

5.5.4 Control

Control refers to how good a predictor the theory is in the 'real'-world context. The theory can be tested as it explains the problem symptom and both the temporary and permanent solutions. It also describes the side effects and external factors influencing the context. The theory, therefore, provides context as well as the causal mechanisms and outcome and can be tested.

5.6 Conclusion

The core variables were derived from the concept analysis performed in Chapter 4. Based on it, a theory building process was engaged in a scientific model generated using the methods described in this chapter, which are based on Tsoukas (1991), and Beer and Physick (1994). The scientific model likened the strategic risks to sustainability to those of the semi-generic archetype of *Shifting the Burden*, and a model was developed based on the concern variable and the seven core categories that emerged during the data collection and analysis. An application of the model was then provided as well as a test for practical adequacy. A discussion of the research results with recommendations and conclusions is offered in Chapter 6.

6 Discussion, recommendations and conclusion

6.1 Introduction

Chapter 6 begins with a discussion of the significance and implications of the research results considering whether the research purpose, concern, and question were met. This is followed by an evaluation of the relevance and utility of the findings followed by their validity. Recommendations for future research are provided followed by the conclusion.

6.2 Significance and implications of the research results

6.2.1 Was the research purpose met?

My intellectual goal in this research was to understand the strategic level happenings that affect sustainability in large infrastructure development. I have come to an understanding of the context and the causal mechanisms behind sustainability in a megaproject with meaningful insights of the complexity of these issues and how decisions made early on in the project have lasting consequences over a long period of time.

My practical and personal goal were to better learn about conducting research as an approach to problem-solving with a desire to influence clients to make more sustainable decisions in doing business. Through this research, I have learnt a valuable approach towards management research and come to a deeper understanding of the close ties to strategy and sustainability in megaprojects. This will assist me with my personal goal of advancing my career through the insights and services I can offer to customers.

6.2.2 Were the research concern and question addressed?

My original concern was: What are the strategic risks to sustainability in megaprojects? I undertook a GT research approach and uncovered seven core variables. These core variables were then subjected to a literature review and concept analysis. The concepts were used to establish variables and a scientific model was developed, establishing the causal relationship based on Tsoukas (1991).

Referring to the discussion on grounded theory in Section 2.3, the theoretical mechanism is what is happening as the domain of the ‘real' and is the underlying mechanism of what is happening and is experienced which are the ‘actual' and the ‘empirical'. The first characteristic of theory seeks to establish ‘what causes what?' as discussed in Section 5.3. This model achieves this by describing a cause-effect relationship, which is one of the key components of a theory. The second characteristic of a theory seeks to establish ‘why?' which has been described in the CLD.

My research concern was with the sustainability of megaprojects. These are large complex projects which often do not deliver lasting benefits to societies and end-users, falling short of promises, and being characterized by large time and budget overruns, and not adding to the development of humans or economies. The research has considered these concerns as they relate to sustainability.

6.2.3 Has the research contributed to the parent discipline?

The parent discipline is risk management. The practical implications for risk management relate to the risk/reward principle and risk allocation. This principal is that risks should be allocated to those who are best positioned to deal with them, and the risk/reward relationship has to do with the correct amount of risk being assumed by the party commensurate with the reward it obtains.

It is unreasonable to expect stakeholders not to act in their interests. When making decisions in a project and assessing the gains versus the losses, stakeholders should allocate risks by upholding the risk management principles of commensurate risk/reward and responsibility. Risks are taken by the parties best able to address the risks.

In addressing shifting the burden problem, responsibility should not only lie with the party who contractually allocated the risk but with the ‘actual' responsible party. There must also be meaningful consequences to the party's actions that are sufficiently punitive to prevent moral hazard and opportunistic behaviour.

The rigidity introduced by a selected course of solution makes this problem difficult to address; therefore, it is imperative that it be addressed early in the project. A key component appears to be the government guarantee. This guarantee allows for the investors in the project to not have to justify the project on the fundamentals they usually would in a private venture as they can lean back on the guarantee should the project fail. The result is that some market fundamentals are not sufficiently scrutinised such as the end-user product or service value and economic profitability. The risk is, therefore, allocated to the society, which consists of the end-users. In this case, the EPC companies also push a solution they are capable of delivering rather than focusing on the customer need. This results in a product approach rather than a customer value approach. It allows the opportunistic behaviour, optimism bias, and strategic misrepresentation found presented in the data as these parties know that once a solution has been chosen, it is committed to for a long period of time, and accountability is difficult at a later stage, especially with the contractual arrangements on risk and responsibility.

In addition to the government guarantee, the government also often establishes conditions in which there are captive markets or monopolies.

If the government guarantee were not in place, then the entity owner would need to be able to justify the project based on revenue to be generated from the customer. They would still have the industrial conditions of the captive market and monopoly they enjoy but would have the burden or demonstrating that their solution meets the customer need and the correct price to warrant the investment in the solution. They would also need to demonstrate the capacity to deliver and operate the solution at the cost and price to the investors.

In such a scenario, the government could assume the role of an investor and share the risk much in the way they need to put up capital provisions and demonstrate their ability to back up their guarantee.

6.3 Evaluating the research

6.3.1 Relevance of research findings

Megaprojects are ever increasingly occurring as countries seek to upgrade existing and install new infrastructure (Beckers et al., 2013). This infrastructure is built with the aim of benefitting society, facilitating development through delivering services. The projects have large costs and, if done incorrectly, can have a profound impact, delaying development in these countries due to wasteful or fruitless expenditures. On the other hand, well-executed beneficial megaprojects can assist in facilitating human development both directly and indirectly.

6.3.2 Utility of research findings

The original intent of the research was to understand the strategic risks, which affected sustainability in megaprojects. The research problem originated from a megaproject that I worked on as well as other megaprojects that my employer at that stage was involved in.

The research question was posed to determine the original intent of the research. The question was posed during interviews, and answers were sought in the documented data. Saturation was reached from the data sources as no new insights relating to the research question were obtained from the data sources.

A theory was formulated as a causal loop model to answer the research question, seeking the underlying cause-effect relationships.

Sustainability in megaprojects is often thought of from an environmental perspective, while the definitions are in fact directed towards a lasting social benefit (Asian Development Bank, 2010). This is directly in line with the purpose and strategic objectives of building the infrastructure in the first place. Focusing on sustainability, therefore, is focusing on the purpose of the infrastructure which is being built.

Megaprojects are complex environments with multiple stakeholders, and meeting the business objectives of the project is also crucial (Turner & Zolin, 2012). Many projects are "*over budget, over time, over and over again*" (Flyvbjerg et al., 2011). Analysis of project success is, therefore, difficult, with analysis of megaproject success being performed using three key indicators: economic sustainability, environmental concerns, and the effect of public support (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Parrock, 2015).

The forecasting of strategic risks through an event or scenario approach, and building responses that build resilience therefore allowing for flexibility to respond to uncertainty would be helpful. However, to achieve this these states of the world must be adequately conceived by the forecasters. The long lead times and high capital expenditure in mega-projects leads to a rigid structure that is not easily adapted. This make resilience difficult to establish as commitment to a particular course of action is necessary.

My experience of megaprojects is that they are complex, with interactions between multiple stakeholders being driven by contractual arrangements. The validity of this experience was confirmed in the research findings and existing literature. Micro-motives are big drivers in the decision-making of stakeholders and can easily result in a social trap and an overall undesirable situation for society at large (Platt, 1973; Schelling, 1971). Projects often have issues with strategic misrepresentation, optimism bias, and hidden agendas by parties so that their decisions and actions are opaque (Flyvbjerg, Garbuio, & Lovallo, n.d., 2009; Flyvbjerg et al., 2011; Kutsch & Hall, 2010; Lamari & Prévost, 2014; Lundrigan, Gil, & Puranam, 2014; Mišić & Radujković, 2015). Measures of project success are project management tools, such as the iron triangle (Toor & Ogunlana, 2010), that do not acknowledge the purpose or end goal of the project, which is to benefit society in the long-term, (Flyvbjerg et al., 2003; Parrock, 2015).

6.3.3 Validity

6.3.3.1 Internal validity and external validity

Internal validity refers to the conclusions of the research being logically drawn from the premises and how all other plausible alternative explanations have been ruled out (Carlile & Christensen, 2005). External validity refers to how the relationship established from this research in this context can be applied to other contexts (Carlile & Christensen, 2005). Carlile and Christensen (2005, p. 16) argue that "*we could only say that a theory is externally valid when the process of seeking and resolving anomaly after anomaly results in a set of categories that are collectively exhaustive and mutually exclusive."*

Data collected for this project was taken from open interviews with professionals who had experience with megaprojects and who are experts in their respective fields. Additional data was collected from online sources such as articles written by professionals who work with megaprojects, interviews, research articles and opinion pieces. Care was taken to collect data from multiple perspectives so as to make triangulation of findings possible during coding. For instance, professionals from the financial, environmental, management and public relations fields were spoken to. Online sources were obtained from professionals in accounting, management, project management, government, civil society and academic fields as well as from end users. The literature review was obtained from peer-reviewed academic sources and from published books.

Engaging a wide variety of authors from various professional disciplines assisted me in addressing some of my personal biases. Furthermore, the use of search engines and keyword searches allowed me to collect opinions from multiple sources in many geographic localities.

To remove my tendency to lean towards the environmental field due to my training and background, a specific attempt was made to investigate sustainability as viewed in the discipline of megaprojects.

A focus was placed on allowing the answer to the research question to emerge from the data and to follow a disciplined research process in this regard. An extract of my proposition log is presented in the appendix, while the record of the data sources has been kept, it is too long to append to the report.

A detailed description of the coding process is provided in Chapter 2, in which details about the coding methods followed to ensure mutual exclusivity and saturation are collectively exhaustive, which relates to the research question at hand.

I believe that the methodology followed was successful in producing mutually exclusive categories, through the coding process of categorisation, continual comparison, inter-relation diagraph and, finally, reduction sampling. During the literature, clear distinct concepts could be established for each category and distinct definitions provided.

Since the research was drawn from the experiences of many parties with megaprojects, I believe that the findings are generally applicable to megaprojects which people may embark upon. The findings, therefore, could be applied to different types of infrastructural megaprojects in different geographies, benefitting the planners and those involved in the research.

Megaprojects are, however, very complex, with numerous stakeholders and are, therefore, heterogeneous in nature, which may limit the applicability to a certain extent.

6.3.3.2 Reliability

Reliability refers to how much the research can be depended upon. Reliability is more about a robust reliable process being followed by the researcher and is important in producing valuable research as noted by Carlile and Christensen (2005, p. 20): "*If we follow a robust, reliable process, even the most "average" of us can produce and publish research that is of high value to academics and practitioners."*

The research process has been clearly presented in Chapter 2. I took care to be disciplined in following this process, keeping memos as the process was followed, and records of the data sources. Chapter 3 provides the results as they emerged during the process followed in Chapter 2. Following the process was important in producing valid results and also in removing researcher bias as far as possible.

The process followed itself was based on an established research approach of grounded theory. Handbooks to assist in the process were used as well as published research and other master's level research reports using the research approaches. This was to ensure that the research process was based on peer-reviewed and accepted practices by other experienced researchers.

6.3.3.3 Confirmability

In order to avoid subjectivity, care was taken to source a wide audience as a data source from multiple disciplines and geographies. A proposition log, memos, copies of the data sources, and the conceptual framework they correspond to were kept. Notes from the interviews were recorded and submitted to the interviewee for their records and any comments.

The paper has been referenced with the sources from which ideas have been collected.

6.3.4 Ethics

The parent discipline is risk management and, therefore, distributive justice is applicable. When looking at ethics, there are five approaches that may be considered: utilitarian, rights, justice (fairness), common good, and virtue (Velasquez, Andre, Shanks, & Meyer, 1990, 1996).

Since infrastructural megaprojects exist to build infrastructure for societies for their use and development, it is reasonable to expect that they should add value to the end-users who will pay for them and to society at large, meeting the objectives of the project. Even though

private organisations are engaged for the expertise to build them, their services are procured under set conditions and circumstances to meet these objectives.

If these infrastructure services are so important for end users' and societies' use and benefits, and they are paid for ultimately by societies' taxes or end users' payment for services, it is reasonable that society and end users should expect the services to provide them with benefits and services that they want and need. These projects often enjoy government protection and guarantees, creating the conditions for a monopoly and monopsony for the chosen megaproject contractors. This speaks to the rights of society and end-users in the solutions and projects.

While sustainability deals with the long-term benefits for society, private commercial interests are often involved in the design, construction and operation of projects. It is not the responsibility of these commercial organisations to solve the social or economic conditions of the various countries entering into megaprojects in order to provide infrastructure. Governments procure these interests for their expertise; at its core, the issue is about societies' interests being addressed in the process of providing infrastructure through megaprojects. Democracy employs a government to establish and operate a legal system, create and regulate a market, and act as a custodian of that society and its resources.

From a utilitarian perspective, it may be asked how the members of a society and those who benefit by servicing society can do better for their society. The decisions that organisations and their chosen representatives make have a profound future impact on a large number of the members of these societies. Their decisions should be in line with the strategic objectives of the project for the good of the society. If this does not take place, then, ethically, we should question why not as well as why this situation exists and what we can do to improve it.

6.4 Future research

Sustainability in megaprojects is difficult for various reasons. The first is that megaprojects are complex with numerous stakeholders interfacing. The second is that they require the

making of early decisions that have lasting impacts in the long term. The third is that they are legally complex, which makes it difficult to administer them and to allocate and manage risk effectively. The fourth is that stakeholders have different interests and goals in the megaproject, which are difficult to align.

According to the findings of this research, further research into government guarantees, risk allocation, and responsibility will be useful as they relate to sustainability. Of importance is the lack of resilience in megaprojects, which prevents stakeholders from adapting to a changing world. Building resilience in mega-projects would allow for better adaption in the face of uncertainty.

6.5 Conclusions

The chapter began by assessing the significance and implications of the research results. This included evaluating whether the research purpose, concern, and question were addressed adequately. Furthermore, it looked at whether the research contributed to the parent discipline. The chapter then proceeded to evaluate the relevance, utility, validity, and ethics of the research findings.

The relevance of the research was determined by discussing infrastructural megaprojects and the need for sustainability. The utility of the research was shown by the source of my research concern as well as my personal experience and the collection of data, which was in line with the need for sustainability in megaprojects. The validity was discussed according to four essential principles of validity, and sound ethics were shown since the infrastructure is being built for the benefit of societies to facilitate their long-term development.

The research method as discussed in Chapter 2 was applied with rigour with continual comparison and revision to ensure that the data collection remained close to the research question. Steps were taken to ensure the validity of the data during collection and analysis.

My goals set out to both learn a research method and to understand strategic risks affecting sustainability in megaprojects. I believe both these goals have been met, and I have a fuller understanding of the cause-effect relationship behind my observations of the research question.

The model requires further refinement due to the complexities and various spatial and temporal scales at play in megaprojects. The level of research required to address these was, however, beyond the scope of this mini-dissertation.

7 References

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Appendix A: Interview log

Four interviews were conducted over Skype. Details of the respondents is provided below.

Reference	Profession	Date	Cycle
Respondent 1	They are a professional consultant in the field of environmental risk. They have worked extensively in this field for over 15 years, on many large mining and infrastructure related projects. They have held positions at large multinational firms and successfully run their own consultancy to JSE-listed clients. Their geographic area of experience is southern, central and eastern Africa; and Australia.	13 July 2016	1
Respondent 2	They are a public relations and communications specialist. They have worked extensively in this field for over 13 years, as a journalist, in production and communications management; while they have concurrently established their own publications company. Their geographic area of experience is southern Africa.	27 July 2016	1
Respondent 3	They are a professional management consultant in South Africa. They are currently employed at a consultancy and focus on country risk dynamics in southern, central, eastern and northern Africa. Prior to consulting they were based on two prominent investment banks where they focused on global markets, country and sovereign risk analysis.	15 August 2016	2
Respondent 4	They are a credit review analyst at a development finance institute in South Africa. Their background is in credit and property finance for commercial and development finance institutions who operate across sub-Saharan Africa. They have over 20 years' experience in this field.	16 August 2016	2

Appendix B: Proposition log

Ref	Data source	Proposition	Cycle
1	(Besanko, Dranove, Shanley, & Schaefer, 2013)	Different persons are implementing the strategy from those who make it. There is a risk of the strategy not being followed.	1
2	(Besanko, Dranove, Shanley, & Schaefer, 2013)	Measuring performance aligned with the strategy helps to ensure that it is executed properly	1
3	(Besanko, Dranove, Shanley, & Schaefer, 2013)	Employee incentives based on strategy implementation gets employees to perform according to these incentives	1
4	(Besanko, Dranove, Shanley, & Schaefer, 2013)	Resource commitment ties a firm into a particular course of action removing its options. This decreases the adaptive and resilience of a firm	1
5	(Douma, 2015)	Overlooking current trends may result in funding issues down the line	1
6	(Cool, Jemison, & Dierickx, 1987)	Negative risk/return outcomes are to be expected following major <business> environmental discontinuities	1
7	(Cool, Jemison, & Dierickx, 1987)	“market power” may be a key factor explaining risk/return.	1
8	(Cool, Jemison, & Dierickx, 1987)	Lower costs for a given quantity reduce the risk of a strategy not yielding the intended results	1
9	(Cool, Jemison, & Dierickx, 1987)	Better operational efficiencies reduce the risk of a strategy not yielding the intended results	1
10	(Cool, Jemison, & Dierickx, 1987)	Resource reallocation is costly. The more committed the resource, the more difficult it is to change.	1
11	(Cool, Jemison, & Dierickx, 1987)	Adaptive responses are seen as aleatory and costly. It is difficult to be flexible and adapt if resources are committed.	1
12	(Cool, Jemison, & Dierickx, 1987)	The ability of the firm to bounce back to the external environment	1
13	(Cool, Jemison, & Dierickx, 1987)	Firms that are far sighted in resource adjustment benefit due to changes in environmental conditions	1
14	(Cool, Jemison, & Dierickx, 1987)	Greater market share leads to less risk	1
15	(Deloitte, 2013)	Data mining, analytics, mobile and cyber-security are disrupting business models	1
16	(Deloitte, 2013)	New communications platforms and models allow for reputation to be in affected very short time	1
17	(Mohammed & Sykes, 2012)	A lower demand affects revenues and the expected value/profits	1
18	(Mohammed & Sykes, 2012)	Lower pricing affects revenues and the expected value/profits	1
19	(Mohammed & Sykes, 2012)	Regulation sets up barriers making it more difficult to exit and pivot	1
20	(Mohammed & Sykes, 2012)	An economic downturn resulting in lower demand	1
21	(Taylor, 2012)	A lack of the correct operating systems heightens the risk to executing strategy.	1
22	(Kaplan & Mikes, 2012)	A strategy with high expected returns requires a higher risk. Proper systems are necessary to manage these risks as they exist to make returns.	1
23	(Gray, 1986)	Strategic planning can often leave out line managers who are responsible for its implementation and understand their units	1

Ref	Data source	Proposition	Cycle
		the best	
24	(Tonello, 2012)	A toxic culture in an organisation can allow for ethical collapses	1
25	(Damodaran, 2007)	The risk taking firm is the one that achieves the return. Firms that are unwilling to take risks don't make the returns and will die out.	1
26	(Damodaran, 2007)	Faster response to information allows for better decisions	1
27	(Damodaran, 2007)	Resource availability allows for firms to respond to these risks	1
28	(Damodaran, 2007)	The more flexible a firm is, the better it can respond to events	1
29	(Damodaran, 2007)	Good corporate governance must focus on the value of the corporation, not the individual	1
30	(Damodaran, 2007)	The correct personnel allow for the correct	1
31	(Damodaran, 2007)	Technology is providing platforms making it possible for new solutions that uproot current ones	1
32	(Damodaran, 2007)	Legal barriers are put in place to try to prevent disruption	1
33	(Munich Re, 2013)	Wrong decisions: refers to all fundamental business-model decisions, strategic partnerships, acquisitions, product and price models, target group definitions, entry into markets, and short-, medium- and long- term investment strategies.	1
34	(Munich Re, 2013)	Refers to systems, processes and resources used, all related shortcomings in structures and processes, and the project risks in the implementation of strategic plans	1
35	(Munich Re, 2013)	refers firstly to the ability to react to legal changes in the areas of compliance (e.g. labour, company or commercial law), taxation, accounting, and insurance and financial supervision, and secondly to developments in the market environment itself	1
36	(Anonymous Interviewee 1, 2016)	If the product/service doesn't offer a lasting or real value to the end user, the strategy may not be sustainable.	1
37	(Anonymous Interviewee 1, 2016)	The inability to control a risk heightens the possible impact. This inability may occur due uncertainty or ability. At a strategic level sustainability tends to be a control risk.	1
38	(Anonymous Interviewee 1, 2016)	Direct treatment of the control risk can be ineffective as it's easy to miscalculate. Hazards can be directly treated, but there's currently a gap in dealing sustainability control risks due to the uncertainty surrounding them.	1
39	(Anonymous Interviewee 1, 2016)	Building resilience in the business allows for a response to uncertain or unexpected risks as the business can respond to something that is not well defined.	1
40	(Anonymous Interviewee 1, 2016)	The long temporal scale of sustainability issues makes them difficult to plan and deal with.	1
41	(Anonymous Interviewee 1, 2016)	Dependency is an issue affecting the resilience a firm to these risks.	1
42	(Damodaran, 2007)	To manage risk, it must be measured. Uncertainty is, therefore, difficult to manage because how can it be measured?	1
43	(Damodaran, 2007)	Probabilistic approaches can be used to provide information on the value of an asset under each outcome.	1
44	(Damodaran, 2007)	Risk assessment techniques tend to focus on negative risks and miss the opportunity that the risk holds.	1
45	(Beckers et al., 2013)	Most overruns are due to short-sighted risk management.	1

Ref	Data source	Proposition	Cycle
46	(Beckers et al., 2013)	Project owners fail to realise that decisions in one stage of a project can have knock-on effects in later stages	1
47	(Beckers et al., 2013)	Structuring and delivery are very complex. This makes strategic risk difficult as it is very detailed.	1
48	(Beckers et al., 2013)	There are a lot of stakeholders at various stages over these projects. This increases the risk interfaces between these parties.	1
49	(Beckers et al., 2013)	Due to the complexity, the risks must be identified and managed from the outset.	1
50	(Mail & Guardian Online, 2006)	Issues such as environmental permitting present uncertainty which can cause issues such as delay or changes to projects, as is the case in this article on the delays in Gautrain.	1
51	(Beckers et al., 2013)	Risks can be embedded early on making it impossible to deal with at a later stage.	1
52	(Beckers et al., 2013)	A forward-looking project risk lifecycle assessment can help identify strategic risks upfront	1
53	(Beckers et al., 2013)	Proper risk allocation to the best risk owners can help risks be best dealt with	1
54	(Flyvbjerg, 2007)	"Delusion" is necessary for projects to proceed.	1
55	(Flyvbjerg, 2007)	"Appraisal optimism" can occur as a bias resulting in the underestimation of risks	1
56	(Garemo, Matzinger, & Palter, n.d.)	To justify projects, project managers competing for funding "massage the data" until they meet thresholds. There is an inherent conflict for these parties to not identify risks	1
57	(Garemo, Matzinger, & Palter, n.d.)	There is a temptation to cut corners on execution. This is especially in light in delivery under-budgeted proposals	1
58	(Priemus, 2010)	There are some complicating factors such as political discontinuities and market dynamics which cloud the project	1
59	(Priemus, 2010)	Mega projects can have the absence of a proper project analysis. Is there any value being added and will the product be used?	1
60	(Priemus, 2010)	Once a particular solution has been committed to, it's difficult to change. Alternatives tend to come up later in the project which isn't helpful as you can't backtrack.	1
61	(Flyvbjerg, 2016b)	Politicians, business people, engineers, and designers build projects for sublime reasons (4 sublimes) resulting in the long planning horizons and complex interfaces being ignored	1
62	(Flyvbjerg, 2016b)	Projects are led by managers without deep experience who change regularly resulting in weak leadership	1
63	(Flyvbjerg, 2016b)	Early stage over commitment resulting in "lock-in" or capture.	1
64	(Flyvbjerg, 2016b)	Delivery is prone to high-risk stochastic activity or "black swans."	1
65	(Flyvbjerg, 2016a)	There would be an argument saying that nothing would be started if we knew all the risks and issues. It is, therefore, beneficial to go in with some sense of ignorance. The argument is known as Hirschman's Hiding Hand. This approach promotes that strategy simply ignores risks through wilful ignorance.	1
66	(Flyvbjerg & Budzier, 2015)	Project planners and practitioners try to capture all the detail in projects when planning for them. Trying to understand the complexity doesn't help address the risks but rather	1

Ref	Data source	Proposition	Cycle
		heuristics which are Drivers of success	
67	(Flyvbjerg & Budzier, 2015)	1. Megaprojects are inherently risky due to long planning horizons and complex interfaces (Flyvbjerg, 2006).	1
68	(Anonymous Interviewee 2, 2016)	If the project is conceived to seek rent, the sustainability is of no importance.	1
69	(Anonymous Interviewee 2, 2016)	Rent seeking behaviour often will result in no value being added as the point is to obtain rent, not add value.	1
70	(Anonymous Interviewee 2, 2016)	Adding value provide a social benefit.	1
71	(Anonymous Interviewee 2, 2016)	Putting up collateral disincentives sustainability as it guarantees profits for investors and companies. The project, therefore, doesn't need to be sustainable since returns and repayment are guaranteed.	1
72	(Dimitriou, 2009)	Globalisation is a raison d'etre for many MTPs. Large corporations have become meaningful economic units who have homogenised and standardised global products.	1
73	(Dimitriou, 2009)	Different benefits are enjoyed by project sponsors and the communities they affect. The sponsors are large corporations who have no allegiance to a place or community.	1
74	(Dimitriou, 2009)	Communities feel that they are made to carry more than their fair share of social, environmental and economic costs resulting in controversies around these projects	1
75	(Dimitriou, 2009)	These projects present opportunities for monopolies or oligopolies which makes the investment very attractive to private investors.	1
76	(Dimitriou, 2009)	The government is tied in as a guarantor of last resort which makes the investment very attractive to private investors.	1
77	(Khan, 2000)	A proper analysis is necessary for a sustainability strategy. The analysis will properly identify relevant factors affecting sustainability in a project	1
78	(Khan, 2000)	The strategy requires proper monitoring and indicators.	1
79	(Alexander, 2016)	Democratic controls are necessary to prevent the gains from being privatised. Private firms will attempt to gain as much as they can unless proper controls are put in place to safeguard against this.	1
80	(Alexander, 2016)	Democratic controls are necessary to prevent the losses from being socialised. The recipients of many impacts or failed projects are society, and therefore losses are transferred to them.	1
81	(Alexander, 2016)	Mega projects are largely driven by geopolitics and not economics.	1
82	(Alexander, 2016)	The recent explosion in mega projects is causing irreversible environmental damage which will transfer the cost onto society.	1
83	(Alexander, 2016)	Environmentally unsound projects lock countries into a particular course of action which are very costly and difficult to change.	1
84	(Alexander, 2016)	New asset classes will help development finance on more sustainable projects.	2
85	(Alexander, 2016)	Public money is used to offset risk to get access to long-term institutional investors.	2
86	(Alexander, 2016)	Investors are seeking to maintain a rate of return through	2

Ref	Data source	Proposition	Cycle
		guaranteed revenue streams and ensuring that laws & regulations don't cut into their profits. This, however, brings the risk of the public good being undermined	
87	(Alexander, 2016)	The rules governing long-term investment by institutions don't effectively incorporate environmental and social risks. This is increased by investment pooling. This may cause issues as governments and society have no control over institutional investors.	2
88	(Respondent 3, 2016)	The revenue model should be sufficient to justify the project on its own.	2
89	(Respondent 3, 2016)	A risk vetting process should detect the risks around a particular model.	2
90	(Respondent 3, 2016)	Assumptions are made when modelling which in hindsight seem like big oversights. Failure in models can easily occur due to assumptions.	2
91	(Respondent 3, 2016)	The government guarantee transfers the risk to the government. This allows the financiers to make loans to parties who cannot robustly demonstrate a business case for their project because the financier knows they can lean back on the government guarantee, unlike in the case of a private venture.	2
92	(Respondent 3, 2016)	Financiers tend to look at the track record of an existing firm to determine their capability to deliver on the project. The lack of a track record should be a flag and require that more rigorous set of controls be put in place.	2
93	(Respondent 3, 2016)	A properly conducted feasibility study helps to establish the need in the market and then design a solution which addresses this. This allows for a product which the market will more likely want and accept.	2
94	(Respondent 3, 2016)	A champion who is focused on delivering value drives the project the way it should be. This person must be properly incentivised but also requires monitoring to ensure that there is proper delivery.	2
95	(Respondent 3, 2016)	Cooperation is necessary since some administration/parties may not be in touch with social conditions on a local scale, and visa versus with macro-scale issues.	2
96	(Respondent 3, 2016)	A solution for one market/end user will not necessarily work in another market. People have a habit of seeing a solution oversees and then wanting to bring it as is into another market and thinking it'll add value.	2
97	(Respondent 3, 2016)	An independent regulator helps to verify the feasibility of projects and facilitate a fair compromise between various parties.	2
98	(Respondent 3, 2016)	If the government guarantee transferred some of the market risks back onto the financiers, the market mechanism for more robust analysis of the capabilities of the concession company / SOE would be used by the financiers helping to ensure the actual social feasibility of the project.	2
99	(Anonymous Interviewee 4, 2016)	The third party independent regulator acts as an intended referee between parties with various interests.	2
100	(Anonymous Interviewee 4, 2016)	It must be established whether there is a willingness of people to pay for the service. This is a risk to the entire economic viability of the project.	2

Ref	Data source	Proposition	Cycle
101	(Anonymous Interviewee 4, 2016)	Early consultation will help establish the consumer's attitude towards the project.	2
102	(Anonymous Interviewee 4, 2016)	Cost overruns can force the project to be unsustainable by driving up pricing to the point that the user refuses to pay	2
103	(Anonymous Interviewee 4, 2016)	A good quality product allows for longevity and lowers costs in delivering the product. This is more sustainable and makes better strategic sense in delivering large infrastructure to consumers.	2
104	(Anonymous Interviewee 4, 2016)	Delays can force the project to be unsustainable by driving up pricing to the point that the user refuses to pay	2
105	(Colverson & Perera, 2012)	Through pre-project assessment and evaluation which is relevant to long-term success. These are important to the sustained success of a project	2
106	(Colverson & Perera, 2012)	The contract lengths can be 30-50 years. This makes sustainability forecasting difficult and increases uncertainty.	2
107	(Colverson & Perera, 2012)	Environmental and social sustainability are not built into the contracts. This means that they are not contractually an obligation and are more easily ignored.	2
108	(Colverson & Perera, 2012)	Pre-planning must is where mitigation for sustainability risks occurs, and its contribution is established.	2
109	(Colverson & Perera, 2012)	Sustainability as a goal and risk must be dealt with by the correct party who in the case of PPPs is the public sector.	2
110	(Colverson & Perera, 2012)	Once solutions and contracts have been negotiated, it is very difficult and costly to backtrack. A committed course which is unsustainable cannot simply be pivoted from.	2
111	(Colverson & Perera, 2012)	Proper evaluation and consideration of the context at hand result from planners applying their mind and not simply trying to import inappropriate solutions.	2
112	(Colverson & Perera, 2012)	Government intentions and end-user behaviour may not be aligned. A good understanding of the use case and end-user is necessary since private interests are involved in the project which are commercial entities which exist to make a return. This was the case with the Arlanda Express project in Finland where users didn't use the train as intended.	2
113	(Colverson & Perera, 2012)	Feasibility studies for the projects can be made by entities which have conflicting interests. Such as the Arlanda Express railway feasibility study was done by the railway authority who has the interest to see more railways built.	2
114	(Colverson & Perera, 2012)	Once the government enters into PPP contracts, they can limit it from delivering on its mandate. The impact is that society and the end-user become more frustrated placing the project at greater risk.	2
115	(Colverson & Perera, 2012)	Some contracts give undue freedoms to the private sector which can impact negatively on the strategy, intended purpose of the project and the PPP in the first place.	2
116	(Colverson & Perera, 2012)	The actions of the consortium are primarily driven by self-interest and not determined by issues outside its project's scope or the wider context of its environment, nor necessarily should it.	2
117	(Colverson & Perera, 2012)	Higher pricing can make a good/service that's needed less accessible. The impact is that the economic viability is compromised through incorrect pricing for the end-user	2
118	(Colverson & Perera, 2012)	The principles of sustainable public procurement:	2

Ref	Data source	Proposition	Cycle
		transparency, accountability, whole life costing, value for money, positive externalities will help ensure that the correct issues are looked into and not neglected.	
119	(Colverson & Perera, 2012)	If environmental and sustainable risks/benefits are not measured as standalone items, there is a likelihood of assessments to be skewed towards financial feasibility or outcomes.	2
120	(Colverson & Perera, 2012)	Selection criteria which are based on "lowest price to purchase" and not "most economically advantageous tender", result in a skewed focus on costs.	2
121	(Hovy, 2015)	Risk allocation is important for creating a "good deal" for society. If a project is structured properly and risks are allocated well, sustainability can create a "good deal" for society while also sharing the risk with other parties.	2
122	(Hovy, 2015)	Risks should be allocated to the party who can best understand and control the risk at the lowest cost.	2
123	(Hovy, 2015)	Risks should be allocated to the party who owns the financial costs as it is incentivised to manage the risk.	2
124	(Hovy, 2015)	The structuring, organisation and extent to which risks are regular or extraordinary affect parties willingness to accept a risk. The structure of the private entity using a project finance structure has certain limitations. The structure affects their ability to accept the risk.	2
125	(Gerbert, Lohr, Rothballer, & Steffen, 2015)	Infrastructural projects have different and longer temporal cycles than political cycles.	2
126	(World Economic Forum, 2015)	Existing environment which has laws and policies geared towards sustainability has a better chance of ensuring that these issues are properly looked into and evaluated.	2
127	(World Economic Forum, 2015)	Responsible business conduct is a prerequisite for sustainable economic success. This is because general society must accept the operations of the business in their society and economy.	2
128	(World Economic Forum, 2015)	Environmental and social permits are provided by the government and contain conditions under which that government is willing to allow the project to operate. This forms a contract with the government for the project and provides security to the project.	2
129	(Marsh & McLennan Companies, 2012)	There can be a preference for society to support a "home-grown" initiative opposed to foreign interests operating in a country.	2
130	(Tango International, 2009)	Programmes which have community involvement in the design create a sense of ownership and therefore acceptance by the community.	2
131	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	When looking at sustainable practices, a company must consider its competitive position as this affects its ability to redefine market uncertainties.	2
132	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Strategic risk assessment should try control for external environmental factors such as social, cultural, political, legal, regulatory, financial, technological and economic. Sustainability then helps restrain impacts through planning and control mechanisms.	2
133	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Frequent changes in government can lead inventors to question the need to pursue sustainable business practices	2

Ref	Data source	Proposition	Cycle
		due to the uncertainty	
134	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	The pursuit of sustainability resides in the inner circle of the business. There must be an internal will to address it.	2
135	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Financial and environmental inefficiency will occur due to continuous use of conventional and inefficient technologies. This will occur as a result of a lack of internal planning to address sustainability.	2
136	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	A Higher level of unsustainable practices (e.g. greenhouse gases) leading to increase of business costs in the future due to a dynamic environment relating to sustainability regulation and requirements.	2
137	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Issues such as penalties and long- term liability can occur due to poor environmental performance. For instance, critical permits may be removed or changed.	2
138	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Damage can be caused to a business brand and negatively affect your public image. This may cause the business to be unattractive to quality staff.	2
139	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Social and psychological related factors present significant changes to the environmentally sustainable design and construction. Efforts are required to enhance the awareness and willingness to accept the sustainable features with associated cost.	2
140	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	Capabilities and competence for innovation are paramount for addressing the business focus on sustainability. Therefore the lack of human resources with innovation-oriented competence and capability presents a significant risk for the sustainable business.	2
141	(Chileshe, Wilson, Zuo, Zillante, & Pullen, 2013)	The realisation of sustainable built environment involves all actors in the supply chain. Interactions amongst various professions and organisations are required. It is also necessary to engage the end users to provide feedback for the purpose of improving the future designs. As a result, effective communication and cooperation are important.	2
142	(Marsh & McLennan Companies, 2012)	Sustainability is acknowledged as being important. However, the necessary capabilities are not in place to address sustainability risks adequately.	3
143	(International Fund for Agricultural Development (IFAD), 2009)	A focus merely on financial and technical targets means that other relevant variables, especially social and communal issues, are neglected	3
144	Goslar, Experiential Knowledge	Upper management drives a project according to the contractual requirements. They become the "Bible Documentation" for the project against which milestones are measured and managed. If sustainability is not included in contractual requirements, its often ignored.	3
145	Goslar, Experiential Knowledge	Upper management often has no experience and training in sustainability. It is not seen as a strategic issue nor risk.	3
146	Goslar, Experiential Knowledge	The absence of sustainability as a performance criterion means that upper management implements no measures to address it.	3
147	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Megaprojects are being built in a context where the boundaries of space are being broken down within the globalised society. There has been a big increase in them, but they have poor sustainability performance.	3

Ref	Data source	Proposition	Cycle
148	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Environmental issues not taken into account during project preparation tend to only surface during construction and operations and have far reaching effects.	3
149	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Positive regional development effects are used to gain political support for projects but often are not realised.	3
150	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	There seems to be a fair amount of unfair unhanded play by parties involved in mega projects. The analysis around the project, therefore, cannot be trusted.	3
151	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Civil society has less say in projects and is therefore not able to play the same level of watchdog.	3
152	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	"Democracy deficit" - Poor governance is practised as they're seen as counterproductive in getting projects started	3
153	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Lack of accountability allows large projects to go ahead and be built even though they may be unsustainable	3
154	(Flyvbjerg, Bruzelius, & Rothengatter, n.d.)	Inadequate deliberation about risk allows for megaprojects to go ahead even though there may have a serious risk.	3
155	(Ehrenfeucht, 2004)	When a megaproject is proposed and appraised, promoters typically overestimate the benefits that will derive from the project, and they similarly underestimate the costs.	3
156	(Ehrenfeucht, 2004)	People tend to be over optimistic about projects	3
157	(Ehrenfeucht, 2004)	Projects bring immediate benefit to many people and leads them to lie and misrepresent to obtain the benefit	3
158	(Ehrenfeucht, 2004)	Politicians making the decisions now will not be in office at a later stage and therefore will not be held accountable for their current decision	3
159	(Ehrenfeucht, 2004)	Megaprojects have a lot of uncertainty and therefore should be thought about regarding risk, not in a deterministic fashion	3
160	(Poole & Samuel, 2011)	Allocate risk to parties who have incentives to reduce the risk impacts. They are the most interested party to ensure that the risk is addressed properly	3
161	(Poole & Samuel, 2011)	If private investors invested in the project without sovereign guarantees, they'd then be taking the risk, and this would help them ensure that the project is sustainable	3
162	(Poole & Samuel, 2011)	If risk is allocated to investors in the long term, they'll ensure that the project is sustainable	3
163	(Poole & Samuel, 2011)	If risk is allocated to investors, they're incentivised to ensure that there won't be cost overruns and to build a long-term sustainable project	3
164	(Crawford, 2014)	there is a risk that political views will skew the project appraisal process to reject or accept certain projects	3
165	(Crawford, 2014)	In-depth assessment too early on can stifle innovation later in the process. It's not beneficial to go into too much detail too early.	3
166	(Crawford, 2014)	In public, private partnerships, private risk takers and their management techniques are introduced too late in the process to influence risk management and allocation	3
167	(Crawford, 2014)	Competition laws and the need for transparency are major barriers to introducing early contractor involvement.	3
168	(Crawford, 2014)	With such a long period, quantitative techniques for measuring performance are questionable.	3
169	(Infrastructure Risk Group, 2013)	There is no established toolkit for early-stage risks analysis which is when strategic risks would be analysed	3

Ref	Data source	Proposition	Cycle
170	(Infrastructure Risk Group, 2013)	Project sponsors will tend to adopt assumptions which favour a project, which might be gaming	3
171	(Infrastructure Risk Group, 2013)	Financial managers will tend to exert pressure to reduce risk contingencies irrespective of actual risk levels to address more short-term financial needs	3
172	(Jennings, n.d.)	over-confidence and over-optimism are often observed by the state. This affects the proper evaluation of such project's sustainability which is found to often be failures.	3
173	(Jennings, n.d.)	The selection of policy tools determines how risks and uncertainties are evaluated	3
174	(Jennings, n.d.)	Difficulties in forecasting risk and general uncertainty make it difficult to identify all relevant risks which will have a down the line effect on a project.	3
175	(HM Treasury, 2011)	Partnerships with local communities are important for the sustainability of projects	3
176	(Alexander, 2016b)	Cost effectiveness. The correct scale must be chosen, rather than sticking to a “small is beautiful” or a “bigger is better” philosophy	3
177	(Alexander, 2016b)	Projects are driven by geopolitics and not economics. As a result, they tend to run over time and over budge.	3
178	(Alexander, 2016b)	Planetary boundaries. A holistic view on resource consumption must be taken into account. The carrying capacity of the planet is being exceeded, and megaprojects drive large-scale resource consumption.	3
179	(Alexander, 2016b)	The public-private partnerships are profit seeking. Institutional money is funding projects but requires positive returns. A risk exists where there is a conflict of interest between profits and the public good.	3
180	(Alexander, 2016b)	The pooling of infrastructure projects into portfolios or asset classes privatises gains and socialises losses.	3
181	(Alexander, 2016b)	The rules governing investments don’t effectively take long-term environmental and social risks into consideration.	3
182	(Trade Union Advisory Committee to the Organisation for Economic Cooperation and Development (OECD), 2015)	The remuneration of financial intermediaries and design of asset manager mandates drives short-terms	3
183	(Trade Union Advisory Committee to the Organisation for Economic Cooperation and Development (OECD), 2015)	There should be equal sharing of risks between private and public money in the case of government guarantees.	3
184	(Trade Union Advisory Committee to the Organisation for Economic Cooperation and Development (OECD), 2015)	Responsible investment should underpin long-term investment looking at kerbing short-termism	3
185	(McClelland, 2014)	Project design is not focused on sustainable outcomes but rather the thing being built.	3
186	(Greiman, 2015)	The measures of success are important in determining whether sustainability is a risk.	3
187	(Greiman, 2015)	If people understand the benefits of a project, it helps them get behind it.	3

Ref	Data source	Proposition	Cycle
188	(Greiman, 2015)	A framework to include environmental and social aspects, in the final analysis, is necessary.	3
189	**(Eberhard, 2013)**	Cost and time overruns affect the sustainability and viability of a project	3
190	(Suárez, Callahan, & Lichtenstein, 2012)	For success, external stakeholders increasing expectations of sustainability must be carefully managing.	3
191	(OMEGA Centre, 2012)	On average. Cost overruns were recorded for projects	4
192	(OMEGA Centre, 2012)	Current measures for project success focus on an area which can only partially cover proper measurement basis.	4
193	(OMEGA Centre, 2012)	Projects evolve over time and therefore must be viewed as dynamic when measuring performance	4
194	(OMEGA Centre, 2012)	The context of the projects must be considered as each is unique and therefore has different variables affecting the project	4
195	(OMEGA Centre, 2012)	The lack of a definition of sustainable development makes it difficult to define the goals of projects	4
196	(OMEGA Centre, 2012)	The lack of a definition of sustainable development makes it difficult to evaluate the performance of projects.	4
197	(OMEGA Centre, 2012)	There are questions as to whether some projects can deliver SD goals	4
198	(OMEGA Centre, 2012)	Stakeholder relationships must be built on trust, credibility and transparency	4
199	(Johannesson, Robaey, & de Roo, 2011)	Two projects referred to here came to exist due to higher energy prices. The sustainability of these projects, therefore, hinges on the energy prices remaining at these levels.	4
200	(Johannesson, Robaey, & de Roo, 2011)	Large projects tend to raise expectations in parties, and some lose out. Realistic expectations must be communicated to local and regional communities	4
201	(Johannesson, Robaey, & de Roo, 2011)	In both cases, the projects have altered the social rhythm within the receiving communities. The local communities must be taken into consideration	4
202	(Johannesson, Robaey, & de Roo, 2011)	Participation doesn't mean that there is community buy-in. In both cases here there was participation during the planning phases but the projects met stark opposition once construction began	4
203	(Johannesson, Robaey, & de Roo, 2011)	When engaging, there are existing structures which people know. These should be made use of for proper engagement.	4
204	(KPMG International, 2012)	Accountability is shared between multiple parties who lose sight of the broader strategic goals.	4
205	(KPMG International, 2012)	Coordination between multiple parties is difficult.	4
206	(KPMG International, 2012)	There are two sources of payment, taxation or end-user. This means that society are currently ultimately footing the bill	4
207	(KPMG International, 2012)	Performance must be measured for the whole life of the project to evaluate its sustainability	4
208	(KPMG International, 2012)	The policy is need from government to push sustainability requirements in projects such as those for cities in this report.	4
209	(Watkins, 2014)	Early stakeholder engagement is important for project success and sustainability	4
210	(Dowall & Reid, 2008)	A holistic strategy for the delivery of infrastructure to focus on the areas where the product/service is needed.	4
211	(Dowall & Reid, 2008)	Citizen involvement is necessary at the level of strategy	4

Ref	Data source	Proposition	Cycle
		formulation to ensure its long-term success.	
212	(Dowall & Reid, 2008)	An outcomes orientated approach is necessary to look at what the best options are for achieving the end outcome.	4
213	(Dowall & Reid, 2008)	Value for money should be assessed as this is a goal of the infrastructure	4
214	(Dowall & Reid, 2008)	Value for money assessments can help determine whether the infrastructure will provide the intended value	4
215	(Palmquist, 2014)	Projects are built over long periods requiring coordination. This creates a complex situation which is difficult to control	4
216	(Palmquist, 2014)	The projects require complex coordination between multiple parties making a complex situation	4
217	(Palmquist, 2014)	There are sunk costs for local businesses and communities which go into megaprojects and don't get recorded. They bear the costs of failed projects.	4
218	(Palmquist, 2014)	Risk management strategies must be continuously monitored and updated	4
219	(Palmquist, 2014)	A sink or swim approach to profit and risk sharing would properly share risks amongst stakeholders	4
220	(Palmquist, 2014)	A sink or swim approach to profit and risk sharing would properly share risks amongst stakeholders	4
221	(Palmquist, 2014)	Projects with better front-end design tend to perform better	4
222		Poor uninformed decision making has resulted in poor project performance	4
223	(Rodriguez, 2016)	In this case, the project is said to improve markets and provide services to millions of people thereby adding value to people.	4
224	(UN-Habitat, 2009)	The book highlights that in many cases, mega-projects are in contradiction to spatial plans. The spatial plans have however been drawn up for planning the urban environment.	4
225	(UN-Habitat, 2009)	The use of private service providers places considerable cost on the poor making them the cost custodian	4
226	(Charrett & Loots, 2016)	Risk allocation is important in improving outcomes in megaprojects	4
227	(Charrett & Loots, 2016)	The product may be developed, but it doesn't align with what was required	4
228	(Charrett & Loots, 2016)	The project may not be sufficiently investigated to check whether it is viable.	4
229	(Charrett & Loots, 2016)	Costs can be reduced to meet investment criteria which may have excluded the project on this basis.	4
230	(Charrett & Loots, 2016)	It is a widely accepted principle that in a construction contract, each risk should be allocated to that party in the best position to manage and control it	4
231	(Charrett & Loots, 2016)	Inappropriate risk allocation means that sometimes the risks cannot be adequately costed for which affects the economic viability	4
232	(Charrett & Loots, 2016)	Risk allocation is often being pushed by the principal onto the contractor who isn't able to control the relevant risk or cost for it.	4
233	(Koppalkar, 2015)	Projects are approved because of the value they create and not costs estimates or execution plans.	4
234	(Muldowney, 2015)	The high level of cost overruns mean that some projects are just unviable	4

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