

University of Southern Queensland
Faculty of Health, Engineering and Sciences

Analysis of Influencing Factors of Construction Project Complexity from Different Stakeholders Perspectives

A dissertation submitted by

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Abstract

The study aimed at identifying and defining specific factors that drive complex road construction projects and determine the influencing factors of project complexity, from different stakeholder's perspectives. This was done by looking at various stages of the project lifecycle, by how these processes could be better managed. With the focus purely being from an general internal organisational point of view.

A two-round questionnaire survey Delphi method approach was used to collect data. Fifteen industry experts (stakeholders) were engaged to provide their opinion and consensus as to the most influencing and complex factors in regards to project complexity at different stages of the project lifecycle of a road construction project. An Importance weighting and Complexity Index (CI) was determined and developed based on the measures identified for their comparative significance.

It was found that the five complexity measures for an overall road construction project included, (1) buildability of the design; (2) cost constraints; (3) technical aspects; (4) environment (Access/Location); and (5) urgency of the project schedule. For each stage of the project development lifecycle they were determined as follows:

- Conception stage: (1) definition of project objectives; (2) level of project definition; (3) Project expectations; and (4) managing stakeholder expectations.
- Strategic stage: (1) level of unknowns; (2) confirming the preferred option; (3) consulting appropriate stakeholders; and (4) strategic estimate.
- Concept stage: (1) engineering and field investigation outcomes; (2) developing the concept design; and (3) the concept design estimate.
- Detailed stage: (1) managing the level and scope of the project; (2) developing the detailed design; and (3) managing project risks.
- Construction stage: (1) managing construction activities and services; (2) managing site risks; and (3) managing construction contracts.
- Finalisation stage: (1) finalising and handover of the completed works; (1) identifying ongoing maintenance works and planning; and (2) post completion review.

It was also determined that the project owner (client) is the most influential stakeholder and that the earliest stages of the project development lifecycle are most important for managing stakeholder inputs, having the most project uncertainty while also being considered as most likely to be overlooked. Communication was indicated as a key measure of maintaining stakeholder relationships. While the panel suggested the current project management guidelines are too convoluted and needed simplifying, there are issues surrounding politics, and client's knowledge of project complexities that are difficult to manage through guidelines.

These findings on complexity measures will be able to assist stakeholders in evaluating degrees of complexity of the projects they are working on to better handle future risks that could be caused to distinct levels of complexity of projects. They also provide an important view for defining and understanding the complexity that comes with a project. Understanding and addressing this complexity will contribute to improving project planning and execution for stakeholders into the future.

ENG4111 & ENG4112 Research Project

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Glossary of terms

MCP - Mega Construction Project

RMS - Roads and Maritime Services

REF - Review of Environmental Factors

CI – Complexity Index

DMO - Complex Project Management and Defence Material Organisation

1.0 Introduction

Over the past two decades a gradual increase has occurred in the number of large scale construction and development projects being conducted. Construction and design companies are now taking on more employees and responsibilities for a chance of making greater profits. On average, over the last decade the Australian population has grown on average +1.6% (Abs.gov.au, 2019) annually. The demand and political pressure for governments to increase infrastructure spending is therefore justified. This will require increased budgeting to fund more significant projects around Australia (Infrastructure Australia, 2019).

This growth has meant with larger more complex construction projects, the impacts and resources needed have increased linearly in order to be able to cope. The common project management principles applied from the past projects are considered no longer adequate to be able to cater for the large number of resources needed to be managed and the increasing different number of stakeholders (projects owners, community, project team members, etc.) inputs. This inadequate process to managed and cater for the number of different stakeholders of such large and complex projects has made decision-making difficult and resulted in poor decisions where perhaps an unnecessary risk was taken on which has had an adverse outcome on the overall project.

The research project looks into finding the gaps in conventional project management processes for complex projects and identifies and analysis factors of construction project complexity from diverse stakeholder perspectives at different stages of the project lifecycle in order to seek a better understanding of how they could be managed and the influencing factors stakeholders perspectives have on these processes.

In this chapter the following sections are cover, the project background which states the supporting statement on the research topic, the research problem which talks about the details for the need of the project, the aims and objectives and finally the researches scope of works and its outlines.

1.1 Background

Working on a complex or uncertain nature of a Mega Construction Project (MCP) requires an adequate approach in being able to manage and contain various stakeholders conflicting interests as well as their differing occupational and overall professional backgrounds.

In projects particularly ones of significant size issues of uncertainty have the effect of impacting on key performance issues, uncertainty can be introduced by the presence of having multiple parties associated with the project and how this is managed by the appropriate project management processes is critical (Atkinson, 2006). While stakeholders (employees and clients) are known to be an essential part of achieving project performance and outcomes they are also known to be one of the more significant contributors to project uncertainty. Large engineering projects have higher risk stakes so the importance of managing stakeholders in terms of inputs and uncertainty becomes even more critical. Risks can differ according to the type of engineering project. Road and tunnel systems (projects) are in the top three when it comes to their market risk of large engineering projects that can be undertaken (Miller and Lessard, 2001). The key market risks when it comes to road and tunnel systems and why they are a focus is the concealed surprises associated with rock formations. Others factors include the many problems with social acceptability when user changes are implemented to the road network as well as the market dangers confronting highways, bridges and tunnels when they are constructed under concession systems by private sponsors.

When it comes to developing and building engineering road projects from an organisational perspective, all projects that involve agents or ownership parties are susceptible to three keys issues of adverse selection, moral hazard, and the distribution of risks. In contribution to project uncertainty, all of these problems have a significant adverse impact. Such issues could be anticipated to be much less of a problem where project managers and agents belong to the same organisation. In the way they communicate data, duties and goals more freely between them, however this may not always be the case (Atkinson, 2006).

Whenever different parties are involved in a MCP, each group has different performance objectives, priorities and perceptions of objectives in terms of what they want to achieve and is in their best personal interests. This stems from the fact that different parties have different levels of risk perceptions. What one party perceives as an acceptable risk might not be the case for another. Various project parties adopt different resources and strategies to manage this whereby one party may deflect the responsible to the other agreeing party. This creates irritation and divergence within the team that will then need to be managed appropriately.

Understanding different stakeholder's priorities and expectations are particularly important during the early phases of the project life cycle, so as not to create major issues later down the track. Each party has different interest levels, time of involvement, understanding of the work required, resources, and timings to get it completed. Key stakeholders have always been known to manage uncertainty in some cases for their own advantage, perhaps to the disadvantages of others, even within the same organisation at times (Atkinson, 2006).

The current professional project management guidelines for MCP have been identified over the years as often failing to be fully developed and understand the importance's of the early strategic and concept stages as these are the areas that often require assistance in developing a clearer understanding of appropriate objectives, issues and performance requirements of the

team of a project. The general overview from traditional project management practices is it is essentially the project manager's task to meet the objectives of the project and reduce or eliminate the risk in meeting these objectives. The common perception by many within the industry today is that project risks and uncertainties are sometimes played down, due to not having the sufficient inputs or taking a business as usual approach to similar risks which have been found on previous projects. Playing down such risks has the potential to impact construction times and project costs if it is left later in the project lifecycle. Typically when this does occur the project manager is normally considered the scape-goat in some respects in that they wear the responsibility of this risk, while sometimes having to accept risky situations in order to get the desired result for the project owner (client).

1.2 Research Problem

Substantial gaps of understanding have been identified in current literature as to how uncertainties and current project management processes that are currently in place, effectively manage complex projects. These gaps have meant that project managers and project decision makers have been left to accept risks and uncertainties outside of what they would otherwise feel comfortable with (Atkinson, 2006). As we moved into a modern age where development and the scale of projects are getting significantly larger and involving more project team members. Stakeholder inputs and perspectives are now carrying a higher weighting and influence than ever before.

Currently little research literature exists into how to manage uncertainties and risks particularly with the increase in stakeholder involvement as projects become increasingly larger and more complex. Different stakeholders offer different inputs, accept different levels of risks and have perspectives that influence a construction project. Luo et al (2017) identified this as a research gap where future research is still required to determine influencing factors of project complexity from the perspective of different stakeholders and at different phases of a project's lifecycle.

Differing opinions of stakeholders can create a division within the project if not properly managed, that can be a cause for poor decisions which could have an adverse outcome on project run-over costs (re-work), time delays and safety issues.

The three overall questions that this research paper aims to identify and clarify the answer to from the gaps in the research identified above are:

1. The most influencing factors of project complexity from different project stakeholder's perspectives?
2. What are the different influencing factors within different phases of the project life cycle from a stakeholder perspective?
3. What current gaps exist in the project management guidelines for managing complex projects and how these could be addressed throughout the project lifecycle from a stakeholder perspective?

1.3 Project Aims and objectives

This project seeks to define and identify specific factors that drive complex road construction projects and determine the influencing factors of project complexity from different stakeholder perspectives throughout different stages of the project lifecycle of a road construction project. To achieve this objective, the research will:

- Review existing literature to identify and define the factors and elements that drive complex projects as well as those that influence the complexity of project throughout the project lifecycle.
- Investigate current project management guidelines identify gaps and issues for managing complex projects.
- Review uncertainty factors associated with projects within the project life including project management scope focusing on that of the project parties (stakeholders).
- Determine from experienced industry experts their importance values of influencing factors of project complexities on road construction projects at different stages of the project lifecycle within Roads and Maritime (RMS).
- Development of management guidelines for addressing complexities throughout the project lifecycle from a stakeholder perspective (if time allows).

1.4 Research Scope

The exact scope of this work was detailed and laid out as part of the project specifications developed as shown in Appendix A - Project Specification. This scope involves defining and identifying specific factors that drive complex road construction projects and determines the influencing factors of project complexity from different stakeholder perspectives throughout different stages of the project lifecycle with the focus purely from a general internal organisational context point of view.

The process of achieving this outcome involves a review of existing literature to help identify gaps and uncertainty in current project management processes that are currently impacting on decision maker's abilities to make appropriate and smart decisions. From these gaps a questionnaire survey has been developed to seek organisation industry expert's (stakeholders) opinions about the most critical factors they believe contribute to project complexity which that impact on project outcomes (time, cost delays, etc.).

The outcome of this analysis will identify the key influencing factors of project complexity, the different influencing factors within different phases of the project life cycle which will be able to be filtered back into helping stakeholders access degrees of complexities to manage risks better. This process also identifies gaps in management guidelines for complex projects based on the stakeholder's perspectives.

2.0 Literature Review

2.1 Introduction

Existing reliable publications were selected and collected for the purpose of this project research into determining the influencing factors of project complexity. A literature review forms a necessary piece of any research project for the purpose of providing a background, gaps in current research to assist in justifying the research being conducted. It will develop the current relationship status between project complexity and stakeholder perspectives which is the focus of this research. The subsequent subsections below that are presented give an overview of the necessary literature in each area.

2.2 Project complexity definitions

Complexity can be interpreted differently depending on the field of works. Different definitions exist in current literature, behind the concept of attempting to define project complexity. The general consensus behind the research that does exist is still difficult to define and even harder to quantify (Luo, 2017). There have been a number of attempts to define project complexity like Edmonds (1992) who proposed a general overview of the concept of complexity and its definition within different field of work (Vidal, 2008, p. 1096) which was:

“Complexity is that property of a model which makes it difficult to formulate its overall behaviour in a given language, even when given reasonably complete information about its atomic components and their inter-relations”

This definition describes that complexity is as a general statement related to the aspects of how the project system is modelled. Another high level statement defining project complexity considers it to include structural, dynamic and interacting elements (Whitty & Maylor, 2009 p. 309). Both of these models relates to project perception, as well of the perception of understanding the project model. Other research that does exist states that project complexity is a highly powerful concept that can be very subjective depending on the stakeholders understanding.

Another source such as Vidal et al. (2011, p. 719) proposed, “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”. Complexity for a while now has been considered to be one of the more important issues raised by project management research from recent times.

For the projects they manage, a number of project managers still loosely use the term complex project as a method of description. However, a difference should be created between complicated activities and complexity of the project, also referred to as a project's complexity. The first term refers to a specific class of projects (namely, the complex ones), with the latter more focused on which aspects define a project as complex (Bosch-Rekvelde 2011).

The College of Complex Project Management and Defence Material Organisation (DMO), come up with a determination for complex projects using common projects as per the following aspects (DMO, 2006a):

1. “Complex projects are characterized by a degree of disorder, instability, uncertainty, irregularity and randomness”.
2. “There is dynamic complexity where the parts in the system can react / interact with each other in different ways”.
3. “There is high uncertainty about what the objectives are, and / or high uncertainty in how to implement the objectives”.
4. “There is a highly pluralist environment across the stakeholders where multiple and divergent views exist”.
5. “The strategy is outcome based, emergent and requiring constant renegotiation; and”
6. “Complex projects are not just ‘complex adaptive systems’ but rather they are ‘complex evolving systems’ dominated by double loop learning – they change the rules of their development as they evolve over time. They do not simply adapt to their environment, but evolve with them” (DMO, 2006a, p.8-9).

This illustrates well the dynamic character of complexity of projects (Bosch-Rekvelde, 2011) and identifies the extent of different concepts and opinions that are surrounding it. The research here is looking to help categorise and rank its importance in terms of the stakeholder’s perspective. It should also be observed that there is a relatively close difference between complicated activities and project complexity with the initial one relating to a particular project class while the other is related to the complexity of a project (Bosch-Rekvelde, 2011).

2.2.1 Concepts of project complexity

Over the years many researchers have found it quite difficult to clearly and precisely produce a single defining definition for what is a project complexity. Across literature each researcher has attempted to define this term however this has resulted in a significant variation in its definition depending on the type of project and what the researcher’s focus was. Gidado and Miller (1992) defined construction project complexity by the following five terms:

1. “Technical complexity of task”
2. “Amount of overlap and interdependencies in construction stages”
3. “Project organisation”
4. “Site layout”
5. “Unpredictability of work on site” (Xia, B. and Chan, A, 2012, p.5)

Gidado (1996) was also able to add some additional elements to his definition of construction project complexity which were:

6. “The employed resources”
7. “The environment”
8. “The level of scientific and technological knowledge required”
9. “The number of parts of flow” (Xia, B. and Chan, A., 2012, p.6)

Other researchers like Akintoye (2000) spoke about key items like site constraints, the scope and overall size of the project as well as how difficult the design is to construct, were all key factors that were introduced as contributors to project complexity. All large scale projects always involve a diverse range of activities occurring across different engineering disciplines,

which are not isolated and can have a different effect on increasing the project complexity Lu, Luo Wang Le & Shi (2014).

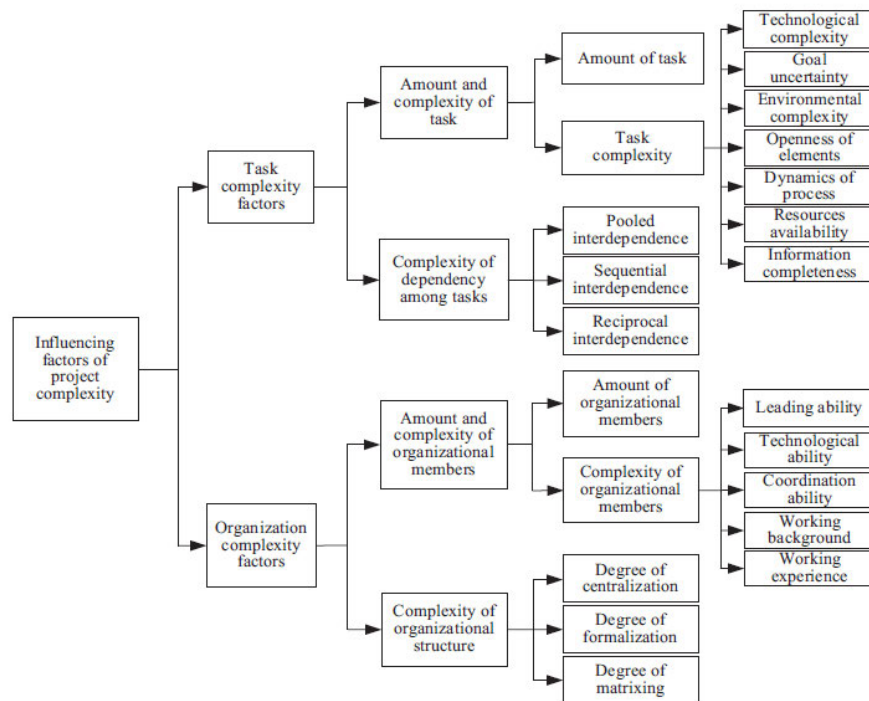


Figure 1: Influencing factors of project complexity from TO measure model (Lu, Luo Wang Le & Shi, 2014).

These research studies are all useful and have powerful perspectives in understanding the main concepts of project complexity. It can be noted that from all the information reviewed that it is still not clear of the definition of the factors that affect project complexity and the ones that do exist only produce vague and broad concepts. This as a result, makes it challenging to appraise project complexity based on the review.

2.2.2 Project complex elements

A number of different elements can contribute to making a large project complex. No two projects are the same as one another, new tasks, challenges and elements always present themselves. PMI (2004) stated that a project is a temporary endeavour undertaken to create a unique product, service or result. Olander (2006) also pointed out that a project is unique in that it involves a set of coordinated activities with a start and a finish date, undertaken to achieve an objective conforming to specific requirements, including constrains of time, cost and resources.

Bosch-Rekveltdt, Jongkind, Mooi, Bakker & Verbraeck (2011) conducted a literature review on articles to determine what elements they identified were most relevant in contributing to project complexity. Their determination is shown in the Table 1 below:

Table 1: Elements contributing to project complexity from literature sources (Bosch-Rekveltdt, et al., 2011 (modified)).

Elements from literature	Authors	Elements defined, alphabetically ordered	Key Stages of Project lifecycle that Applies
Degree of definition of goal, scope	Gerakli and Adlbrecht (2007); Crawford (2005); Vidal and Marle (2008)	Clarity of goals	Conception Stage
Company internal policies (ambiguity, hidden information)	Gerakli and Adlbrecht (2007)	Company internal support	Strategic, concept and detailed design
Variety of project management methods and tools applied	Vidal and Marle (2008)	Compatibility of project management methods and tools	Strategic, concept and detailed design stages
Form of Contract	Müller and Turner (2007); Gerakli and Adlbrecht (2007)	Contract types	Detailed design
Partner's transparency, empathy (the personal and intangible matter that improves cooperation)	Gerakli and Adlbrecht (2007)	Cooperation JV partner	Construction stage
Interrelatedness/ interdependence of elements	Gerakli and Adlbrecht (2007); Williams (1999); Vidal and Marle, (2008)	Dependencies between tasks	All stages
Dependency on other departments/ companies	Gerakli and Adlbrecht (2007); Williams (1999)	Dependencies on other stakeholders	All stages
Commercial newness of the project (new partners, team, processes, etc.)	Gerakli and Adlbrecht (2007)	Experience with parties involved	All stages
Knowledge (i.e. education and/or training)	Baccarini (1996)	Experience with technology	-
Multi-objectives, with conflicting goals	Williams (1999); Baccarini (1996); Thompson (1967); Vidal and Marle (2008); Gerakli and Adlbrecht (2007)	Goal alignment	Conception, strategic and concept stages
Impact of a change in one production process on other production processes	Tatikonda and Rosenthal (2000); Vidal and Marle (2008)	Interrelations between technical processes	Construction stage
Competition	Vidal and Marle (2008)	Level of competition	Construction stage
Technological newness of the project	Gerakli and Adlbrecht (2007); Tatikonda (1999); Shenhar and Dvir (2004); Dewar and Hage (1978); Vidal and Marle (2008)	Newness of technology (world-wide)	All stages
Number of different disciplines	Gerakli and Adlbrecht (2007); Baccarini (1996); Williams (1999); Vidal and Marle (2008)	Number of different disciplines	All stages
Number of different languages	Gerakli and Adlbrecht (2007)	Number of different languages	N/A
Number of different cultures	Gerakli and Adlbrecht (2007); Vidal and Marle (2008)	Number of different nationalities	N/A
Number of different norms and standards	Gerakli and Adlbrecht (2007); Vidal and Marle (2008)	Number of different norms and standards	Strategic, concept and detailed design stages
Variety of financial resources	Vidal and Marle (2008)	Number of financial resources	Construction stage
Variety of goals	Gerakli and Adlbrecht (2007)	Number of goals	Construction stage
Differentiation by territory	Müller and Turner (2007); Miller (1973); Hall (1979); Vidal and Marle (2008)	Number of locations	N/A
Number of partners, contractors, suppliers	Gerakli and Adlbrecht (2007); Baccarini (1996); Williams (1999); Ashby (1957); Vidal and Marle (2008)	Number of stakeholders	All stages
Number of activities	Vidal and Marle (2008)	Number of tasks	All stages
Differentiation by time (i.e. involved at different times during a project)	Baccarini 1996; Dewar and Hage (1978)	Overlapping office hours	All stages
Influence of politics	Gerakli and Adlbrecht (2007)	Political influence	Concept and construction stages
Scheduling	Thomas and Mengel (2008)	Project drive	Construction stage
Project duration	Xia and Lee (2005); Vidal and Marle (2008)	Project duration	Construction stage
Configuration of macro-organization (local stakeholders)	Gerakli and Adlbrecht (2007)	Required local content	Conception, strategic and concept stages
Skills	Thomas and Mengel (2008); Baccarini (1996); Vidal and Marle (2008)	Resource and skills availability	All stages
Risk management	Williams (2002)	Risk management	All stages
Number of deliverables, largeness of scope (number of components etc.), number of decisions to be made, quantity of information to analyze	Vidal and Marle (2008); Gerakli and Adlbrecht (2007)	Scope largeness	All stages
Size of the project (in budget)	Gerakli and Adlbrecht (2007); Müller and Turner (2007); Thomas and Mengel 2008; Williams (2002); Weaver (1948); Vidal and Marle (2008)	Size in capital expenditure	Construction stage
Size of the project (in number of people)	Gerakli and Adlbrecht (2007); Müller and Turner (2007); Thomas and Mengel (2008); Williams (2002); Weaver (1948); Vidal and Marle (2008)	Size in engineering hours	Construction stage
Number of project members	Xia and Lee (2005); Williams (1999); Vidal and Marle (2008)	Size of project team	All stages
Frequency and impact of changes in macro-organization (suppliers, contract, raw material pricing, exchange rates)	Gerakli and Adlbrecht (2007)	Stability project environment	Construction stage
Client transparency, empathy (the personal and intangible matter that improves cooperation)	Gerakli and Adlbrecht (2007)	Trust in contractor	Construction stage
Team transparency, empathy (the personal and intangible matter that improves cooperation)	Gerakli and Adlbrecht (2007); Vidal and Marle (2008)	Trust in project team	All stages
Frequency and impact of changes in technological aspects (quality, velocity etc.), dynamism (i.e. changing information, specifications, change order, etc.)	Gerakli and Adlbrecht (2007)	Uncertainties in scope	N/A
Degree of definition of methods	Gerakli and Adlbrecht (2007); Crawford (2005); Vidal and Marle (2008)	Uncertainty in methods	Conception and strategic stages
Variety of perspectives	Gerakli and Adlbrecht (2007); Vidal and Marle (2008)	Variety of stakeholders' perspectives	Conception, strategic and concept stages
Variety of tasks	Williams (1999)	Variety of tasks	All stages

2.2.2.1 Size of the project

The size of the project (dollars, length, width, structures, etc.) appears to be part of a vital condition for determining a project's complexity. Vidal (2008) marks it as a project complexity factor. The size of a project is directly linked to the size of a particular project effort. The primary sizing factors consider the project team size (number of staff), duration, cost and the number of potential stakeholders involved in the project.

2.2.2.2 Variety of the Project System

The range of the project scheme was recognised and deemed a necessary condition for the complexity of the project. Corbett et al., cited in Vidal, 2008 stated that:

...the one thing that comes through loud and clear is that complexity is tied up with variety, be it in the world of biology, physics or manufacturing. Moreover, it has something to do with how all of this variety interacts.

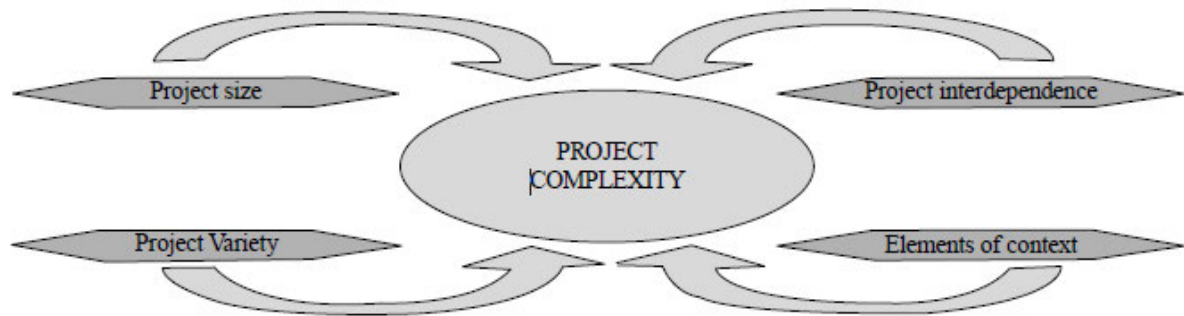


Figure 2: Drivers of project complexity (Vidal, 2008).

2.2.2.3 Project Interdependencies

Rodrigues and Bower cited in Vidal, 2008 have explained that:

...experience suggests that the interrelationships between the project's components are more complex than is suggested by the traditional work breakdown structure of project network

This suggests that project interdependencies have a significant bearing on project complexity and that the current and more traditional methods of project management cannot sufficiently keep up to the reality of interdependence (Vidal, 2008).

2.2.2.4 Project Contextually

Project contextually is consisted to be an important part of complexity due to it being a common denominator of a complex system. Koivu et al. cited in Vidal, 2008 identified project complexity which most notably consists of the fact that:

“...the context and practices that apply to one project are not directly transferable to other projects with different institutional and cultural configurations, which have to be taken into account in the processes of project management and leadership”.

This statement concludes that the complexity of the project cannot be analysed or managed without taking into account the project context consequences (Vidal, 2008).

2.3 Fundamental Uncertainties in projects and project management

2.3.1 Uncertainty in Estimates

Uncertainty relating to the potential variability in performance measures like cost, duration and the quality of planned activities (Atkinson, 2006). Many examples exist from many projects in the past where the time and effort needed to conduct a task, was not fully known or understood so this risk was carried into the next project process. The importance of estimating project activities is a critical one in terms of control and planning.

Atkinson (2006) determined the cause of uncertainty due to estimates included the following:

- “Lack of a clear specification of what is required”.
- “Novelty, or lack of experience of this particular activity”.
- “Complexity in terms of the number of influencing factors and associated inter-dependencies”.
- “Limited analysis of the processes involved in the activity”.
- “Possible occurrence of particular events or conditions which might affect the activity”.
- “Emerging factors unknowable at the start of the project”.
- “Bias exhibited by estimators, typically optimism bias” (Atkinson, 2006, p 688).

Typically uncertainty and lack of clarity in estimates comes from ambiguity, vagueness and contradictions because of the lack of data and inputs conducted by the project team, inaccurate of details, incompleteness of the project and its structure and how it is managed. Uncertainty of estimates also comes from the project team not involving all the players as well as ignorance in the amount of time, resources and effort that should be consumed to clarify the issue of incompleteness.

2.3.2 Uncertainty associated with project stakeholders

Uncertainties can exist in all projects with project parties playing an associated role in this as a consequence, while employees and other agents like the project owner, are essential to the achievement of project performance (Atkinson, 2006). The involvement of them into the projects organisational context can cause substantially adverse issues to the project. These include problems such as adverse selection, moral hazard and risk allocation (Atkinson, 2006). This becomes even more of an issue where these agents or parties are from different organisations, as the parties are less likely to share information (IP), responsibilities or objectives. Different stakeholders will have distinct performance goals, or differencing opinions of priorities and the way that they perceive objectives. The result of this is the different stakeholders will have distinct perceptions of the hazards connected with these goals and may therefore wish to embrace on different approaches to manage related project uncertainty (Atkinson, 2006). This creates a division and aggravation between the different parties as their perceptions and capabilities are misaligned as well as their ability to manage them. Ward cited in Ward 2008 argued that having multiple stakeholders in a project introduces uncertainties associated with:

- “Objectives, expectations and associated priorities of different stakeholders, and hence stakeholder perceptions about project risk”.
- “Specification of responsibilities”.
- “Perceptions of roles and responsibilities”.
- “Communication across interfaces”.
- “The capabilities of various stakeholders”.
- “Formal contractual conditions and their effects”.
- “Informal understandings on top of, or instead of formal contracts”.
- “Arrangements and mechanisms for coordination and control” Ward (2008, p. 569).

Defining the aspects the vagueness of responsibilities and roles of the project stakeholders has always been known to have a significant impact on the management of project-related uncertainty. Over recent time construction contractors have been able to exploit this vagueness of project roles through their ability to be more attentive than their overseeing client (via additional claims for example). The purpose of this is that the contractor is trying to identify additional revenue and extract the client for all funds possible. The client does maintain a level of control over the contractor via the conditions set out within the contract agreement between the two parties. The contract allows the client to determine what needs to be produced, the sum for the cost of the works, how the client can assess and monitor what the contractor is producing, and how things should proceed in the case of unforeseen events which typically result in costly project variations for the client. In theory, the contract seeks to reduce uncertainty about each party’s responsibilities however this sometimes cannot always be the case (Ward, 2008, p569).

Risk Allocation relates to whoever takes on the responsibility of project-related issues between the principal and the agent. Ward (2008) stated that risk allocation is very important because it can strongly influence the motivation of the principal and agent, and the extent to which uncertainty is assessed and managed. It has been long known within the construction industry that the principal and the agent perceive risks and manage them differently. They also have different skill sets and desires to manage risk that suits and makes them feel comfortable. A party or stakeholder is likely to attempt the management of uncertainty differently which in most cases is for their own advantage and in some instances to the other party’s disadvantage (Ward 2008).

2.3.3 Uncertainty associated with stages in the project life cycle

Determining stakeholder expectations and priorities in the early stage of a projects development can be associated with other difficulties later in the project process (Atkinson, 2006). Chapman and Ward identified six Ws frameworks for the purpose of addressing uncertainty in the management issues of the project life cycle. With these being:

1. “who are the parties ultimately involved?”
2. “what do the parties want to achieve?”
3. “what is it that each party is interested in?”
4. “which way (how) is each party’s work to be done?”
5. “what resources are required?”
6. “when does it have to be done?” Ward (2008, p 566).

Understanding each of these issues helps to show the uncertainty associated with effectively stating the basics of project risk management. Applying the six Ws frameworks at the earliest phases of the project life cycle can be incredibly helpful in informing project design and logistics growth by clarifying the key sources of uncertainty (Atkinson, 2006). The majority of this uncertainty typically occurs during the design and development (plan) stages as these process are not thoroughly enough carried out. The table 2 below identifies the typical uncertainty management issues in each stage of the project life cycle which was developed by (Chapman and Ward, 2003. Copyright John Wiley & Sons Ltd).

Table 2: Typical uncertainty management issues in each stage of the project life cycle (Chapman and Ward, 2003).

Stages of the PLC	Uncertainty management issues
Conceive the product	Level of definition
	Definition of appropriate performance objectives
	Managing stakeholder expectations
Design the product strategically	Novelty of design and technology
	Determining 'fixed' points in the design
	Control of changes
Plan the execution strategically	Identifying and allowing for regulatory constraints
	Concurrency of activities required
	Capturing dependency relationships
	Errors and omissions
Allocate resources tactically	Adequate accuracy of resource estimates
	Estimating resources required
	Defining responsibilities (number and scope of contracts)
	Defining contractual terms and conditions
	Selection of capable participants (tendering procedures and bid selection)
Execute production	Exercising adequate coordination and control
	Determining the level and scope of control systems
	Ensuring effective communication between participants
	Provision of appropriate organizational arrangements
	Ensuring effective leadership
	Ensuring continuity in personnel and responsibilities
	Responding effectively to sources which are realized
Deliver the product	Adequate testing
	Adequate training
	Managing stakeholder expectations
	Obtaining licences to operate
Review the process	Capturing corporate knowledge
	Learning key lessons
	Understanding what success means
Support the product	Provision of appropriate organization arrangements
	Identifying extent of liabilities
	Managing stakeholder expectations

2.4 Limited scope of project management

Atkinson (2006) stated that there is a current perception that conventional project management processes and practices do not effectively encompass all stages of the project life cycle as shown in table 2 previously. Atkinson (2006) also indicated that prevalent procedures in risk management often fail to tackle the fundamental sources of uncertainty that drive issues in the lifecycle of a project. The stage in particular that is known to not consider a more sound and comprehensive project management process in the current practises is during the conception stage (strategic/initial) and also the support at the tail end of the project with the strategic issues normally associated with the highest level of uncertainty.

Project management today is mainly just concerned with ticking off the required steps to get things done, with the assumption that it was complete and thorough. This view has meant such topics such as 'whole of life costs' and 'value management' workshops have appeared independently to the traditional management process. Atkinson (2006, p.691) also pointed out that standard project management (prevalent practices) are worried with legitimising the project plan, and uncertainty (surrounding fundamental basic sources of uncertainty) is being played down. The project manager is often considered as the acceptable recipient of project risk and uncertainty to assist the project owner in offering relief. If any subsequent issues arise during the project, the project manager is typically the scape-goat for the project owner which should not be the case and needs to be managed better.

2.5 Project Stakeholders – external and internal

Achterkamp and Vos (2008) stated that it is common knowledge in project management that in order to make a project a success, the interests of the key stakeholders or even that of all stakeholders should be taken into account. Stakeholders are known as persons, groups, neighbourhoods, organisations, institutions, societies and even the natural environment (Mitchell, Agle, & Wood, 1997). A stakeholder by definition has a stake in the particular activity or project. For the successful engagement of a stakeholder it is important to understand the nature of their involvement in gaining a successful outcome. This stake can be ownership, rights (moral or illegal), interest or support in the way of contribution or knowledge. It is also important to understand that particular groups and individuals have their own invested interests, or agendas they are trying to push in order to get their own desired outcomes. Unfortunately this does not always result in the best outcome for the project; therefore it is up to the project manager to best manage all these invested interests in an unbiased professional manner.

Mitchell, Agle, & Wood (1997) generated a stakeholder identification and salience model, distinguishing the attributes of power, legitimacy and urgency to assist in characterising different stakeholders into these three groups. This model shown in figure 3, distinguishes eight of the different types of stakeholders.

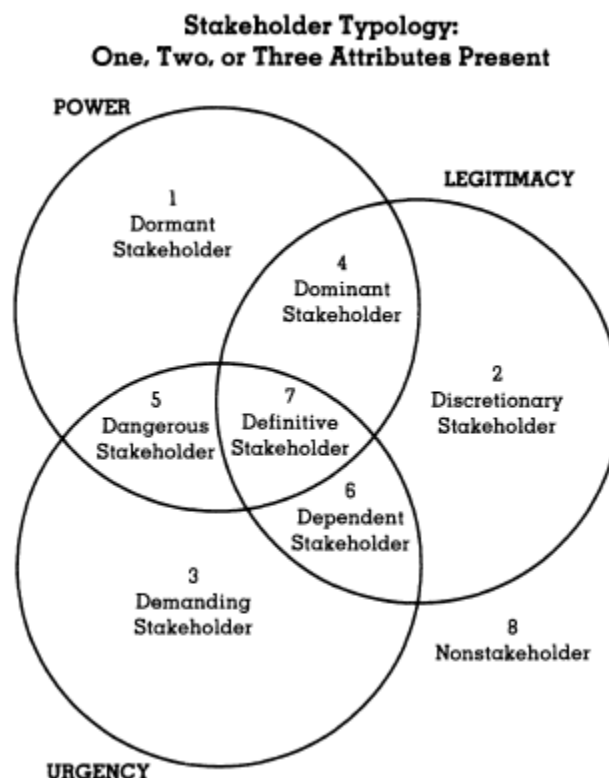


Figure 3: Stakeholder typology according to (Mitchell, Agle, & Wood, 1997).

Project managers are likely to do little in the way of dedicating a significant amount of resources, time and energy for a stakeholder that process only one of the identified attributes above. They are however likely to give more priority and effort for the higher salience stakeholders (process two or more attributes) claims in relation to a project. This typology mostly looks into the identification and classification of external stakeholders.

For internal stakeholders, those that are located within a project the four specific key roles are the client, decision maker (project management), designer (all those active in the project) and those stakeholders that are passively involved. Freeman (1984) defined stakeholders within an organisation as “...a stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization’s objectives...” (p. 46). There are stakeholders who are known to represent active roles and there are those impacted stakeholders who are represented in their fourth passive positions (Achterkamp and Vos, 2008).

Current research on stakeholders has suggested previously that they provide a number of key components to a projects success however at the same time can contribute to having a negative influence on a project complexity. Lu, Luo Wang Le & Shi (2014) identified that the combination of difficulties in communication and coordination are due to differences in thought processes as well as increased levels of organisational and management amplitudes due to large project numbers adding to a projects complexity. Other stakeholder influences can come from sub-contractors, government parties and other local pressure groups (Bosh-Rekveltdt, 2011). Stakeholders both external and internal can have their own personal agendas, as well as differing opinions and perspectives on the direction of the project and what the best outcome is for it. Probably the three key roles of the project owner (client), the project manager and team member all actively contribute most to a project throughout its development lifecycle so have to most relevant view in identifying the most appropriate contributions to project complexity.

2.6 Managing stakeholder relationships

A vital part of any project’s success comes from developing and maintaining good relationships with the stakeholders involved or affected by the project. Identifying and managing stakeholder’s expectations requires the right balance of leadership skillsets, communication, trust and understanding how different individuals or parties (groups) operate.

The purpose of stakeholder management is to achieve the overall general support of the project implementation for the purpose of identifying project related issues and not just stakeholder driven issues with background agendas (Mok, Shen, Yang, 2015). Managing stakeholder relationships is a process best managed continuously during the entire project development and construction stages in order to achieve an optimal outcome. By involving all stakeholders particularly project stakeholders in the planning, decision making and implementation processes, clearer project paths and reduced conflicts can be achieved.

Landin (2000) considered that the long-term success and stakeholder satisfaction of any construction project is that it is dependent on the decision making process of the decision maker in this case the project manager and their care in being able to maintain a strong stakeholder communication connection. Other literature like Bakens, Foliente & Jasuja (2005) agreed with the bases set by Landin that the key to a good stakeholder management is communication. Aaltonen, Jaakko & Tuomas (2008) found that another important factor in maintaining a strong stakeholder management is the relationship between the stakeholder and the project team members. All these factors were cited as critical success factors for stakeholder management, but verification was needed through further quantitative and qualitative studies (Yang, Shen, Ho, Drew & Xue 2011).

2.7 Literature Review Conclusions

After reviewing the literature it was identified that there was a large number of different extents of different concepts, definitions and opinions surrounding project complexity and its elements. No clear definition or direction was found to be consistent across any of the literature reviewed and none of which appeared to be defined from a project stakeholder's perspective. Other studies like Bosch-Rekvelde, et al., (2010) were also found to have identified a number of different elements that existed in contributing to project complexity from different literature however few sources clearly indicated what stage of the project lifecycle that these elements contributed most to a project's complexity.

While conducting this literature review, a strong link between project complexities and uncertainties in projects was found. Atkinson (2006) related uncertainty to the potential variability in performance measures like cost, duration and the quality of planned activities. Atkinson demonstrated that uncertainties in estimates, project stakeholders and the project lifecycle (who, what, when, etc.) all had a significant contribution in adding to the complexity of a project.

Achterkamp and Vos (2008) indicated that it is common knowledge within the field of project management that in order to make a project successful, the interests of the key stakeholders or even that of all stakeholders should be taken into account. The review found that the vital part of that project success was through developing and maintaining good relationships with all stakeholders involved or affected by that of a project. Factors like communication, trust and understanding to what drives a particular party or individual in terms of their desires, expectations and what they considered important.

All these factors in one way or the other are having a significant impact on the time, cost and efficiency associated with completing a large construction project on time and under budget. Identifying these factors of complexity at different stages of the project lifecycle appears to be still unknown. While the ability to control and manage these risks of complexity and uncertainty by using current conventional project management guidelines is currently questionable and further research is needed to identify these, as some of the fundamental sources of uncertainty are being played down.

3.0 Methodology

3.1 Introduction

To collect data a web-based questionnaire survey was developed for experienced and knowledgeable road construction industry practitioners to act as the respondents. A survey is regarded an appropriate research tool to collect enough information points across various study units (Baarda & de Goede, 2006; Verschuren & Doorewaard, 1999). The questionnaire survey method has been vastly used and applied as a measurement method across multiple research papers and articles in the past for the purpose of measuring project complexity and other associated factors. The advantages of performing an on-line survey over that of a case study or face-to-face interview are detailed and listed below:

- Convenience: easy and convenient for respondents to complete, which creates increased engagement and more confidence in response rates.
- Cost-efficiency: reduces set-up and administration costs as no paper, printing or postage is needed. It also minimises time taken out of employers days over an interview for example.
- Accessibility and reach: surveys increases accessibility as they can be accessed through multiple devices (laptops, tablets, mobile phones, etc.). A link to a survey can be sent via e-mail to reach people quickly around different locations.
- Objectivity: online surveys add objectivity to the feedback by the way of eliminating any influence on responses that may be present in telephone call or in-person surveys.
- More Accurate: a number of studies have indicated that there is a significant less margin-of-error in on-line surveys making them more accurate.
- Quick Results: real-time results can be received as soon as a respondent has completed the questionnaire, so it can be view and analysed very quickly.

The Delphi survey method was the methodology approach used in order to build a general consensus using a panel of selected experts who completed a series of two rounds of questionnaires for the purpose of providing a controlled feedback opinion. The number of rounds in this method can vary between two and seven, with too many rounds wasting the respondent's time (Rowe and Wright, 1999; Adnan and Morledge, 2003). In order to achieve an acceptable consensus, two rounds of questionnaires were found as achieving the required agreement from within the group.

The results from the first round feed into the following round in order to achieve this controlled feedback opinion. Masini (1993) stated that even though judgements obtained from industry experts can consist of subjective opinions at times, they are considered more reliable than an individual statement and more objective in their overall outcomes. Other advantages with this methodology are that the responses are weighted equally so that the opinions of the group don't shift; it also allows respondents to reconsider their previous

response based on the rankings of others. This is why the Delphi method is considered to be a best-known consensus reaching approach (Fowles and Jones, 1983) which is appropriate for this research topic.

The structure for the methodology in which the survey was conducted was in the form of a mixed approach of both the quantitative and qualitative research methods. As both of these research methods have the advantage to work much better as a team and have the benefit of not conflicting. Past research by Bosch-Rekvelde (2011) and Xia & Chan (2012) completed on project complexity have adopted a similar structural approach like this.

Adopting that of just a quantitative approach can run the possibility of providing a too vague of an approach however does have the advantage of being easier and quicker to answer over that of qualitative. Quantitative questions are more quantifiable and provided a better quality of data. The methodology of this research is to combine the two methods with a combination of quantitative and some qualitative questions.

As this research wants to generate reliable, generalisation and apply a statistical analysis approach, a structured method will be used as specific questions and hypotheses need to be investigated as part of this research. The advantage that this method opposed to a loosely structured one is it produces data that can be analysed. This allows the researcher to determine a possible result or response ahead of time which assists in reducing the time respondents spend working on the questionnaire. A less structured approach does discover new ideas that perhaps might not have been identified at the beginning of the study, however it is not always known their reliability and generates doubts in the research that a structural approach aims to avoid (Seale, 2012).

This survey approach was used for developing both an Importance weighting and a Complexity index generated from the experts scoring and comments for the purpose of reflecting on the complexity degrees across the whole project process while also considering a few other factors. Different parties have different understandings of project complexity; thus, the evaluation system used will assist in considering the position of the project stakeholders.

3.2 Data Collection

In order to meet the project aim described, draw results and resolve conclusions a questionnaire Delphi survey methodology for data collection was applied, this approach has been used in past literature by Gidado (1996) and Xia and Chan (2012) as a processes for measuring project success and complexity.

The target group of the survey consisted of a number of different project stakeholder professionals across a single organisation (RMS). Ethical approval to conduct this approach was granted by the university before being undertaken refer to Appendix B. Prior to distributing the survey a participation information sheet was provided to a number of individuals to seek their initial approval and so they could understand the dynamics of the questionnaire, for the purpose of creating commitment amongst the respondents and hence improve the response rate (Porter & Whitcomb, 2007).

Both rounds of the questionnaire were issued to the same respondents both times via e-mail with round one of the survey open and on-line for a week, with the results collated over the weekend prior to issuing out round two of the questionnaire in the following week.

The data collection procedure was conducted as follows:

- Conduct a review of existing literature to find gaps in research to identify and create the questionnaire survey.
- Received ethics approval from USQ prior to undertaking questionnaire.
- The online questionnaire was developed and conducted in two rounds, round 1 involved respondents answering questions relating to their demographic information (names will not be published) such as educational background, work experience (years), designation (role) and stakeholders interest area. The secondary part involved respondents answering a series of multiple-response structured questions followed by a selection of open-ended questions which will be ranked in the following round 2 (Refer to section 3.5 for research questions).
- In round 2 each respondent selected received a second questionnaire based on the results found in the previous round. Selected respondents ranked items in order of their priority using a Likert scale with '1' corresponding to 'highly important' and '5' 'low importance' for example. In this round a consensus is formed and the actual outcome can be presented from the respondents (Jacobs, 1996).

3.3 Sample procedure

The primary objective of this research was to collect data inputs regarding the subject of project complexity from different stakeholder perspectives, the panel of respondents completing the survey needed to be hand pick on the bases of them having a competent knowledge of road project management principles and practices. The majority of panel respondents selected needed to have a minimum of 5 years but preferably more than 10 years with an engineering educational background and working in a senior or managers role. As a sound educational background was a preference, it was important to make sure that they made up at least 60-70% of the respondents. Respondents also needed to have an appropriate experience level working on complex projects.

The panel respondents proposed were selected from within Roads and Maritimes Services (RMS). RMS is the NSW transport cluster operating organisation that delivers value to its clients and the community through secure, effective and high-quality highway and maritime networks as part of the transport scheme.

Panel respondents consisted of a combination of project team members (road designers/ structural engineering/ environment, contracts, etc.), project managers, project engineers and some senior managers, for the purpose of obtaining a consistent and board organisational wide knowledge data set.

The project team panel respondents used in this research study are classified as long-term project teams, which are known to be more balanced and permanent in terms of working within an organisation. The advantages of this is that roles and tasks are clearer and more easily understood and defined versus that of a short-term project that is less than one year in duration where this is sometimes not the case. The same project team respondents were used across the two round questionnaires for the purpose of maintaining a consistent result and knowledge based across the two rounds, reducing the error in the results.

3.4 Sample size and response rate

The questionnaire was sent via e-mail as an electronic survey to help assist in providing a better communication link between the researcher and the respondent. The purpose of this method is that it provides a more cost-effective way of conducting research while also giving a better quality of data including a faster rate of response. The majority of Delphi method studies in the past have typically consisted of a respondent's panel of 15-20 people (Ludwig, 2001). Ziglio (1996) stated that good results could be achieved with a panel of as small as 10-15 respondents. For this research project 15 industry experts were handpicked from within RMS from varying backgrounds as stated in section 3.3. The quiz was tailored and designed to be limited to a timeframe of approximately 15-20 minutes for both rounds, as the majority of respondents were completing it within work time. A two week timeframe was allowed for the completion of rounds 1 and 2 as well as the analysis of the questionnaire results received after round 1.

3.5 Research questions

The following research questions were designed based on the aims and objectives of the research project as well as gaps, uncertainties and inconsistencies identified in existing literature. The questions have been developed as not to be too difficult to answer, analytical not descriptive, not too broad or too narrow and were aimed to be clear and focused. The Delphi method methodology approach used (see chapter 3 for details) consisted of a two-round questionnaire. Both round 1 and 2 questions have been provided (Refer to Appendix C for on-line questionnaire details and layout).

The questionnaires round 1 and round 2 survey questions are listed below:

Question 1 (Round 1 and 2)

Consent Form

The purpose of this research project is the analysis of influencing factors of construction project complexity from different stakeholder's perspectives. This is a research project being conducted by Mitchell Rowles from the University of Southern Queensland. You are invited to participate in this research project because you are experienced in the field of road construction. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about your experiences in the roads industry. We will do our best to keep your information confidential. All data is

stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Southern Queensland representatives.

If you have any questions about the research study, please contact Mitchell Rowles. This research has been reviewed and approved according to University of Southern Queensland procedures for research ethics.

Electronic consent: Please select your choice below.

Clicking on the “agree” button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the ‘disagree’ button.

- Agree
- Disagree

Question 2 (Round 1 only)

What is the highest level of education you have currently completed?

- Graduated from high School
- Associate Degree
- Technology Degree
- Bachelor Degree
- Other (please specify)

Question 3 (Round 1 only)

How many years of work experience or knowledge do you have in the roads engineering field?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 20+ years
- Other (please specify)

Question 4 (Round 1 only)

What is your current job role?

- Individual Contributor
- Team lead
- Manager
- Senior Manager
- Regional Manager
- Client
- Other (please specify)

Question 5 (Round 1 only)

What is the classification of your current job role or stakeholder role?

- Road Designer
- Surveyor
- Geotechnical Engineer
- Contracts Management
- Environment
- Project Management
- Engineer
- Contractor
- Other (please specify)

Question 6 (Round 1 only)

Can you provide five project complexity measures that you consider to be the most important from a large scale project you have recently worked on?

Responses to provide a list of five measures (Provide respondents some potential examples found in literature as listed below):

- Cost Constraints
- Technical Aspects
- Organisation (Resources)
- Number of Stakeholders Involved (internal and external)
- Project Size (Number of people and budget)
- Urgency of the project schedule (time management)
- Environment (Access/Location)
- Construction Methods
- Buildability of the design work
- Delivery System
- Form of Contract
- Knowledge based (education and training)
- Project duration
- Other (please specify)

(Round 2 only, follow-up question, Question 2)

Filtered and analysis respondent's answers to provide top five listed for respondents to rank in terms of importance.

Can you rank the five complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

- Technical Aspects
- Cost Constraints
- Urgency of project schedule (time management)
- Environment (Assess/Location)
- Buildability of the design work

Rank in order with 1 the most important and 5 being the least, a Not Applicable tick box was provided.

Question 7 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Definition of project objectives
- Level of project definition
- Managing stakeholder expectations
- Project expectations
- Obtain approval to proceed
- Other (please specify)

(Round 2 only, follow-up question, Question 3)

Filter and analysis respondent's answers to provide top four listed for respondents to rank in terms of importance.

Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

- Definition of project objectives
- Level of project definition
- Managing stakeholders expectations
- Project expectations

Rank in order with 1 the most important and 4 being the least, a Not Applicable tick box was provided.

Question 8 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Determining the design layout and its 'fixed' points
- Level of unknowns (Geotechnical, community, environment, road design accuracy, etc)
- Consulting appropriate stakeholders
- Strategic estimate
- Confirming the preferred option (for concept design)
- Obtain approval to proceed
- Other (please specify)

(Round 2 only, follow-up question, Question 4)

Filter and analysis respondent's answers to provide top four listed for respondents to rank in terms of importance.

Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

- Level of unknowns (Geotechnical, community, environment, road design accuracy, etc.)
- Consulting appropriate stakeholders
- Strategic estimate
- Confirming the preferred option (for concept design)

Rank in order with 1 the most important and 4 being the least, a Not Applicable tick box was provided.

Question 9 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Defining contractual terms and conditions (if required)
- Engineering and field investigation outcomes
- Selection of project team (tender selection, internal team members, etc)
- Preparing the REF
- Identifying utility impacts
- Development the concept design
- Concept design estimate
- Obtain approval to proceed
- Other (please specify)

(Round 2 only, follow-up question, Question 5)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

- Engineering and field investigation outcomes
- Developing the concept design
- Concept design estimate

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 10 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Managing project risks
- Managing the level and scope of the project
- Continuity in personal and responsibilities
- Developing the detail design
- Detailed design estimate
- Preparing construction contract documents
- Obtain approval to proceed
- Other (please specify)

(Round 2 only, follow-up question, Question 6)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

- Managing project risks
- Managing the level and scope of the project
- Developing the detailed design

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 11 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Managing construction activities and services
- Managing site risks (unknowns)
- Adjusting public utilities
- Tendering and tender estimate
- Managing construction contracts
- Managing stakeholder expectations
- Other (please specify)

(Round 2 only, follow-up question, Question 7)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can the rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

- Managing construction activities and services
- Managing site risks (unknowns)
- Managing construction contracts

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 12 (Round 1 only)

Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Identifying ongoing maintenance work and planning
- Finalising and handover of the completed works
- Post completion review (what successes and key learnings were identified)
- Identifying extent of liabilities
- Managing stakeholder expectations
- Provision of appropriate organisation arrangements
- Other (please specify)

(Round 2 only, follow-up question, Question 8)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

- Identifying ongoing maintenance works and planning
- Finalising and handover of the completed works
- Post completion review (what successes and key learning's were identified)

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 13 (Round 1 only)

What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?

- Politicians
- Community
- Project owner (Client)
- Project manager
- Project team members
- Environmental
- Contractor
- Other (please specify)

(Round 2 only, follow-up question, Question 9)

Filter and analysis respondent's answers to provide top five listed for respondents to rank in terms of importance.

Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

- Politicians
- Community
- Project owner (Client)
- Project Manager
- Environmental

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 14 (Round 1 only)

Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?

Responses to provide a list of three measures in any order (Provide respondents some potential examples found in literature as listed below):

- Project Owner (Client)
- Project Manager
- Project Team
- Contractor
- Construction Team
- Other (please specify)

(Round 2 only follow-up question, Question 10)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in delivery of a project? (With 1 being the most important and 3 being the least)

- Contractor
- Project Manager
- Project Owner (Client)

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 15 (Round 1 only)

Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?

- Yes
- No

Question 16 (Round 1 only)

Can you select three stages of a projects development lifecycle that you believe is the most important in managing both internal (project team) and external (community, political) stakeholders inputs?

Responses to provide a list of three measures in any order (Provide respondents some potential examples found in literature as listed below):

- Conception of the project
- Strategic design stage
- Concept design stage
- Detailed design stage
- Construction stage
- Finalisation stage
- Other (please specify)

(Round 2 only follow-up question)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three stages of the projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

- Conception of the project
- Strategic design stage
- Concept design stage

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 17 (Round 1 only)

At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please provide three project lifecycle stages that you consider most important in any order?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Conception of the project
- Strategic design stage
- Concept design stage
- Detailed design stage
- Construction stage
- Finalisation stage
- Other (please specify)

(Round 2 only follow-up question, Question 12)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

- Conception of the project
- Strategic design stage
- Concept design stage

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 18 (Round 1) (Question 13 in Round 2)

Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders): – Strongly agree/agree/Neither agree or disagree/disagree/Strongly disagree/ Not Applicable

- Should the general public have more influence over a projects objectives and direction
- Do external partners (contractors) and internal clients (principal) perceive risks differently
- Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantages of the other, impacting on the overall project goals
- Does the above statement occur on projects managed internally by a single organisation

Measure differences in the stakeholder's answers between rounds 1 and 2 after completing the questionnaire both times.

Question 19 (Round 1 only)

What stage of the project development process do you believe is most likely to be overlooked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?

Responses to provide a list of three measures (Provide respondents some potential examples found in literature as listed below):

- Conception of the project
- Strategic design stage
- Concept design stage
- Detailed design stage
- Construction stage
- Finalisation stage
- Other (please specify)

(Round 2 only follow-up question, Question 14)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you rank the three stages of the project development process that you believe is most likely to be overlooked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least).

- Conception of the project
- Strategic design stage
- Concept design stage

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 20 (Round 1) (Question 15 in Round 2)

Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders):- Strongly agree/agree/Neither agree or disagree/disagree/Strongly disagree/ Not Applicable

- Different stakeholders had different perspectives
- The larger the number of stakeholders the higher the project complexity (difficulty)
- Different stakeholders (internal only) perceive risks in relation to objectives differently
- Does a project suffered from late stakeholder engagement/involvement
- Different stakeholders have different interest levels
- Do all stakeholders align themselves with the projects objectives

Measure differences in the stakeholder's answers between rounds 1 and 2 after completing the questionnaire both times.

Question 21 (Round 1 only)

A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?

- Communication
- Trust
- Consistent Message
- Minimise surprises (scope change)
- Developing relationships
- Education
- Addressing issues as and when they arise
- Other (please specify)

(Round 2 only follow-up question, Question 16)

Filter and analysis respondent's answers to provide top three listed for respondents to rank in terms of importance.

Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

- Communication
- Developing relationships
- Addressing issues as and when they arise

Rank in order with 1 the most important and 3 being the least, a Not Applicable tick box was provided.

Question 22 (Round 1 only)

What do you believe is the best method of managing different stakeholder's perspectives or inputs? (This can be the community or other project individuals for example)

Question 23 (Round 1) (Question 17 in Round 2)

Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders: Strongly agree/agree/Neither agree or disagree/disagree/Strongly disagree/ Not Applicable

- Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.
- Does conventional project management used today best manage stakeholder inputs
- Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level, operational procedures.
- The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.

Measure differences in the stakeholder's answers between rounds 1 and 2 after completing the questionnaire both times.

Question 24 (Round 1 only)

What gaps exist in the current project management guidelines that could better manage complex projects?

(Round 2 only follow-up question, Question 18)

Filter and analysis respondent's answers to provide listed for respondents to select their top most applicable in terms of importance.

Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects (Select at least or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed
- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a project lifecycle
- Political interference and unrealistic expectations which can't be addressed by guidelines
- Closing out stakeholder issues before commencing to next stage
- Managing and improving the operational performance of their own project team
- Clients knowledge of project complexities
- No gaps, guidelines are through enough as is
- Organisation collaboration
- Efficiencies with the level of bureaucracy in government
- Additional information needed on how/who manages project risks
- None of these are applicable

3.6 Data Analysis

The data analysis process was conducted in two stages during the research project, following the round 1 responses being returned as well as the responses from Round 2 by the panel of experts. Details of these analysis processes for both rounds are explained in the following sections.

3.6.1 Round 1 Analysis

The first round of the Delphi questionnaire was part of forming an importance consensus, undertaken as part of the examination process. For the questions asked every selected expert was required to select either their top five or top three most critical important complexities measured based on their expert experience within the roads industry. The selections provided were those determined within the literature reviewed with an option on all of the questions for respondents to add additional comments.

The data and respondents comments, determined in round one of the questionnaire, were feed into determining the top ranking elements required for round two. Similar to Chan, A., Yung, E., Lam, P., Tam, C. and Cheung, S. (2001), measures were selected based on 50% of the industry experts selecting them for further ranking and consideration. As there was an odd number of respondent's selections of seven votes or 47% were rounded up as meeting the cut off criteria due to the number of experts available. In the extremely odd event that there are cases where the greater than plus 47% selection was not achieved the nearest measure was rounded up to provide a top five or top three ranking selection as part of round 2.

Short-answered responses were filtered down with the key terms identified using a word cloud system and collaborated together to feed into the selection process for round two where applicable in this research.

3.6.2 Round 2 Analysis

The second round of the Delphi questionnaire was part of the determining and constructing an overall consensus within the same selected panellists that conducted round 1, regarding the importance of measures and their complexity to a road construction project. A Likert point scale was then used as described in section 3.2 to allow each of the measurable items conducted in the round 2 to be ranked and scored.

From this data the mean score and the Importance weighting (W_{CMi}) could be derived. The W_{CMi} was found using the following Equation 1 below:

$$W_{CMi} = M_{CMi} / \sum_{i=1}^n M_{CMi}$$

Equation 1: Importance weighting formula.

Where:

W_{CMi} = represents the importance weighting of a particular measure

M_{CMi} = represents the mean rating of a particular measure

$\sum M_{CMi}$ = represents the total sum of the mean ratings being measured

n = number of measures being rated

The mean score and Importance weighting was used for the purpose of determining the significance that the particular measurable item had based on the opinion of the panel and how it impacts on construction and development.

The secondary part of the analysis involved developing a Complexity Index (CI) rating system for road projects to reflect the complexity degree at the different stages of the project lifecycle for the project complexity questions only. The complexity rating system equation was obtained based on the determined mean values established as part of the quiz results. The purpose of developing this complexity equation was to assess the complexity of the measurable road construction lifecycle stage elements.

As part of this process Kendall's coefficient of concordance (W) was also determined for the purpose of obtaining a measure of consistency and is also used as it is a measure of the amount of agreement among the panel of respondents. In combination with the Pearson correlation matrix for the purpose of showing the correlation coefficients between the variables that were measured. So that linear trends could be discussed between the measures for project complexity at different stages of a construction project.

3.7 Validation

The validation process used to determine if the questionnaire measures what it was designed to measure is the use of the content validation. This validation process refers to observing the aim and objectives of the research project to assist in determining whether or not the questionnaire addresses this topic appropriately. This approach is most often considered to be the most important of the validation processes particularly when developing and designing a new questionnaire.

Another part of the validation process for this research project was ensuring the panel member experts selected meet a majority of the sufficient working experience requirements within the road construction industry field, of having at least 5 years of experience, a diverse panel stakeholder background role and holding a leadership position as detailed in section 3.3. All these factors were essential to ensuring the validity of this Delphi study.

The purpose of adopting these approaches was that it ensured all the desirable measurements were taken, in that all are of the correct quality and that none were missed for the purpose of improving the accuracy and overall outcomes of the research.

4.0 Results and Analysis

4.1 Selection of expert panel

The selection panel of experts is an important part of conducting a Delphi study. For the purpose of this survey the majority of panel members were selected based on the following criteria:

- 1) Having sufficient working knowledge and experience in the road construction industry field.
- 2) Be from within a single large scale organisation so are considered long term.
- 3) Have at least a minimum of 5 years but preferably more than 10 years with an engineering educational background.
- 4) Have a combination of diverse project team members for the purpose of obtaining a consistent and board organisational wide knowledge data set.

The purpose of selecting panel members based on the criteria above was to ensure the validity of the survey in being able to achieve a solid knowledge base. A panel of fifteen industry experts were selected based on meeting the majority of the requirements above, agreeing to share their time and knowledge in this Delphi survey. The majority of Delphi method studies in the past have typically consisted of a respondent's panel of 15-20 people. Ludwig (2001) and Ziglio (1996) stated that good results can be achieved with a panel of as small as 10-15 respondents which was why this middle number was selected. A listing of the panel members for this survey is shown in table below.

Table 3: List of job panel experts.

Classification of current stakeholder role	Number
Road designer	2
Surveyor	1
Contracts management	1
Environment	1
Project manager	4
Engineer (Civil)	6
Total	15

The selected respondent's experts were from a wide range of different stakeholder backgrounds, with a slight favour towards project managers and engineers. As they were considered to have a greater knowledge set of the overall requirements for managing large projects and their processes for the purpose of providing an even view for this Delphi study. All the experts selected had an acceptable level of expertise and experience in the development and construction of road projects. The table below shows the number of years the panel had been involved the road industry.

Table 4: Respondents years working in the road construction industry.

Years	The percentage
0-5	20%
6-10	33.33%
11-20	13.33%
16-20	6.67%
20+	26.67%
Average (Years)	>80% over 7 years

The majority of experts held senior or manager positions within the organisation. The panel's current job roles are shown in the table below.

Table 5: Job role of panel experts.

Classification of current job role	Number
Individual contributor	4
Team lead	2
Manager	4
Senior manager	2
Client	3

The expert panel was also as part of the selection criteria had to have a sufficient level of education ideally in the form of an engineering degree. The respondent's current level of education they had completed when this survey was completed is shown in the Table 6 below.

Table 6: Experts panel highest level of education.

Highest level of education	The Percentage
Graduated from high school	6.67%
Associate degree	20%
Bachelor degree	60%
Masters	13.33%

The appropriate job classification, senior working roles, working experience and level of educational background of the panel of experts selected ensures and helps secure the validity of this Delphi research project.

4.2 Overall road construction project complexities

4.2.1 Round 1: Listing the complexity measure for an overall large scale road construction project

The panels experts were asked to select their five most important and critical complexity measures. They were also given the option to comment and add any additional ones to the thirteen provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 7 below.

Table 7: Complexity measures for an overall road construction project provided by respondents in round one of the Delphi survey.

Complexity measures for a road construction project (overall)	Experts frequency	Responses No.
1. Technical Aspects	80%	12
2. Cost Constraints	73%	11
3. Urgency of the project schedule (time management)	60%	9
4. Environment (Access/Location)	60%	9
5. Buildability of the design work	47%	7

6. Number of stakeholders involved (internal and external)	27%	4
7. Project size (Number of people and budget)	27%	4
8. Delivery System	27%	4
9. Organisation (Resources)	20%	3
10. Form of Contract	20%	3
11. Construction Methods	14%	2
12. Knowledge base (education and training)	14%	2
13. Project Duration	14%	2
14. Construction quality and maintainability (added)	7%	1
15. Safety (added)	7%	1

As discussed in section 3.6.1, like that of Chan et al. (2001), measures were selected based on 50% of the industry experts selecting them. As there were fifteen respondents, in the event where the responses equaled 47% results to round up in order to meet that 50% cut off mark. Five of these complexity measures met this criterion as part of the round one, they included:

- 1) Technical aspects.
- 2) Cost constraints.
- 3) Urgency of the project schedule (time management).
- 4) Environment (access/location).
- 5) Buildability of the design work.

Panel members added in two comments of safety and construction quality and maintainability which were considered to be indirectly related to the top five complexity measures selected and therefore were not carried through.

4.2.2 Round 2: Rating and determining the complexity measure for an overall large scale road construction project

In the second round the panel members were asked to rank the top five complexity measures determined in the section above. For the purpose of determining which of the five complexity measures they considered to be most important. The results from the second round are shown in the Table 8 below.

Table 8: Complexity measures for an overall road construction project provided by respondents in round two of Delphi survey

Complexity measures for a road construction project (overall)	Mean	Rank	Importance weightings
Buildability of the design work	3.53	1	0.235
Cost Constraints	3.40	2	0.227
Technical Aspects	3.27	3	0.218
Environment (Access/Location)	2.47	4	0.165
Urgency of the project schedule (time management)	2.33	5	0.155

Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.683 Level of significance = 0.766

It can be seen that the ranked order of three of the top five complexity measures changed between the round one and two surveys being conducted (see Table 9 below). With the buildability of the design work moving up five positions and the technical aspect and urgency of the project schedule (time management) both dropping two places respectively.

Table 9: Ranked change of complexity measures from Delphi rounds one to two for an overall road construction project

Round 1	Round 2	Order Change (R2 to R1)
1 Technical Aspects	1 Buildability of the design work	+5
2 Cost Constraints	2 Cost Constraints	=
3 Urgency of the project schedule (time management)	3 Technical Aspects	-2
4 Environment (Access/Location)	4 Environment (Access/Location)	=
5 Buildability of the design work	5 Urgency of the project schedule (time management)	-2

To determine a composite indicator for the purpose of assessing the complexity of an overall road construction project, a Complexity Index (CI) was created which is shown in the following Equation 2.

$$CI = 0.235 \times \text{Buildability of the design work} + 0.227 \times \text{Cost Constraints} + 0.218 \times \text{Technical Aspects} + 0.165 \times \text{Environment (Access/Location)} + 0.155 \times \text{Urgency of the project schedule (time management)}$$

Equation 2: Complexity Index overall construction project.

The Equation 2 index was obtained on the premise that this model is considered linear and additive. The derivation of this linear and additive model is logical and valid as shown in the Table 10 below, the Pearson correlation model shows that the top five weighted complexity measures are not strongly correlated at the 5% level of significance. Although the use of a non-linear model to fit the data obtained seems more appropriate, over-fitting can be a common issue with some non-linear models, particular these where the sample size is not overly large (Neter et al., 2005; Weisberg, 2005).

Table 10: Correlations matrix among the five measures for an overall road construction project.

Road construction project (Overall) correlations matrix among the five complexity measures					
	Buildability of the design work	Cost Constraints	Technical Aspects	Environment (Access/Location)	Urgency of the project schedule
Buildability of the design work	1	-0.463*	0.101	-0.039	-0.205
Cost Constraints		1	-0.340	-0.373	-0.066
Technical Aspects			1	-0.268	-0.439
Environment (Access/Location)				1	-0.327
Urgency of the project schedule (time management)					1

Notes: * $p < 0.05$, ** $p < 0.01$, $p < 0.001$ (1-tailed)

Kendall's coefficient of concordance (W) was also determined for the purpose of obtaining a measure of consistency. For this measureable item it was found to be 0.683. This indicated a significant amount of agreement amongst the group. As the level of significance (see Table 8) was found to be greater than 0.05, there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.3 Conception stage road construction project complexities

4.3.1 Round 1: Listing complexity measures for a road construction project during the conception stage

The panel experts were asked to select their three most important complexity measures. With the option to comment and add any additional ones to the five provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire for during the conception stage are shown in the Table 11 below.

Table 11: Complexity measures during the conception stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the conception stage	Experts frequency	Responses No.
1. Definition of project objectives	87%	13
2. Level of project definition	67%	10
3. Managing stakeholder expectations	67%	10
4. Project expectations	67%	10
5. Obtain approval to proceed	14%	2

The results showed the four complexity measures selected by respondents as most important during the conception stage for the first round of the survey; they were as follows:

- 1) Definition of project objectives.
- 2) Level of project definition.
- 3) Managing stakeholder expectation.
- 4) Project expectations.

The panel's members did not add any additional comments in the responses.

4.3.2 Round 2: Rating and determining the complexity measures for a road construction project during the conception stage

In the second round panel members were asked to rank the four complexity measures as determined in the section above. This was done for the purpose of determining which of the four complexity measures they considered to be most important during the conception stage. The results of the second round are shown within the Table 12 below.

Table 12: Complexity measures during the conception stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the conception stage	Mean	Rank	Importance weightings
Definition of project objectives	3.73	1	0.373
Level of project definition	2.53	2	0.253
Project expectations	2.27	3	0.227
Managing stakeholder expectations	1.47	4	0.147

Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.808 Level of significance = 0.114

The order of the ranked measures only changed minimally. With both the managing stakeholder expectations and project expectations changing positions between the two surveys rounds as shown in Table 13 below.

Table 13: Ranked change of complexity measures from Delphi rounds one to two during the conception stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Definition of project objectives	1 Definition of project objectives	=
2 Level of project definition	2 Level of project definition	=
3 Managing stakeholder expectations	3 Project expectations	+1
4 Project expectations	4 Managing stakeholder expectations	-1

In order to determine the composite indicator for the purpose of assessing the complexity items during the project conception stage. A Complexity Index (CI) was created as shown in the following Equation 3.

$$CI = 0.373 \times \text{Definition of project objectives} + 0.253 \times \text{Level of project definition} + 0.227 \times \text{Project expectations} + 0.147 \times \text{Managing stakeholder expectations}$$

Equation 3: Complexity Index conception stage.

Equation 3 complexity index was obtained on the premise that this model is considered linear and additive. Similarly to section 4.2.2, the Pearson correlation model of the top four weighted complexities during the conception stage are shown in the Table 14 below.

Table 14: Correlations matrix among the four measures during the conception stage.

Road construction project conception stage correlations matrix among the four complexity measures				
	Definition of project objectives	Level of project definition	Project expectations	Managing stakeholder expectations
Definition of project objectives	1	-0.348	-0.399	0.163
Level of project definition		1	-0.501*	-0.533*
Project expectations			1	-0.236
Managing stakeholder expectations				1

Notes: * p < 0.05, ** p < 0.01, p < 0.001 (1-tailed)

The Kendall's coefficient of concordance (W) was used as a measure of the amount of agreement amongst the panel of respondents. For this measureable item it was found to be 0.808. This indicated a significant strong amount of agreement amongst the group across the four measures. From the level of significance (see Table 12) was determined to be greater than 0.05, therefore there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.4 Strategic design stage road construction project complexities

4.4.1 Round 1: Listing complexity measures during the strategic design stage

The panel was asked to select their three most important and critical complexity measures for the strategic stage. With the option to comment and add any additional ones to the six provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 15 below.

Table 15: Complexity measures during the strategic design stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the strategic design stage	Experts frequency	Responses No.
1. Level of unknowns (geotech, community, environment, road design accuracy, identifying constraints, etc	87%	13
2. Consulting appropriate stakeholders	54%	8
3. Strategic estimate	54%	8
4. Confirming the preferred option (for concept design)	54%	8
5. Determining the design layout and its 'fixed' points	34%	5
6. Obtain approval to proceed	7%	1
7. Identifying the appropriate asset owners (added)	7%	1

From the results above the panel expert's four most important complexity measures during the strategic design stage were as follows:

- 1) Level of unknowns.
- 2) Consulting appropriate stakeholders.
- 3) Strategic estimate.
- 4) Confirming the preferred option (for concept design).

One of the panel members added identifying the appropriate asset owners however as it was not considered to be a significant influencing factor to project complexity. Particularly at the strategic stage it was therefore not carried over into round two.

4.4.2 Round 2: Rating and determining the complexity measures during the strategic design stage

The panel members were asked to rank the four complexity measures as determined in the section above. For the purpose of determining which of the four complexity measures they considered to be most important during the strategic design stage. The results of the second round are shown in the Table 16 below.

Table 16: Complexity measures during the strategic design stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the strategic design stage	Mean	Rank	Importance weightings
Level of unknowns (geotech, community, environment, road design accuracy, identifying constraints, etc)	3.07	1	0.307
Confirming the preferred option (for concept design)	2.80	2	0.280
Consulting appropriate stakeholders	2.20	3	0.220
Strategic estimate	1.93	4	0.193

Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.717 Level of significance = 0.342

The level of unknowns remained the top ranked complexity measure for the strategic stage. With confirming the preferred option jumped up two places. While the strategic estimate and consulting appropriate stakeholders dropping a place each when compared against round one.

Table 17: Ranked change of complexity measures from Delphi rounds one to two during the strategic design stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Level of unknowns	1 Level of unknowns	=
2 Consulting appropriate stakeholders	2 Confirming the preferred option (for concept design)	+2
3 Strategic estimate	3 Consulting appropriate stakeholders	-1
4 Confirming the preferred option (for concept design)	4 Strategic estimate	-1

In order to determine the composite indicator for the purpose of assessing the complexity items during the project strategic design stage. A Complexity Index (CI) was derived in the form of the following Equation 4.

$$CI = 0.307 \times \text{Level of unknowns} + 0.280 \times \text{Confirming the preferred option (for concept design)} + 0.220 \times \text{Consulting appropriate stakeholders} + 0.193 \times \text{strategic estimate}$$

Equation 4: Complexity Index strategic stage.

Equation 4 complexity index was obtained on the premise that the model is considered to be linear and additive. Similar to section 4.2.2, the Pearson correlation model of the top four weighted complexities during the strategic stage are shown in the Table 18 below.

Table 18: Correlations matrix among the four measures during the strategic design stage.

Road construction project strategic design stage correlations matrix among the four complexity measures				
	Level of unknowns	Confirming the preferred option (for concept design)	Consulting appropriate stakeholders	Strategic estimate
Level of unknowns	1	-0.441*	-0.272	-0.149
Confirming the preferred option (for concept design)		1	-0.402	-0.272
Consulting appropriate stakeholders			1	-0.441*
Strategic estimate				1

Notes: * p < 0.05, ** p < 0.01, p < 0.001 (1-tailed)

The Kendall's coefficient of concordance (W) was measured as 0.717. Confirming there was a strong agreeance within the group regarding the strategic stage complexities. From the level of significance (see Table 16) which was found to be greater than 0.05, there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.5 Concept design stage road construction project complexities

4.5.1 Round 1: Listing complexity measures during the concept design stage

The panel was asked to select their three most important complexity measures for the concept design stage. With the option available to comment and add any additional ones to the eight provided based from the literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 19 below.

Table 19: Complexity measures during the concept design stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the concept design stage	Experts frequency	Responses No.
1. Engineering and field investigation outcomes	87%	13
2. Developing the concept design	87%	13
3. Concept design estimate	40%	6
4. Identifying utility impacts	34%	5
5. Preparing the REF	20%	3
6. Defining contractual terms and conditions (if required)	14%	2
7. Selection of project team (tender selection, internal team members, etc.)	7%	1
8. Obtain approval to proceed	7%	1
9. Managing scope creep (added)	7%	1

The results showed the three complexity measures selected by respondents as most important during the concept design stage for the first round of the survey were as follows:

- 1) Engineering and field investigation outcomes.
- 2) Developing the concept design.
- 3) Concept design estimate.

The concept design estimate did not meet the plus 47% selection criteria however for the purpose of this research for determining the top three most important complexities it was pushed up to be ranked as part of round 2.

One of the panel's members did add an additional comment of managing scope creep. This is a common item for most projects with the goal post of a project constantly being moved or pushed back. But as it is considered an indirect relation to developing the concept design it was not carried through, as this research was only focused on key terms.

4.5.2 Round 2: Rating and determining the complexity measures during the concept design stage

The panel members were then asked to rank the three complexity measures as determined in the section above. The purpose of this was to determine which of the three complexity measures they considered to be most important during the concept design stage. The results of the second round are shown in the Table 20 below.

Table 20: Complexity measures during the concept design stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the concept design stage	Mean	Rank	Importance weightings
Engineering and field investigation outcomes	2.53	1	0.422
Developing the concept design	2.20	2	0.367
Concept design estimate	1.27	3	0.212
Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.763 Level of significance = 0.084			

Surprisingly there was no change in the order that the panel members ranked the complexity measures for the concept design stage between both rounds of the Delphi method.

Table 21: Ranked change of complexity measures from Delphi rounds one to two during the concept design stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Engineering and field investigation outcomes	1 Engineering and field investigation outcomes	=
2 Developing the concept design	2 Developing the concept design	=
3 Concept design estimate	3 Concept design estimate	=

In order to determine the composite indicator during the projects detailed design stage. A Complexity Index (CI) was created by in the following Equation 5.

$$CI = 0.422 \times \text{Engineering and field investigation outcomes} + 0.367 \times \text{Developing the concept design} + 0.212 \times \text{Concept design estimate}$$

Equation 5: Complexity Index concept stage.

The Equation 5 complexity index was obtained on the premise that this model is linear and additive. Similar to section 4.2.2, the Pearson correlation model of the top three weighted complexities during the concept stage are shown in the Table 22 below.

Table 22: Correlations matrix among the four measures during the concept design stage.

Road construction project concept design stage correlations matrix among the four complexity measures			
	Engineering and field investigation outcomes	Developing the concept design	Concept design estimate
Engineering and field investigation outcomes	1	-0.594**	-0.401
Developing the concept design		1	-0.498*
Concept design estimate			1
Notes: * p < 0.05, ** p < 0.01, p < 0.001 (1-tailed)			

For the concept design stage Kendall's coefficient of concordance (W) was measured as 0.763. This confirmed a strong agreement within the group regarding the different concept design stage complexities. From the level of significance (see Table 20) which was only just greater than 0.05, there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.6 Detailed design stage road construction project complexities

4.6.1 Round 1: Listing complexity measures during the detailed design stage

The experts were asked to select their three most important and critical complexity measures for the detailed design stage. Where they had the option to comment and add any additional ones to the seven provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 23 below.

Table 23: Complexity measures during the detailed design stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the detailed design stage	Experts frequency	Responses No.
1. Developing the detailed design	87%	13
2. Managing project risks	67%	10
3. Managing the level and scope of the project	54%	8
4. Detailed design estimate	47%	7
5. Continuity in personal and responsibilities	20%	3
6. Preparing construction contract documents	14%	2
7. Obtain approval to proceed	14%	2
8. Handover to construction (added)	7%	1

From the results the panel identified three of the most important complexity measures during the detailed design stage they were:

- 1) Developing the detailed design.
- 2) Managing project risks.
- 3) Managing the level and scope of the project.

One of the panel members added the handover to construction however it was not considered to be a significant influencing factor to project complexity particularly during the detailed design. As it wasn't a common term evident in any of the literature reviewed, it was for this reason not carried over into round two.

4.6.2 Round 2: Rating and determining the complexity measures during the detailed design stage

The panel members were asked to rank the three complexity measures as determined in the section above. For the purpose of determining which of the three complexity measures they considered to be most important during the detailed design stage. The results of the second round are shown in the Table 24 below.

Table 24: Complexity measures during the detailed design stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the detailed design stage	Mean	Rank	Importance weightings
Managing the level and scope of the project	2.07	1	0.345
Developing the detailed design	2.00	2	0.333
Managing project risks	1.93	3	0.322

Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.687 Level of significance = 0.525

Managing the level of scope of the project was found to of jumped up two places to be the top ranked measure. With both measures of developing the detailed design and managing project risks dropping a place each when compared to round 1.

Table 25: Ranked change of complexity measures from Delphi rounds one to two during the detailed design stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Developing the detailed design	1 Managing the level and scope of the project	+2
2 Managing project risks	2 Developing the detailed design	-1
3 Managing the level and scope of the project	3 Managing project risks	-1

In order to determine the composite indicator for the purpose of assessing the complexity items during the projects detailed design stage. A Complexity Index (CI) was created by the following Equation 6.

$$CI = 0.345 \times \text{Managing the level and scope of the project} + 0.333 \times \text{Developing the detailed design} + 0.212 \times \text{Managing project risks}$$

Equation 6: Complexity Index detailed stage.

Equation 6 complexity index was obtained on the premise that this model is considered to be linear and additive. Similar to section 4.2.2, the Pearson correlation model of the top three weighted complexities during the detailed stage are shown in the Table 26 below.

Table 26: Correlations matrix among the four measures during the detailed design stage.

Road construction project detailed design stage correlations matrix among the four complexity measures			
	Managing the level and scope of the project	Developing the detailed design	Managing project risks
Managing the level and scope of the project	1	-0.58*	-0.328
Developing the detailed design		1	-0.58*
Managing project risks			1

Notes: * $p < 0.05$, ** $p < 0.01$, $p < 0.001$ (1-tailed)

For the detailed design stage Kendall's coefficient of concordance (W) was measured as 0.687. This again was similar to the strategic and concept design stages confirming a strong agreeance within the group regarding the detailed design stage complexities. From the level of significance (see Table 20) which was determined to be greater than 0.05, there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.7 Construction stage road construction project complexities

4.7.1 Round 1: Listing complexity measures during the construction stage

The panels experts were asked to select their three most important and critical complexity measures for the construction stage. They were given the option to comment and add any additional ones to the six provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 27 below.

Table 27: Complexity measures during the construction stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the construction stage	Experts frequency	Responses No.
1. Managing construction activities and services	80%	12
2. Managing site risks (unknowns)	67%	10
3. Managing construction contracts	54%	8
4. Managing stakeholder expectations	40%	6
5. Adjusting public utilities	27%	4
6. Tendering and tender estimate	14%	2
7. Project quality (added)	7%	1
8. Construction feedback to design (added)	7%	1
9. Managing scope creep (added)	7%	1

The results identified the three most important complexity measures during the construction stage were:

- 1) Managing construction activities and services.
- 2) Managing site risks (unknowns).
- 3) Managing construction contracts.

Three of the panel members added additional factors of project quality, construction feedback to design and managing scope creep.

Project quality (i.e. of the construction works) and managing scope creep were both considered as an indirect relation to the term managing construction activities and services and therefore were not carried through. The other comment of construction feedback to design was not considered to be a significant influencing factor to project complexity during the construction stage. Due to it not being a common term found in the literature reviewed, so for this reason wasn't carried over into the round two.

4.7.2 Round 2: Rating and determining the complexity measures during the construction stage

The panel members were asked to rank the three complexity measures as determined in the section above. For the purpose of determining which of the three complexity measures they considered to be most important during the construction stage. The results of the second round are shown in the Table 28 below.

Table 28: Complexity measures during the construction stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the construction stage	Mean	Rank	Importance weightings
Managing construction activities and services	2.46	1	0.403
Managing site risks (unknowns)	2.07	2	0.339
Managing construction contracts	1.57	3	0.257
Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.594 Level of significance = 0.566			

Surprisingly there was no change in the order that the panel members ranked for the complexity measures between both rounds 1 and 2 of the Delphi method.

Table 29: Ranked change of complexity measures from Delphi rounds one to two during the construction stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Managing construction activities and services	1 Managing construction activities and services	=
2 Managing site risks (unknowns)	2 Managing site risks (unknowns)	=
3 Managing construction contracts	3 Managing construction contracts	=

In determine the composite indicator for the purpose of assessing the complexity items during the projects detailed design stage. A Complexity Index (CI) was derived in the following Equation 7.

$$CI = 0.403 \times \text{Managing construction activities and services} + 0.339 \times \text{Managing site risks} + 0.257 \times \text{Managing construction contracts}.$$

Equation 7: Complexity Index construction stage.

Equation 7 complexity index was obtained on the premise that this model is considered linear and additive. Similar to section 4.2.2, the Pearson correlation model of the top three weighted complexities during the construction stage as shown in the Table 30 below.

Table 30: Correlations matrix among the four measures during the construction stage.

Road construction project construction stage correlations matrix among the four complexity measures			
	Managing construction activities and services	Managing site risks (unknowns)	Managing construction contracts
Managing construction activities and services	1	-0.186	0.425*
Managing site risks (unknowns)		1	-0.016
Managing construction contracts			1
Notes: * p < 0.05, ** p < 0.01, p < 0.001 (1-tailed)			

Kendall's coefficient of concordance (W) was measured as 0.594. This was lower than that was measured in the concept and detailed design stages. But still indicates a good amount of agreement within the group regarding construction stage complexities. From the level of significance (see Table 28) which is greater than 0.05, there is therefore a failure to reject the null hypothesis as there is less disagreement between the data and the null hypothesis.

4.8 Finalisation stage road construction project complexities

4.8.1 Round 1: Listing complexity measures during the finalisation stage

The panels experts were asked to select their three most important measures for the finalisation stage. Where they were also given the option to comment and add any additional ones to the six provided based from the available literature research conducted. The respondent's selections from the round 1 questionnaire are shown in the Table 31 below.

Table 31: Complexity measures during the finalisation stage provided by respondents in round one of Delphi survey.

Complexity measures for a road construction project during the finalisation stage	Experts frequency	Responses No.
1. Finalising and handover of the completed works	94%	14
2. Identifying ongoing maintenance works and planning	60%	9
3. Post completion review (what successes and key learning's were identified)	54%	8
4. Identifying extent of liabilities	33%	5
5. Managing stakeholder expectations	27%	4
6. Provision of appropriate organisation arrangements	7%	1
7. Defect rectification and close out (added)	7%	1
8. Closing out all non-conformance reports (added)	7%	1
9. Post-construction design and safety review (added)	7%	1

The results from the panel experts identified three of the most important complexity measures during the finalisation stage were:

- Finalising and handover of the completed works.
- Identifying ongoing maintenance works and planning.
- Post completion review (what successes and key learning's were identified).

Three of the panel members added defect rectification and close out, closing out all non-conformance reports and post-construction design and safety review as additional comments. The last response was considered an indirect relation to the post-construction review. While the other two comments were considered to be indirectly related to the other selected (top three) measures which is why they weren't carried through into round 2.

4.8.2 Round 2: Rating and determining the complexity measures during the finalisation stage

The panel members were asked to rank the three complexity measures as determined in the section above. For the purpose of determining which of the three complexity measures they considered to be most important during the finalisation stage. The results of the second round are shown in the Table 32 below.

Table 32: Complexity measures for a road construction project during the finalisation stage provided by respondents in round two of the Delphi survey.

Complexity measures for a road construction project during the finalisation stage	Mean	Rank	Importance weightings
Finalising and handover of the completed works	2.21	1	0.361
Identifying ongoing maintenance works and planning	2.21	1	0.361
Post completion review (what successes and key learning's were identified)	1.71	2	0.279

Notes: Number (n) = 15, Kendall's Coefficient of Concordance (W) = 0.582 Level of significance = 0.501

The results showed that both the finalising and handover of the completed works and identifying ongoing maintenance works both ranked number one in the second round. With the later gaining one position and the post completion review also gaining one position moving into second.

Table 33: Ranked change of complexity measures from Delphi Rounds one to two during the finalisation stage.

Round 1	Round 2	Order Change (R2 to R1)
1 Finalising and handover of the completed works	1 Finalising and handover of the completed works	=
2 Identifying ongoing maintenance works and planning	1 Identifying ongoing maintenance works and planning	+1
3 Post completion review	2 Post completion review	+1

To determine the composite indicator for the purpose of assessing the complexity items during the projects finalisation design stage. A Complexity Index (CI) was created by the following Equation 8.

$$CI = 0.361 \times \text{Finalising and handover of the completed works} + 0.361 \times \text{Identifying ongoing maintenance works and planning} + 0.279 \times \text{Post completion review}$$

Equation 8: Complexity Index finalisation stage.

Equation 8 complexity index was obtained on the premise that this model is considered linear and additive. Similar to section 4.2.2, the Pearson correlation model of the top three weighted complexities during the finalisation as shown in the Table 34 below.

Table 34: Correlations matrix among the four measures during the finalisation stage of a road construction project.

Road construction project finalisation stage correlations matrix among the four complexity measures			
	Finalising and handover of the completed works	Identifying ongoing maintenance works and planning	Post completion review (what successes and key learning's were identified)
Finalising and handover of the completed works	1	0.032	-0.325
Identifying ongoing maintenance works and planning		1	0.055
Post completion review (what successes and key learning's were identified)			1
Notes: * p < 0.05, ** p < 0.01, p < 0.001 (1-tailed)			

Kendall's coefficient of concordance (W) was measured as 0.582. This was extremely similar to that measured in the construction stage indicating an acceptable amount of agreement within the panel. From the level of significance (see Table 32) which is greater than 0.05, there is a failure to reject the null hypothesis meaning there is less disagreement between the data and the null hypothesis.

4.9 Stakeholders impacts on road construction projects

4.9.1 Round 1: Stakeholders that have the most influence on a project objectives

The panel group revealed that they considered a number of stakeholders influential when it comes to how they impact on a projects objective. When the items were measured there was a heavy agreement towards the: Community (94%); Project Owner (94%) as the overarching most influencing stakeholders in round 1.

With: Environmental (80%); Politicians (74%); and the Project Manager (67%) also meeting the 50% cut off criteria to be carried through to the ranking process in round two. No additional stakeholders were added by the panel. The results are shown in the Figure 4 below.

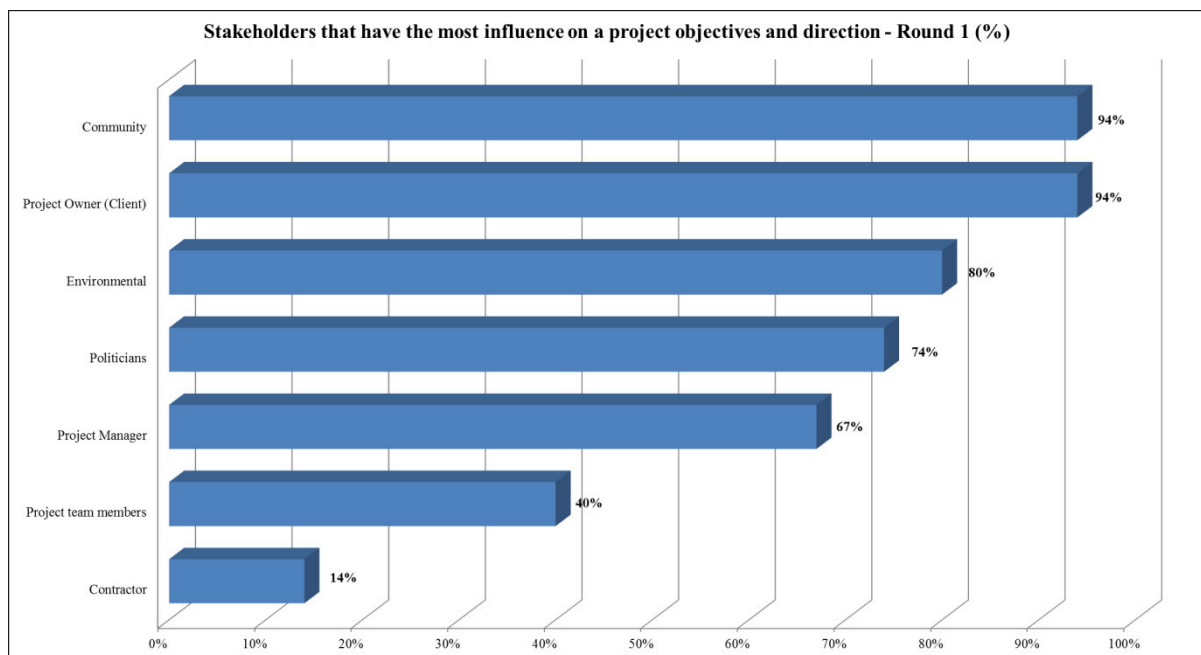


Figure 4: Round 1: Stakeholders that have the most influence on a projects objectives and direction provided by respondents in round one of Delphi survey.

4.9.2 Round 2: Stakeholders that have the most influence on a project objectives

In round 2 there was some significant reconsidering in the way respondents ranked their top five stakeholders between the two rounds. There was a clear separation between the top three and bottom two stakeholders in terms of their important weighting with:

- 1) Project Owner (moved up one place).
- 2) Politicians (moved up to two places).
- 3) Community (dropped two places).

With the lesser weighted stakeholders of:

- 4) Environmental (dropping one place).
- 5) Project Manager (remaining in its same place).

The summary of the results from the second round are shown below in the Table 35 and Table 36.

Table 35: Stakeholders that have the most influence on a projects objectives and direction provided by respondents in round two of the Delphi survey.

Stakeholders that have the most influence on a project objectives and direction	Mean	Rank	Importance weightings
1 Project Owner (Client)	3.67	1	0.245
2 Politicians	3.40	2	0.227
3 Community	3.27	3	0.218
4 Environmental	2.60	4	0.173
5 Project Manager	2.07	5	0.138

Table 36: Ranked change of the most influencing stakeholders from Delphi Rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Community	1 Project Owner (Client)	+1
2 Project Owner (Client)	2 Politicians	+2
3 Environmental	3 Community	-2
4 Politicians	4 Environmental	-1
5 Project Manager	5 Project Manager	=

4.9.3 Round 1: Stakeholders that accept the highest risk allocation on a project

When it comes to delivery of a project there is always a level of risk that is allocated to a particular group or individual in the development and construction of a road project. This risk level can vary from group to group or between different individuals. The round 1 results revealed the three highest ranked stakeholders that accept the greatest amount of risk with percentages were:

- 1) Project owner (client) (87%).
- 2) Contractor (67%).
- 2) Project manager (67%).

It should also be noted that no additional stakeholders were added.

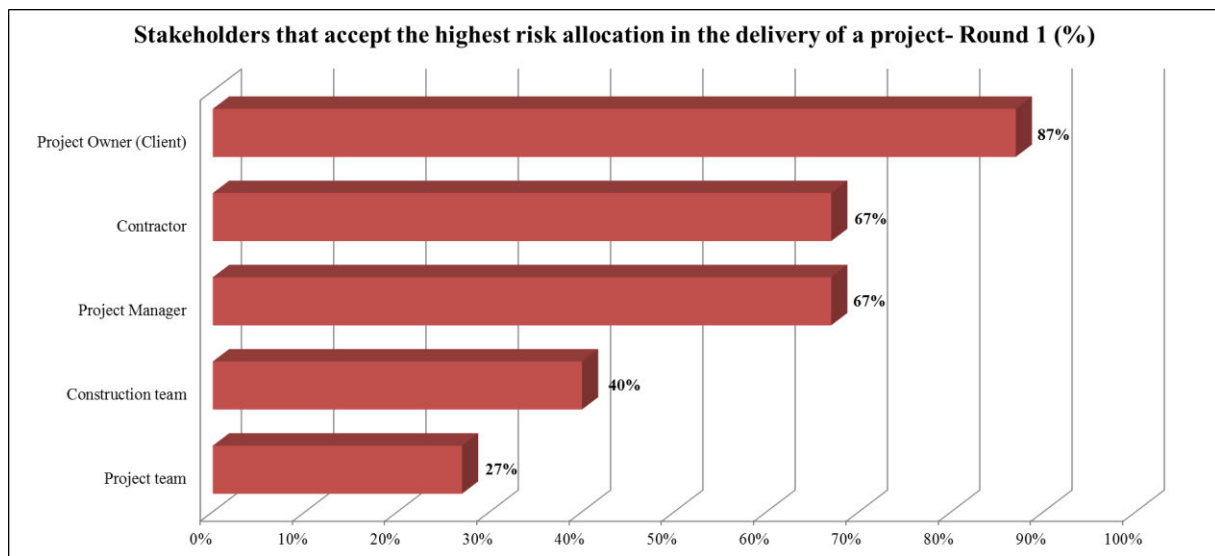


Figure 5: Round 1: Stakeholders that accept the highest risk allocation on a project.

4.9.4 Round 2: Stakeholders that accept the highest risk allocation in the delivery of a project

When the panel members were asked to rank the three stakeholders for round 2, the results determined that the (1) Project owner (client) at the end of the day accepts the highest risk level in the development and construction of a road project. There was found to be a significant gap between the top measure and the following measures of (2) Project Manager and (3) Contractor in terms of their importance weightings. With the panel identifying these as having a similar weighting when it comes to risk allocation.

Table 37: Stakeholders that accept the highest risk allocation by respondents in round two of the Delphi survey.

Stakeholders that accept the highest risk allocation in the delivery of a project	Mean	Rank	Importance weightings
1 Project Owner (Client)	2.60	1	0.433
2 Project Manager	1.73	2	0.288
3 Contractor	1.67	3	0.278

Table 38: Ranked change of the stakeholders that accept the highest risk allocation from Delphi rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Project Owner (Client)	1 Project Owner (Client)	=
2 Contractor	2 Project Manager	+1
3 Project Manager	3 Contractor	-1

4.9.5 Round 1: Objectives of a project changed due to a stakeholders input (internal or external)

The respondents were asked to confirm if they had ever been involved in a project where the objectives had changed during its development because of a stakeholder. The results identified an overarching respondent of Yes (94%) with only one of the panel members identifying No to this particular question.

Given the response, this question was not carried over into round 2 due to the consensus received. The results are shown in the Figure 6 below.

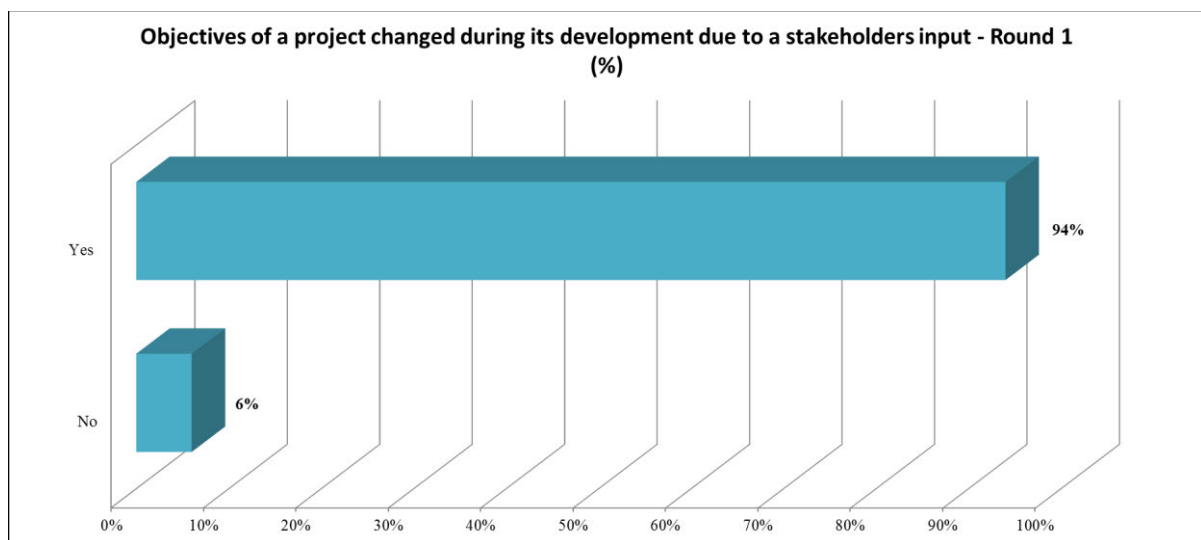


Figure 6: Round 1: Objectives of a project changed due to stakeholders input.

4.9.6 Round 1: Stage of a projects lifecycle that is most important to managing stakeholder inputs.

When considering the project lifecycles it was important to know what stage is most critical in being able to manage stakeholder inputs. As this is an important factor in being able to manage project complexity.

The survey asked respondents to select their three project lifecycle stages that they deemed to be most important. The results were clear in showing a differential between the top three and the bottom three project lifecycles. With the panel members indicating the initial/early stages of a project are the most important. In being able to manage stakeholder inputs and minimise rework and delays.

The results top three results with percentages are shown as follows:

- 1) Concept design stage (94%).
- 2) Strategic design stage (74%).
- 3) Conception of the project (60%).

No additional project stages were added.

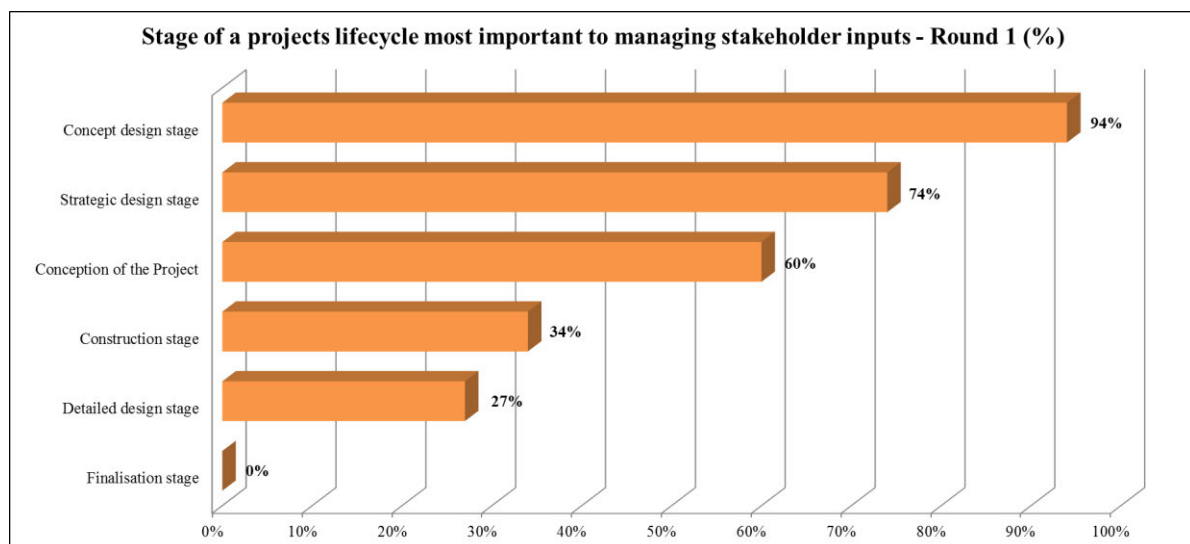


Figure 7: Round 1: Stage of a projects lifecycle most important to managing stakeholder inputs.

4.9.7 Round 2: Stage of a projects lifecycle most important to managing stakeholder inputs

For round 2 panel members were asked to rank the top three stages identified previously. This was for the purpose of determining which was the most critical in being able to effectively managing stakeholder changes or inputs.

There was surprisingly no change in the order that the panel members ranked the most important stages for managing stakeholder inputs between both rounds one and two. With the earlier stages deemed to be key in being able to best work with stakeholders, see the results below.

Table 39: Stage of the project lifecycle most important for managing stakeholder inputs provided by respondents in round two of the Delphi survey.

Stage of a projects lifecycle most important to managing stakeholder inputs	Mean	Rank	Importance weightings
1 Concept design stage	2.27	1	0.378
2 Strategic design stage	2.07	2	0.344
3 Conception of the Project	1.67	3	0.278

Table 40: Ranked change of the stage of a projects lifecycle most important in managing stakeholder inputs from Delphi rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Concept design stage	1 Concept design stage	=
2 Strategic design stage	2 Strategic design stage	=
3 Conception of the Project	3 Conception of the Project	=

4.9.8 Round 1: Stakeholder involvement in construction projects

It was discussed earlier that stakeholder engagement and involvement are keys in the development and overall success of a project. The respondents in round 1 were asked to provide a response to a series of short stakeholder statements. This was for the purpose of determining their general consensus. The results are as shown in the Table 41 and Figure 8 below.

Table 41: Round 1: Stakeholder Involvement in construction projects results.

Stakeholders Involvement in construction projects (Round 1)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Different stakeholders have different perspectives	5	10	0	0	0	0	15	1.67	0.47
The larger the number of stakeholders the higher the project complexity (difficulty)	2	10	1	2	0	0	15	2.20	0.83
Different stakeholders (internal only) perceive risks in relation to objectives differently	3	12	0	0	0	0	15	1.80	0.40
Does a project suffer from late stakeholder engagement/involvement	7	6	2	0	0	0	15	1.67	0.70
Different stakeholders have different interest levels	7	8	0	0	0	0	15	1.53	0.50
Do all stakeholders align themselves with the projects objectives	0	1	2	7	5	0	15	4.07	0.85

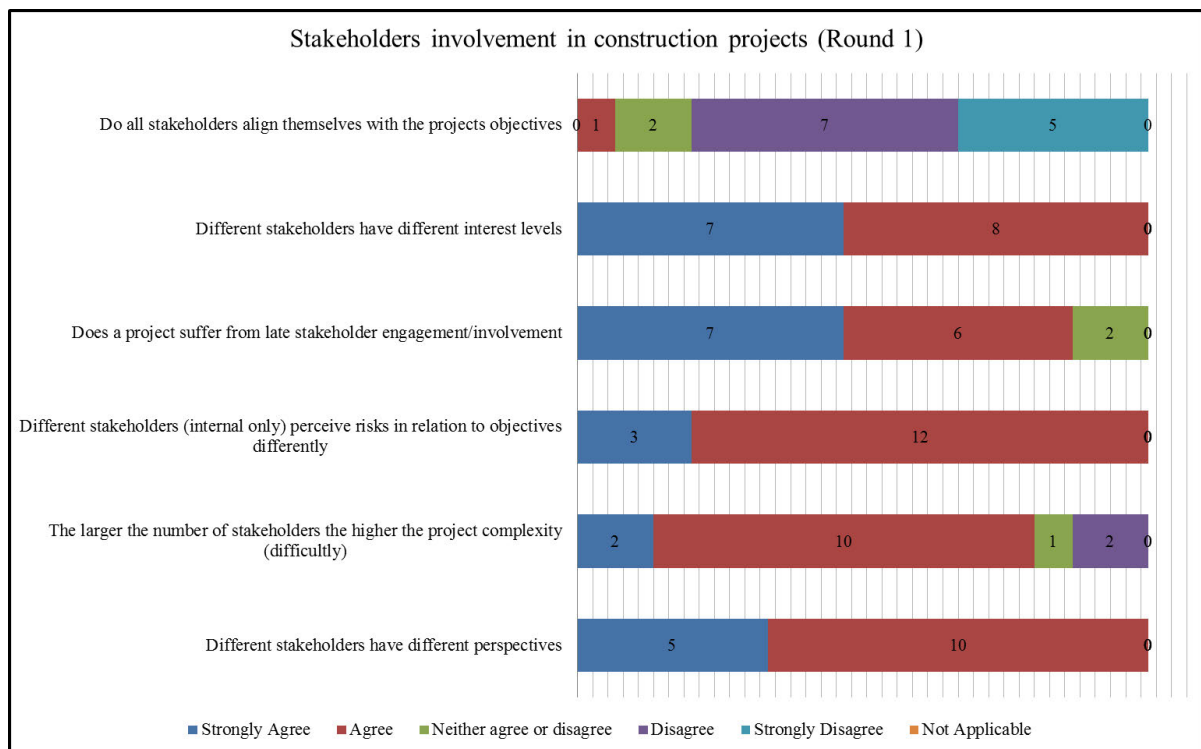


Figure 8: Round 1: Graph representing stakeholder answers to their involvement in construction projects.

The round one results provided a pretty clear consensus, with the experts generally disagreeing with the statement “*All stakeholders align themselves with the projects objectives*”. This identified some significant evidence that some stakeholders have different opinions or ideas that are not aligned with the goals of the project. Showing a clear indicator of potential cost and time implications as well as not getting the best result for the project.

In the other five short statements provided the majority of the answers given were in agreeance which this backed up by the literature review completed. The same question was conducted again in the following section in order to determine a final consensus.

4.9.9 Round 2: Stakeholders involvement in construction projects

For round 2 the focus group was asked to retake the proposition of the short answer questions regarding between internal and external stakeholder asked in round 1 above. This was for the purpose of confirming the consensus of the expert group across the two rounds. The results of the second round are shown in the Table 42 and Figure 9 below.

Table 42: Round 2: Stakeholder involvement in construction projects results.

Stakeholders Involvement in construction projects (Round 2)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Different stakeholders have different perspectives	7	7	1	0	0	0	15	1.60	0.61
The larger the number of stakeholders the higher the project complexity (difficulty)	4	9	1	1	0	0	15	1.93	0.77
Different stakeholders (internal only) perceive risks in relation to objectives differently	5	7	2	1	0	0	15	1.93	0.85
Does a project suffer from late stakeholder engagement/involvement	7	7	1	0	0	0	15	1.60	0.61
Different stakeholders have different interest levels	7	7	1	0	0	0	15	1.60	0.61
Do all stakeholders align themselves with the projects objectives	0	0	2	12	1	0	15	3.93	0.44

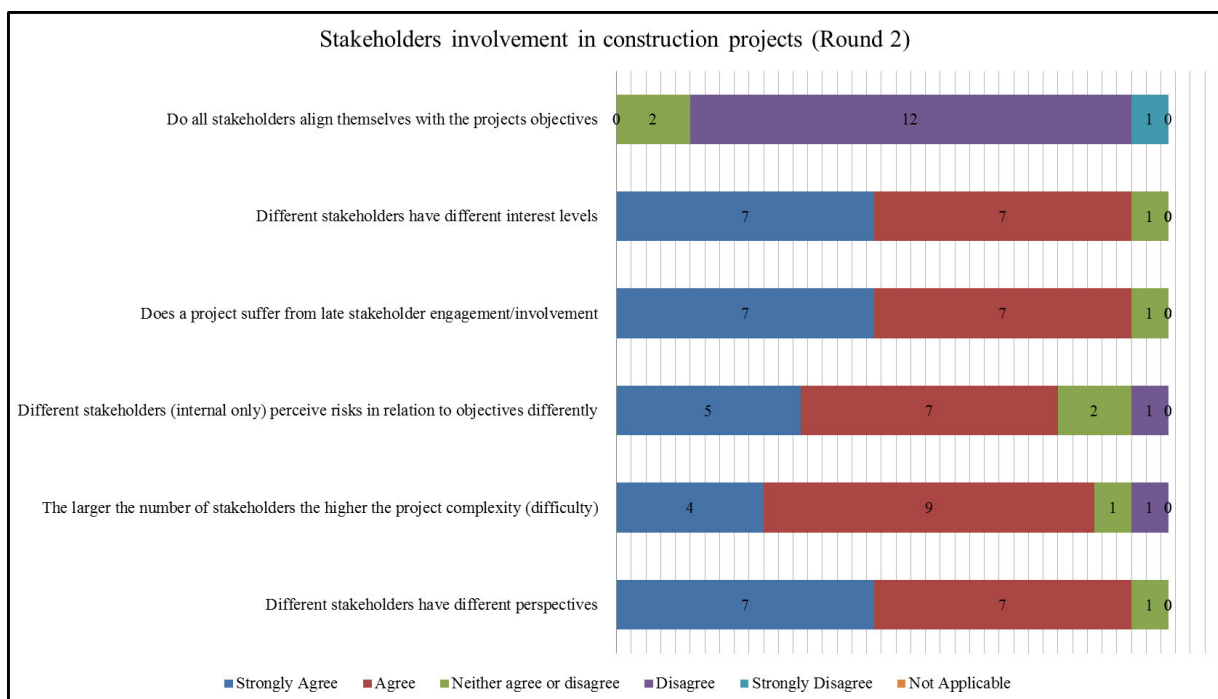


Figure 9: Round 2: Bar graph representing stakeholder answers to their involvement in construction projects.

The results and general consensus of the group found in round 2 was quite similar to that found in round 1. There was a familiar disagreement from the group that not all stakeholders attempt to align themselves with the project objectives.

For the other five statements the group was all in agreeance with a more favoured positon versus that of the data collected in round one. The mean was used as a comparison of the two data sets between the rounds, as it is an important measure of mathematical expectation or average. The results identified that there was only one noticeable difference of a change greater than +0.15 for the statement *“the larger the number of stakeholders the higher the project complexity”* which had a change of 0.27 that more favoured this statement.

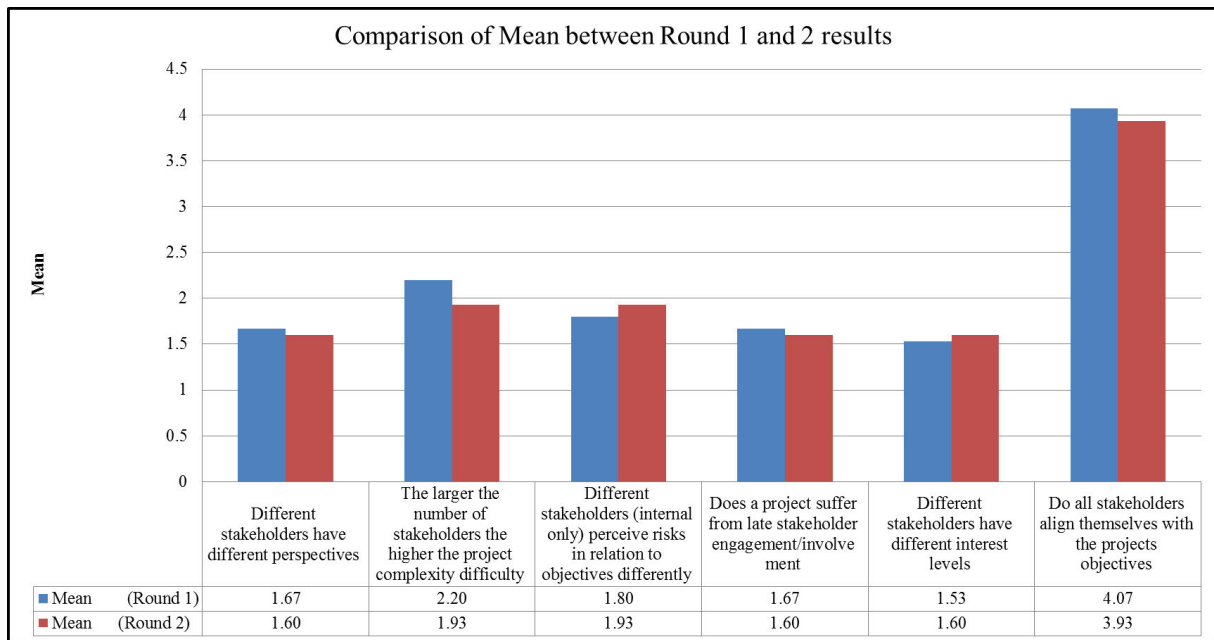


Figure 10: Comparison of mean between round 1 and 2 for stakeholder involvement in a construction project.

4.10 Project uncertainties and risks in road construction projects

4.10.1 Round 1: Project lifecycle stage that holds the most project uncertainty

Project uncertainty occurs in all projects and at all stages of the project lifecycle. So it was important to confirm what particular stage of the lifecycle of a project hold the highest level of uncertainty.

The results indicated a clear favouritism from the group that the initial to earlier stages of the project lifecycle shown below with percentages as:

- 1) Concept design stage (87%).
- 2) Strategic design stage (80%).
- 3) Conception of the project (73%).

These were all clear selections over the later stages of a project as shown in the Figure 11 below for round 1. No additional comments were added by the group.

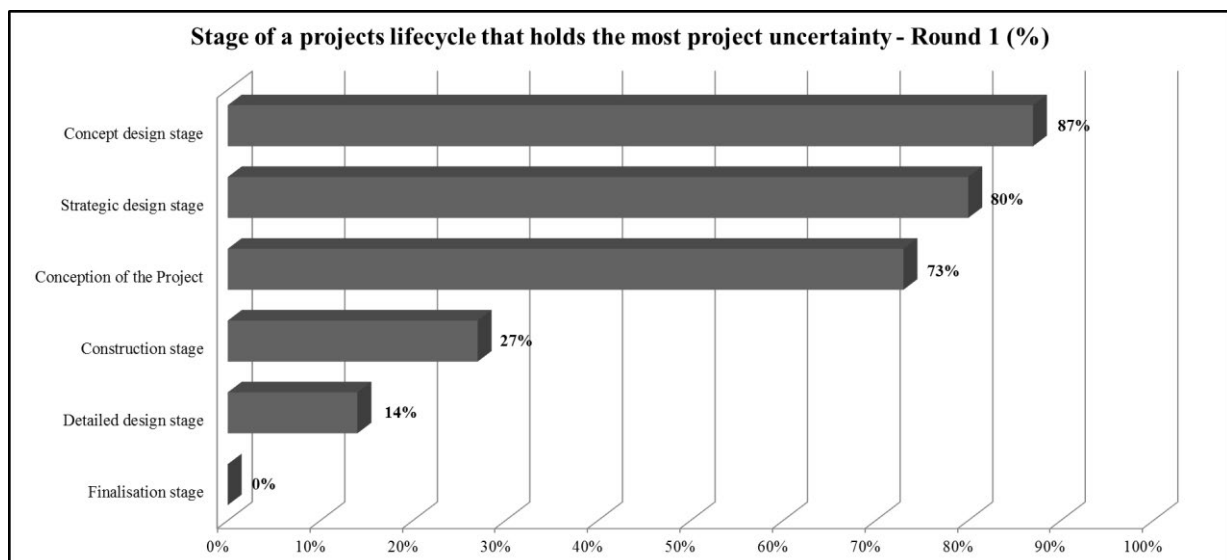


Figure 11: Round 1: Stage of a projects lifecycle that holds the most project uncertainty.

4.10.2 Round 2: Project lifecycle stage that holds the most project uncertainty

Round 2 involved ranking the top three stages determined in round 1 as shown in the section above.

The results identified an order change with the straight swap of the (3) concept design stage with the (1) conception of the project. While the (2) strategic design stage remaining in its same position.

This order appeared to revert back to that of the same order process steps that are in the development guidelines, identifying the earlier stages of the development process as holding the most project uncertainty. Refer to Table 43 and Table 44 below for details.

Table 43: Stage of the project lifecycle that holds the most project uncertainty provided by respondents in round two of the Delphi survey.

Stage of a projects lifecycle that holds the most project uncertainty	Mean	Rank	Importance weightings
1. Conception of the project	2.80	1	0.467
2. Strategic design stage	2.13	2	0.355
3. Concept design stage	1.07	3	0.178

Table 44: Ranked change of the stage of a projects lifecycle that hold the most project uncertainty from Delphi rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Concept design stage	1 Conception of the project	+2
2 Strategic design stage	2 Strategic design stage	=
3 Conception of the Project	3 Concept design stage	-2

4.10.3 Round 1: Project risk in construction projects

Project risks occur on all projects, different groups and individuals manage risks and perceive them differently, sometimes unfortunately for their own benefits.

The panel members were asked to provide a response to a series of short project risk statements as part of the round 1 questionnaire. The results from the group's initial consensus to the statements are represented in the following Table 45 and Figure 12 below.

Table 45: Round 1: Project risk in construction projects results.

Project risk in construction projects (Round 1)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Should the general public have more influence over a projects objectives and direction	0	5	4	3	3	0	15	3.27	1.12
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	5	9	0	1	0	0	15	2.80	0.91
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	0	7	5	2	1	0	15	2.40	0.61
Does the above statement occur on projects managed internally by a single organisation	0	10	4	1	0	0	15	1.80	0.75

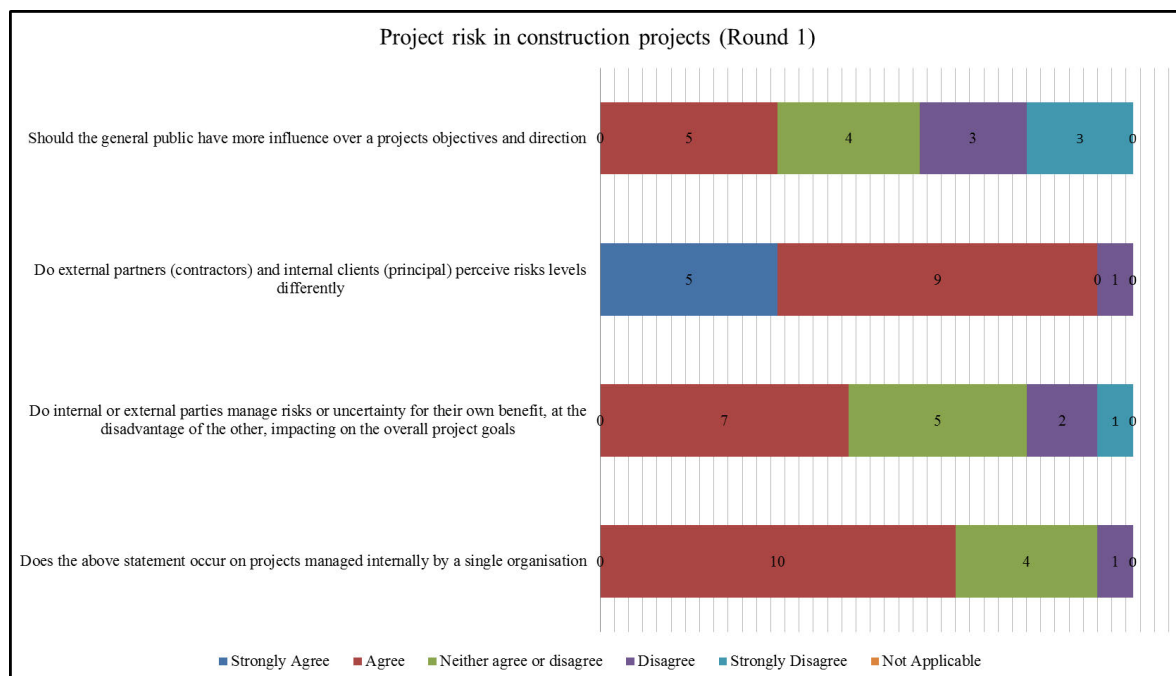


Figure 12: Round 1: Graph representing project risk in construction projects.

The findings of the results provided a very interesting response. The group gave quite a mixed result for the statement “*should the general public have more influence over a projects objectives and direction*” with some of the respondents for it. While some remained undecided and others against it, with no real consensus being reached in round 1.

There was also a strong agreeance that external and internal clients perceived risks differently. There is some doubt however as to whether or not they manage risks for their own benefit at the disadvantage of the other, where only seven of the respondents of the 15 respondents agreeing that they believed this was the case. There was also a strong backing behind the fact that this does occur within internal (same) organisations.

4.10.4 Round 2: Project risk in construction projects

The panel members were then asked to retake the proposition of the short answer questions regarding project risk associated with construction projects as asked in round 1. For the purpose of confirming the consensus of the expert group across the two rounds, the results from the second round are shown in the Table 46 and Figure 13 below.

Table 46: Round 2: Project risk in construction projects results.

Project risk in construction projects (Round 2)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Should the general public have more influence over a projects objectives and direction	0	6	4	4	1	0	15	3.00	0.97
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	4	9	1	1	0	0	15	1.93	0.77
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	3	6	2	4	0	0	15	2.47	1.09
Does the above statement occur on projects managed internally by a single organisation	0	5	5	4	0	1	15	3.13	1.09

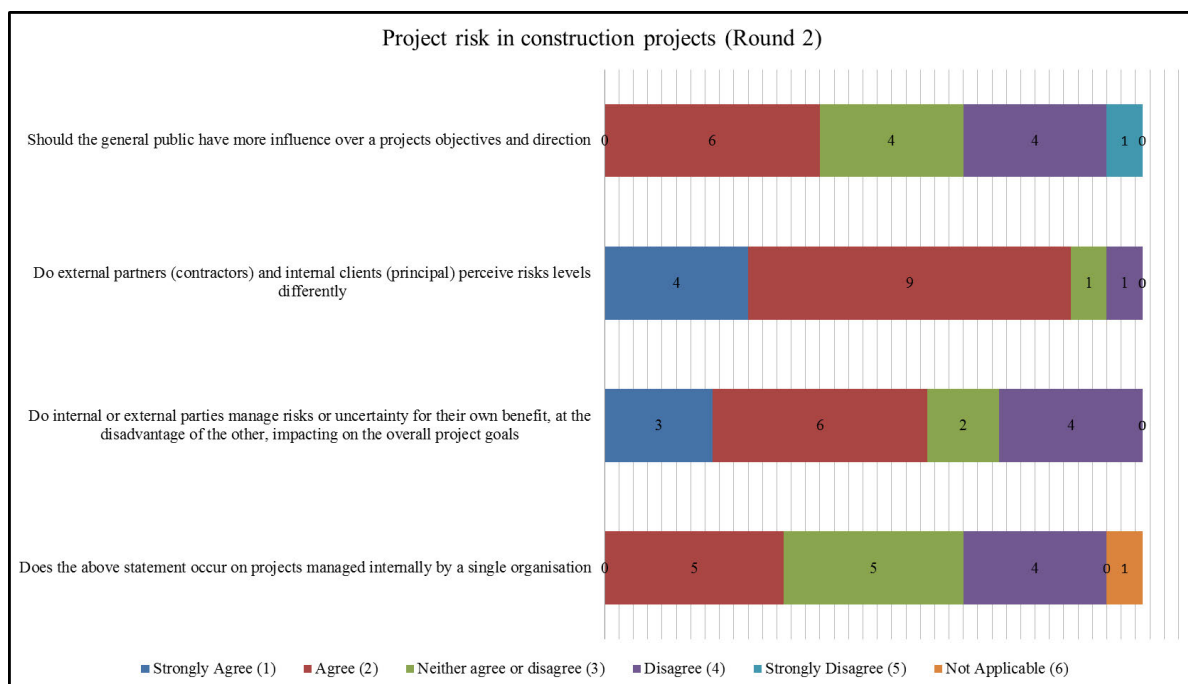


Figure 13: Round 2: Bar graph representing project risks in construction projects.

It was noted there was a change in the consensus of the panel across the two rounds conducted for two of the statements addressed as part of the survey. The statements “*do external partners (contractors) and internal clients (principal) perceive risks levels differently*” and “*does the above statement occur on projects managed internally by a single organisation*”. Both had a significant swing as shown in the Figure 14 below. The first statement shifted from a neither agree nor disagree to a general agreeance from the group were as the later shifted the opposite direction with the group sitting more on the fence. There was minimal change in the other two statements asked.

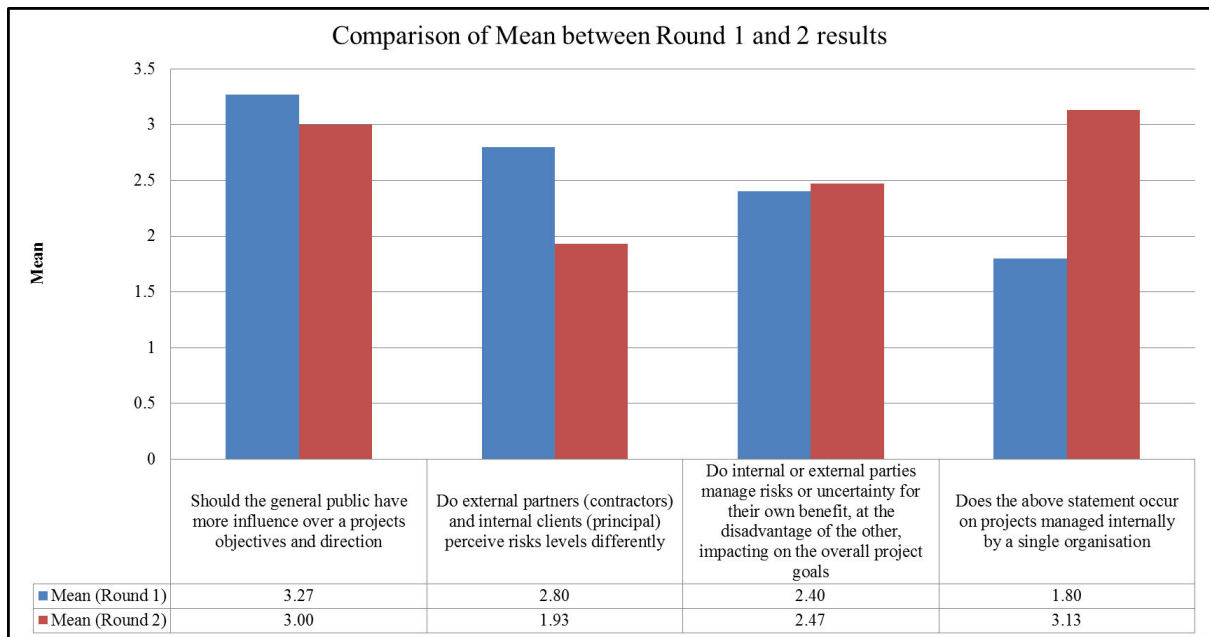


Figure 14: Comparison of mean between round 1 and 2 for project risk in a construction project.

4.10.5 Round 1: Stage of a projects development process most likely to be overlooked

Some project development lifecycles can be at times overlooked, skipped through or missed by either the project manager or project team as part of the process of a project. It is important to identify which stages this is likely to occur in so it can be better managed in being able to produce more cost effective projects.

When the results were collated there was a clear favour from the group that again the initial stages of the project lifecycle hold the most project risk in terms of a process or step being missed. The results shown below with percentages were:

- 1) Strategic design stage (94%).
- 2) Conception of the project (80%).
- 3) Concept design stage (60%).

No additional comments were added.

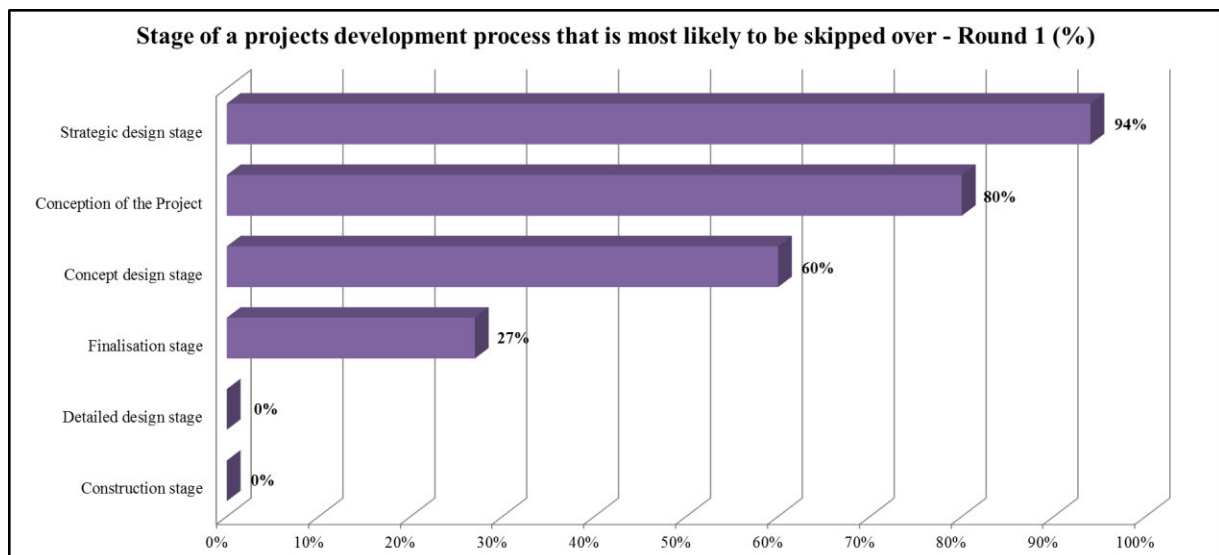


Figure 15: Round 1: Stage of a projects development most likely to be skipped over.

4.10.6 Round 2: Stage of a projects development process most likely to be overlooked

The round 2 of results determined that the panel ranked both the (1) conception of the project and (1) strategic design stage as the two stages with the highest and same importance weightings. These stages were to the focus group indicated by them as most likely to be missed or skipped through without sufficient detail being conducted first, with the (2) concept design following.

Again the initial stages of the project lifecycle were considered keys in this area by the group. The results of the second round are shown in the Table 47 and Table 48 below.

Table 47: Stage of the project lifecycle that is most likely to be skipped over provided by respondents in round two of the Delphi survey.

Stage of a projects development process that is most likely to be skipped over	Mean	Rank	Importance weightings
1. Conception of the project	2.33	1	0.389
1. Strategic design stage	2.33	1	0.389
2. Concept design stage	1.33	2	0.222

Table 48: Ranked change of the stage of a projects lifecycle that is most likely to be skipped over from Delphi rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Strategic design stage	1 Conception of the project	+1
2 Conception of the Project	1 Strategic design stage	=
3 Concept design stage	2 Concept design stage	+1

4.11 Managing stakeholder relationships in road construction projects

4.11.1 Round 1: Important elements that best assist in managing stakeholder relationships and perspectives

In the construction and development of a project a virtual part of its success comes through developing and managing stakeholder relationships.

The panel was asked to answer the two questions as follows with respect to this:

- A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?
- What do you believe is the best method of managing different stakeholder's perspectives or inputs?

The results from the first question are shown in the Figure 16 below.

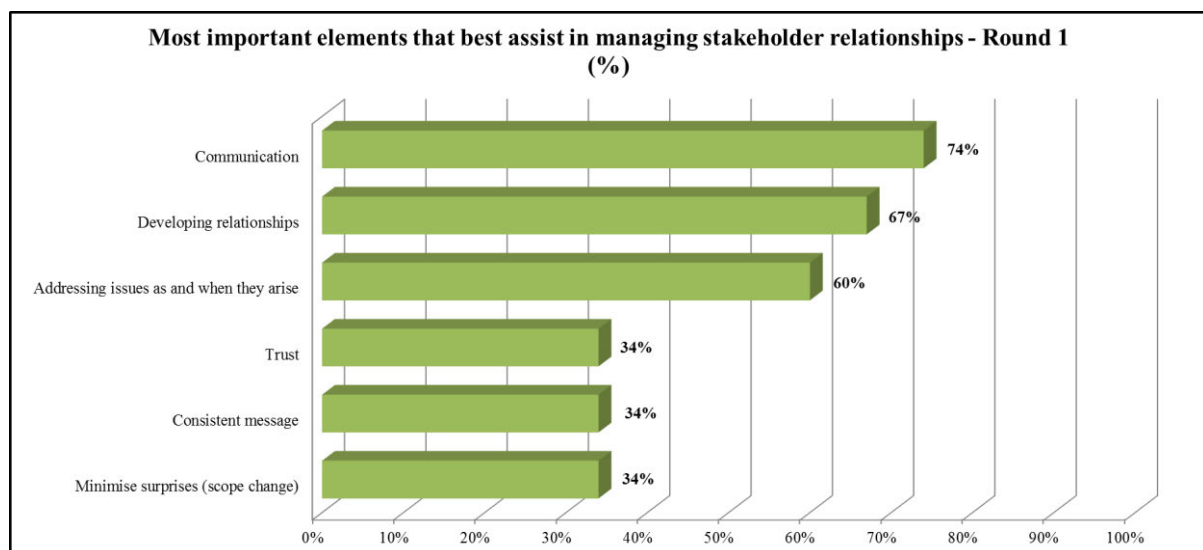


Figure 16: Round 1 Most important elements that assist in managing stakeholder relationships.

There was a clear agreement by the group shown below with percentages of the top three as:

- 1) Communication (74%).
- 2) Developing relationships (67%).
- 3) Addressing issues as and when they arise (60%).

One respondent commented suggesting that they all applied which is true to an extent however the purpose of this research was to determine just the key factors. The secondary question results are shown in following Table 49.

Table 49: Round 1 Panels response for managing stakeholder's perspectives and inputs.

Responses for managing stakeholder's perspectives and inputs	
Respondent No.	Responses
Number 1	Communication and transparency
Number 2	Communication of what a project is addressing and it's benefits
Number 3	Treating stakeholders with consistency and based on legitimate issues raised
Number 4	Timely and open communication
Number 5	Two way communication
Number 6	Maintaining clear and open communication between all parties
Number 7	Effective and constructive communication that occurs early and with all stakeholders is what I believe to be an effective method of managing stakeholder perspectives.
Number 8	Face to Face meetings, regular and consistent contact
Number 9	Transparency in communication, and doing what you say you will do
Number 10	Early communication
Number 11	Communication
Number 12	Open Communication and access to information
Number 13	Providing a level of communication that is straight forward and forthcoming while referring back to the intent of the projects
Number 14	Face to Face engagement and keeping communication lines open
Number 15	Understanding stakeholders objectives, explaining other stakeholders/project objectives, explaining outcomes/consequences (+ve and -ve) in relation to the stakeholders objectives

The results showed an overwhelming response for communication with 13 of the 15 respondents mentioning it as part of their answer.

Many forms of communication was mentioned weather it was early, open, transparency, face to face, two way and consistent it was very clear that this term is the key to managing stakeholder's perspectives.

The two other comments made were about treating stakeholders with consistently and making sure stakeholders understood the projects objectives. As there was a clear consensus regarding communication this question was not followed up in the second round.

4.11.2 Round 2: Important elements that best assist in managing stakeholder relationships and perspectives

In the second round the group was asked to rank what stage of a projects lifecycle they consider to most likely be overlooked and skipped over from the top three results determined in round 1 as shown above.

There was no rearrangement of the order between the two rounds of the questionnaire as shown in the Table 51 below. (1) Communication was still ranked the most important measure with a score of 0.445. Followed by (2) developing relationships and (3) addressing issues as and when they arise following as per round one.

The details of the results are shown in the Table 50 and Table 51 below.

Table 50: Most important elements that best assist in managing stakeholder relationships provided by respondents in round two of the Delphi survey.

Most important elements that best assist in managing stakeholder relationships	Mean	Rank	Importance weightings
1 Communication	2.67	1	0.445
2 Developing relationships	2.00	2	0.333
3 Addressing issues as and when they arise	1.33	3	0.222

Table 51: Ranked change of the most important elements that best assist in managing stakeholder's relationships from Delphi rounds one to two.

Round 1	Round 2	Order Change (R2 to R1)
1 Communication	1 Communication	=
2 Developing relationships	2 Developing relationships	=
3 Addressing issues as and when they arise	3 Addressing issues as and when they arise	=

4.12 Project management processes in road construction projects

4.12.1 Round 1: Project management processes in construction projects

Atkinson (2006) stated that common risk management practices often fail to address the basic sources of uncertainty that drive problems in the project lifecycle. While also indicating there is a current perception that the conventional project management process used today are not effective in addressing issues across all stages of project management.

The panel was asked to provide a response to a series of short project management process statements as part of the round 1 questionnaire. The results of the group's initial consensus to the statements are represented in the following Table 52 and Figure 17.

Table 52: Round 1: Project management in construction projects.

Project management processes in construction projects (Round 1)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption was it was thoroughly completed	0	10	2	3	0	0	15	2.53	0.81
Does conventional project management used today best manage stakeholder inputs	0	2	10	3	0	0	15	3.07	0.57
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures	0	9	6	0	0	0	15	2.40	0.49
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner	1	7	7	0	0	0	15	2.40	0.61

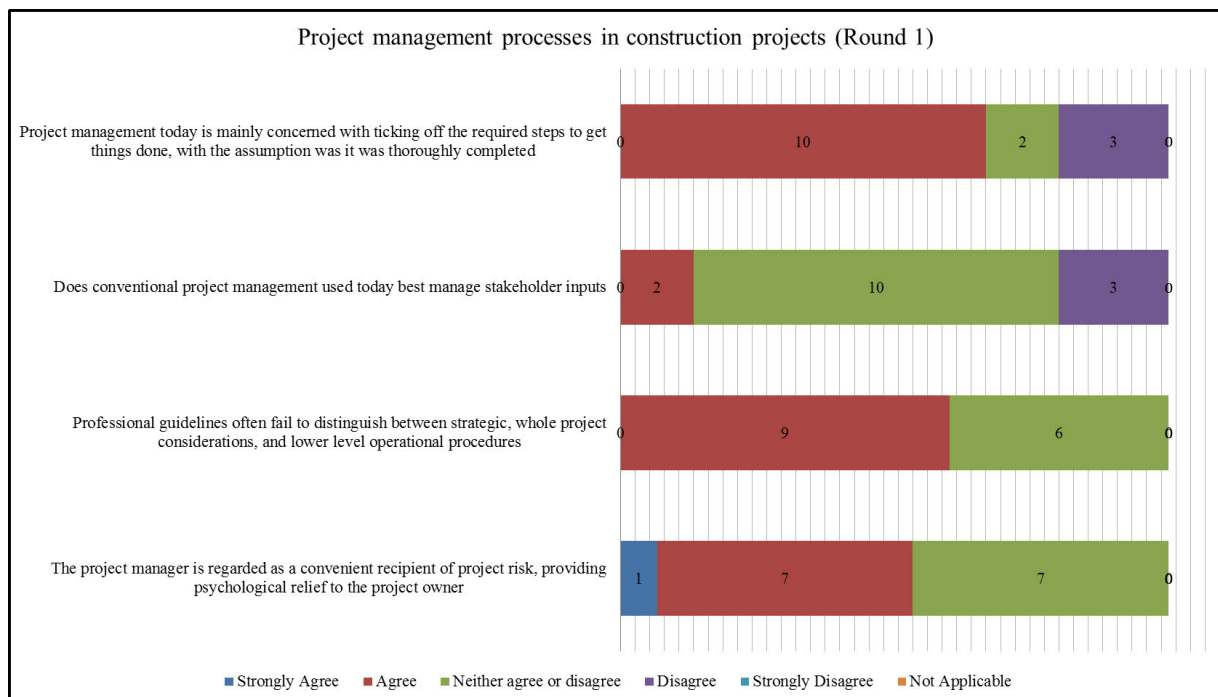


Figure 17: Round 1: Bar graph representing project management processes in construction projects.

The results showed from the mean summary in Table 52 previously and the Figure 17 above that there was generally an agreeance with three of the statements provided these being:

- *“Project management is just concerned with tick off steps”.*
- *“The project manager is a convenient recipient of project risk”.*
- *“Guidelines often fail to distinguish between project processes”.*

The other statement however which was *“does conventional project management used today best manage stakeholder inputs”* the panel were significant undecided neither agreeing or disagreeing with this statement. This indicated that current project management perhaps does not best manage stakeholder inputs.

4.12.2 Round 2: Project management processes in construction projects

The panel members were asked to retake the proposition of the short answer questions regarding project management processes within construction projects as asked in round 1 above. This was for the purpose of confirming the consensus of the expert group across the two rounds. The results of the second round are shown in the Table 53 and Figure 18 below.

Table 53: Round 2: Project management processes in construction projects results.

Project management processes in construction projects (Round 2)									
	Strongly Agree (1)	Agree (2)	Neither agree or disagree (3)	Disagree (4)	Strongly Disagree (5)	Not Applicable (6)	Total	Mean	Standard Deviation
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption was it was thoroughly completed	2	10	1	2	0	0	15	2.20	0.83
Does conventional project management used today best manage stakeholder inputs	0	5	9	1	0	0	15	2.73	0.57
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures	1	8	5	1	0	0	15	2.40	0.71
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner	1	7	3	4	0	0	15	2.67	0.94

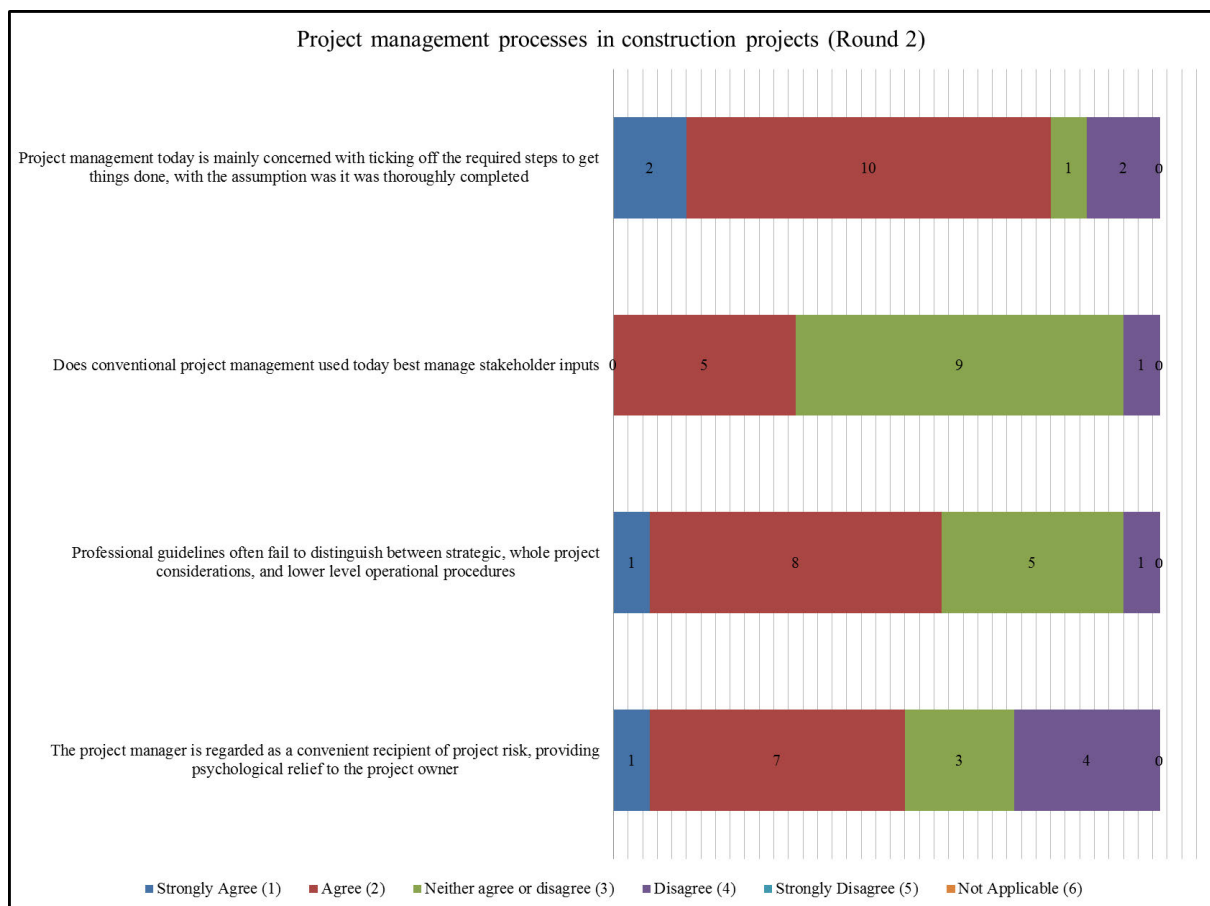


Figure 18: Round 2: Bar graph representing project management processes in construction projects.

The results showed from the mean summary in the Figure 19 below were that they were generally consistent with the results that were determined in round 1.

The following statement however “*does conventional project management used today best manage stakeholder inputs*” saw the panel take a more favoured response too. In that they were in more of an agreeance with this statement then they were in the previous round.

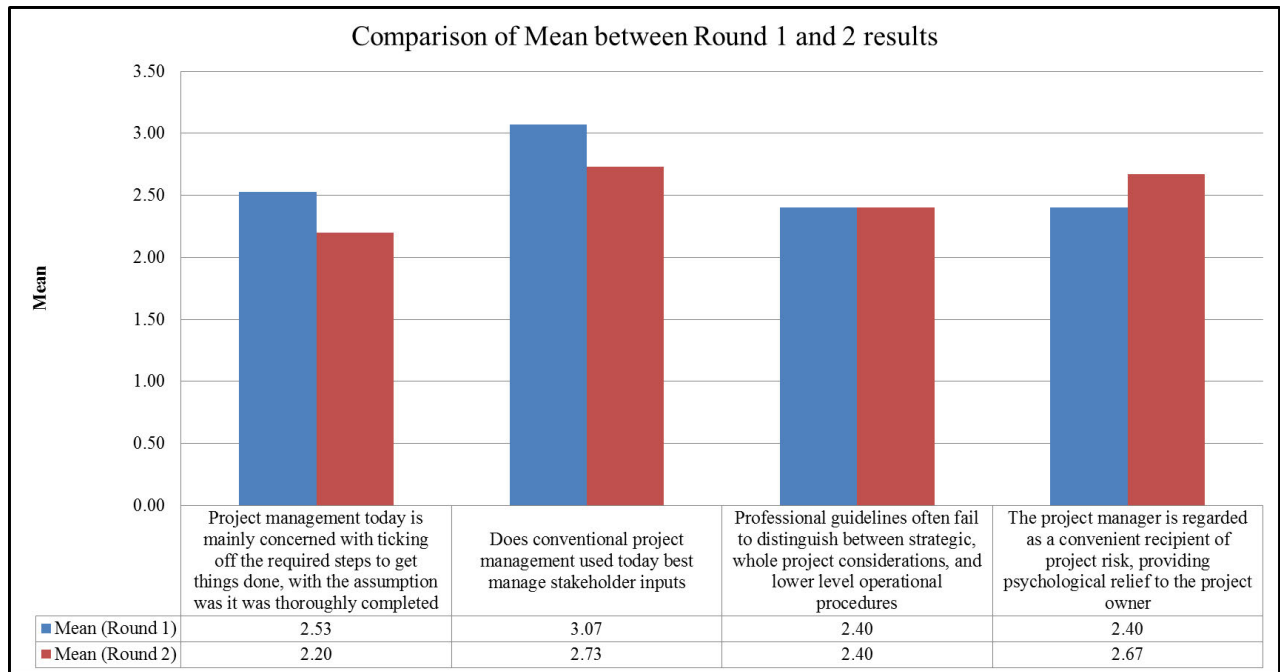


Figure 19: Comparison of mean between rounds 1 and 2 for project management processes in construction projects.

4.12.3 Round 1: Panel responses to gaps in the current project management guidelines

The survey asked the panel to provide a comment on what they thought were gaps in the current project management guidelines that could help in better managing complex projects. The result responses summary is shown below in Table 54.

Table 54: Round 1 Panel's responses to gaps in current management guidelines.

Panel's responses to gaps in the current project management guidelines	
Respondent No.	Responses
Number 1	No response provided
Number 2	The problem elements are political interference and unrealistic expectations which can't be addressed by guidelines
Number 3	It depends on what project management guidelines you are referring too
Number 4	Peer review of processes
Number 5	Not sure of current project management guidelines
Number 6	Mechanism to close out stakeholder issues before commencing to next stage
Number 7	One of the main gaps that exist is methods of managing and improving the operational performance of their own project team. Clarifying and measuring project objectives is an effective way of enabling project managers to effectively monitor and control project activities to improve results.
Number 8	Client knowledge of project complexities - 'training the client'
Number 9	Additional information on how to manage project risks, and who needs to be involved when accepting to move forward and manage a risk
Number 10	Early identification of assets owners so the correct standards are followed
Number 11	Efficiencies with the level of bureaucracy in government
Number 12	Project Pack is not followed accurately with respect to referring back to previous stage project managers for design decisions and consultation. Information is lost when design decisions have not been recorded or tracked accurately.
Number 13	I believe the current project management guidelines are far too convoluted. This results in individuals overlooking/dismissing crucial steps in a project's life-cycle resulting in unforeseen issues later on. Having a more succinct guideline would alleviate this issue.
Number 14	Organisation collaboration
Number 15	No gaps, guidelines are pretty thorough. Project Manager is always prioritising which activities occur and which don't by considering the complexity of the project and the appropriate use of resources/funds.

Two of respondents indicated that they were unsure of what the current guideline surrounding project management were and what they involved. The other thirteen statements were filtered down to determine a top ten. Respondent's number 3 and 4 were removed as both statements were very vague and didn't answer the question in general terms.

Respondent number 12 response was also not carried through as the answer was more focused on design management and not focused on project management related issues.

The final ten statements were then filtered down with the key message and terms carried through to the selection process as part of the second round.

4.12.4 Round 2: Panel responses to gaps in the current project management guidelines

In following round 2 the panel was asked to select at least 1 or up to a maximum of five of the measures. That they considered most applicable from their previous responses completed by themselves or others. The resulting response summary is shown below in Table 55.

Table 55: Panel's selection of gaps in the current project management guidelines.

Panel's selection of gaps in the current project management guidelines	Experts frequency	Responses No.
1. Political interference and unrealistic expectations which can't be addressed by guidelines	67%	10
2. Clients knowledge of project complexities	60%	9
3. Efficiencies with the level of bureaucracy in government	54%	8
4. Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle	47%	7
5. Early Identification of assets owners so the correct standards are followed	40%	6
6. Closing out stakeholder issues before commencing to next stage	40%	6
7. Managing and improving the operational performance of their own project team	34%	5
8. Organisation collaboration	34%	5
9. Additional information needed on how/who manages project risks	27%	4
10. No gaps, guidelines are thorough enough as is	7%	1
11. None of these are applicable	0%	0

The results found a consensus on the top four measures similar to that of Chan et al. (2001), where the panel had to identify the key gaps that they considered missing in the current project management guidelines. The following top four gaps identified were:

- 1) Political interference and unrealistic expectations which can't be addressed by guidelines (67%).
- 2) Client's knowledge of project complexities (60%).
- 3) Efficiencies with the level of bureaucracy in government (54%).
- 4) Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a project (47%).

5.0 Discussion

5.1 Overall road construction project complexities

A few similarities were able to be drawn from the results, particularly from those of previous studies like Gidado and Miller (1992) and Akintoye (2000). Both the technical aspects and environment were marked as highly important when it comes to project complexities on overall road construction projects. When comparing these factors with other discipline construction projects conducted internationally they appear to be consistent.

Kendall's coefficient of concordance (W) was determined to be 0.683. This indicated a strong measure of consistency provided by the panel as to the agreement on the ranking of the order found in section 4.2.2. There were also two key trends in the relationship between the top five complexity measures with a moderate negative relationship between the factors of:

- 'Buildability of the design work and cost constraints'.
- 'Technical aspects and urgency of the project schedule'.

Indicating that as one of the variables increased the other corresponding one decreased.

5.2 Conception stage road construction project complexities

The overall trend of the key measures during the conception stage was similar to those mentioned in Chapman and Ward (2003). The ability to define project objectives, the level of definition of the project and managing the expectations of the project including that of the stakeholders were not only determined as project complexities but also identified as uncertainties in management from literature.

A moderate negative relationship was found between the level of project definition and the two measures of project expectations and managing stakeholder expectations. Therefore as the project stakeholder's expectations increases it becomes significantly more difficult to define the level of the project definition.

5.3 Strategic design stage road construction project complexities

The results data showed that the level of unknowns and confirming the preferred option (concept design) are key complexity factors during the strategic design stage. Both of these measures received high importance weightings to indicate they are factors that need to be seriously considered.

Kendall's coefficient of concordance (W) was determined to be 0.717. This indicated a very strong measure of consistency provided by the panel as to the agreement on the ranking of the order found in section 4.4.2. There were also some important correlations that were identified between some of the measures. These consisted of a moderate negative relationship between the factors of:

- 'Level of unknowns' and 'confirming the preferred option'.
- 'Confirming the preferred option' and 'consulting appropriate stakeholders'
- 'Consulting appropriate stakeholders' and 'strategic estimate'.

5.4 Concept design stage road construction project complexities

The analysis showed that there was no order rearrangement for the top three project complexities between rounds 1 and 2 of the findings, indicating that the panel was set on their top three complexity measures.

There was an overarching agreeance within the group backed up by the high mean and importance weights given for the top two measures of engineering and field investigations and developing the concept design. A consistent moderate negative correlation was represented between the three of the identified measurable items which meant each item had an inverse effect on the other as shown in Table 22.

5.5 Detailed design stage road construction project complexities

The ability to 'manage the level and scope of a project' was rated by the panel as being the most important complexity measure when it comes to the detailed design. This stage is all about developing and refining the selected concept design, which was rated as the second measure of importance.

The ability to maximise the cost-efficiency of the project while controlling and mitigating its risks is very important and was reflected in the results. The analysis found that there was a moderately negative relationship between the factors of:

- 'Managing the level and scope of the project' and 'developing the detailed design'.
- 'Managing project risks' and 'developing the detailed design'.

So as the level and scope of the project increases it becomes increasingly more difficult to develop the detailed design.

5.6 Construction stage road construction project complexities

The results found were similar to those in the concept design stage. There was no order rearrangement for the top three project complexities across the two rounds, indicating that the panel had a level of confidence in their selected measures. During construction managing tasks, risks and contracts were ranked as the key measures when it comes to the construction of a roads project. There was only one moderately positive correlation relationship identified between two of the measure that was:

- 'Managing construction activities and services' and 'managing construction contracts'.

Confirming that as the management of the construction activities increased so did the ability in managing the construction contract.

5.7 Finalisation stage road construction project complexities

From the findings the panel of experts ranked both measures of ‘Finalising and handover of the completed work’ and ‘identifying ongoing maintenance work and planning’ with the same level of importance. This was closely followed by the ‘post completion review’ in second. Unlike all the other project stages above there was no notable correlation between any of the key terms found.

5.8 Stakeholder impacts

Stakeholders are known to be critically important in being able to contribute to a project’s success however at the same time can also be significant contributors to having a negative influence on a project as was stated by Lu et al. (2014). The panel was asked a series of questions surrounding that of the stakeholder’s involvement and inputs for the purpose of being able to create a clearer picture of the factors that make constructing road projects difficult.

5.8.1 Stakeholders that have the most influence on a projects objectives

The results identified that in the second round the following most influential stakeholders when it comes to the project objectives were:

- 1) Project owner (client).
- 2) Politicians.
- 3) Community.
- 4) Environmental.
- 5) Project manager.

According to the panel members at the end the day the decision surrounding the project objectives and amending them ultimately lies with the responsibility of the client. On review the group also placed high importance weightings on both the politician and the community stakeholders as shown in Table 35. They are known to have a significant influence on a project and apply pressure to the client if pressed hard enough.

5.8.2 Stakeholders that accept the highest risk allocation on a project

Project uncertainty from literature is associated with project stakeholders, while employers and agents as well as project clients are considered essential to the achievement of project performance (Atkinson, 2006).

The results from the survey identified that the top three stakeholders that accept the highest risk allocation were the:

- 1) Project owner (client).
- 2) Project manager.
- 3) Contractor.

These results can be explained from the findings in the literature review conducted, where project related issues can occur between the principal (i.e. Client) and the agent (i.e. contractor). In who tries to be the bigger influencer for the purpose of trying to advantage themselves. This leaves the project manager as the middle man who needs to manage these two influential stakeholders to try and achieve the best project outcome.

5.8.3 Objectives of a project changing due to a stakeholders inputs

The results showed an overwhelming agreeance that the panel members at some point had been affected by the objectives of a project being changed due to a particular stakeholder being involved with 94% of them agreeing and only one respondent disagreeing. Deciphering these results it is clear that in the majority of road construction projects conducted. There is a high probability that the project objectives will change which will most likely be due to the top three influential stakeholders identified back in section 5.8.1.

5.8.4 Stage of a projects lifecycle that is most important to managing stakeholder inputs.

When it comes to managing stakeholder's inputs, the earlier stages in the lifecycle process were considered by the panel as the most important.

There was no ranked change in the order as shown in Table 40 between the two rounds. The concept design was ranked number one with an importance weighting of 0.378. Typically this is the stage where the community starts getting involved, as the project group has selected the preferred option and has sufficient detail in being able to present the design.

This can however create issues in that if either the community group or individuals are unhappy with a section or the project as a whole, in that they will apply pressure to the local member or government organisation managing the project as shown in section 5.8.1. In the strategic and conception stages only normally the internal stakeholders of the project team members, client, local council and perhaps some private traffic management companies that manage motorways are typically involved. This was why they were ranked with a lower importance weighting.

5.8.5 Stakeholders involvement in construction projects

It has been well documented in literature that stakeholder's involvement in construction projects can both improve project outcomes while at the same time have a negative impact on the complexity of the project.

The results of the survey across both rounds and in particular round 2 provided a clear consensus surrounding stakeholder involvement in road projects. The results across the two rounds showed that there was only one noticeable difference of a change greater than +0.15 for the statement '*the larger the number of stakeholders the higher the project complexity*' which had a change of 0.27 that more favoured this statement.

There was a general disagreement from the panel that '*stakeholders don't align themselves with project objectives*' if this is the case then all projects are at risk of not providing the best outcome or costing significant amounts of money. For the purpose of having multiple options developed.

For the other five statements the panel was in agreement as shown in Figure 9. The results here showed that different stakeholders have different interest levels and perspectives. While they also perceive risks differently, though this can sometimes be a benefit for the project in that a particular stakeholder will push their risk or perspective for further investigations. If the individual (or group) doesn't push back or there is an overarching disagreement across the project team these risks can at times be overlooked.

It was also found that late stakeholder engagement can cause a project to suffer. This can be difficult sometimes if you're managing a sensitive individual, or the project timeline is set on the critical path.

5.9 Project uncertainties and risks

5.9.1 Project lifecycle stage that holds the most project uncertainty

The data indicated that the earlier stages of the project lifecycle hold the most project uncertainty, with the conception of the project ranked the highest, the strategic design in second followed by the concept design. There was a clear separation in the importance weighting scores between the three measures, matching up in the same order as the project lifecycle.

5.9.2 Project risk in construction projects

From the literature review conducted it is clear that project risk of varying levels exists in all construction projects, the literature stated that different parties have differing perceptions of risks with each party managing risk differently and sometimes for their own benefit.

The results of the survey across both rounds and in particular round 2 identified that the panel was unsure as to whether or not the general public should have a greater influence over a projects direction. They did agree similar to literature those internal and external stakeholders perceive risks differently and that both parties sometimes manage risks for their own advantage to disadvantage the other. When the group was asked if this type of dynamic occurred within a single organisation they were of a split opinion with some saying it does occur, others sitting on the fence and some disagreeing.

5.9.3 Stage of a project development process most likely to be overlooked

The results indicated that the earliest stages of the project lifecycle are most likely to be overlooked or processes skipped through. Both the conception of the project and strategic design ranked the same in first position with a fair gap in the important weightings back to the concept design.

These results are interesting because back in section 5.8.4 and 5.9.1. These same stages were considered to be most important for managing stakeholder inputs while they also held the most project uncertainty. If risks or a particular stakeholder are being overlooked this will increase the chances of project complexities later on in the project process.

5.10 Managing stakeholder relationships in road construction projects

The data and results showed that when it comes to managing stakeholder relationships and input. Communication was overwhelmingly the most critical component as it was selected as the top ranked measure in section 4.11.2. When the panel was asked to provide a short answered response 13 of the 15 respondents mentioned it as part of their answer.

The key type of communication terms mentioned were early, open, transparency, face to face, two ways and consistency with all being considered important. Developing relationships, addressing issues as and when they arise, while treating stakeholders with consistency was also identified which was consistent with these mentioned in the literature review conducted.

5.11 Project management processes in road construction projects

5.11.1 Project management processes in construction projects

When it comes to project management today the panel agreed that typically it is mainly just concerned with ticking off the required steps with the assumption that it was completed thoroughly to an appropriate level of detail. This result was consistent with the statement *‘does conventional project management used today best manage stakeholder inputs’* where the panel generally was unsure with the majority disagreeing or neither agree or disagree with this. The result here indicates that a more comprehensive ‘outside the box’ approach needs to be taken when it comes to managing stakeholder inputs over that of using conventional management measures.

The other two statements had a score of 2.40 to 2.67 leaning the results towards a generally agreeance that:

- ‘Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures’.
- ‘Project manager provides some psychological relief to the project owner’.

These indicated that the current guidelines don’t cover the whole spectrum of the project processes and that generally the project manager accepts some of the risks that perhaps should be put on the client. It is noted that the results between the two rounds were generally similar.

5.11.2 Gaps in the current project management guidelines

The panel was asked to identify what potential gaps in current management guidelines could be applied in being able to better manage larger sized projects. For the purpose of this report only those responses above the 47% threshold similar to Chan et al. (2001) were considered as key with the top four identified as:

- 1) ‘Political interference and unrealistic expectations which can’t be addressed by guidelines’.
- 2) ‘Client’s knowledge of project complexities’.
- 3) ‘Efficiencies with the level of bureaucracy in government’.
- 4) ‘Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a project’.

The results indicated that in terms of the guidelines themselves they appear to be complex and difficult to follow. It appears a clearer more simplified methodology needs to be considered to allow project managers a clearer picture of the steps that need to be applied so that they are not overlooked due to a lack of understanding.

The other three statements from the panel indicated a lack of knowledge from clients and senior management within organisations. In particular surrounding project complexities in what is involved in a project. For example understanding the level of detail being put into an idea or suggested change before a decision is being made as to whether or not it should be

progressed or not. Another factor identified is the level of 'politics' in some government organisations which can't be put into guidelines but can have a significant impact on whether or not a project goes ahead or not. Some projects can be developed at times to a 'shove ready' status but the project estimate might be significantly higher than the initial expectation. If this doesn't meet the expectation of the organisations higher management the project may be shelved. Otherwise it will have to go through the process of being looked at again to find potential cost savings that have probably already been sufficiently investigated, delaying the project for another 12 plus months in some cases.

6.0 Conclusions

A two round Delphi method was conducted as it provided a sufficient amount of consensus amongst the group to not warrant any future rounds.

The Delphi method is considered a useful structure method in utilizing the knowledge base of specific experts in the road industry field. It acts as a self-validating mechanism in defining parameters particular in terms of evaluating project complexity at different stages. Although this method cannot perfectly eliminate the assessment subjectivity, the cautious selection of the specialised panel helps ensure that the study findings are considered reliable.

6.1 Overall road construction project complexities

The complexities order of the top five weighted measures for an overall road construction project with the Importance weightings are shown as:

- 1) Buildability of the design (0.235).
- 2) Cost constraints (0.227).
- 3) Technical aspects (0.218).
- 4) Environment (0.165).
- 5) Urgency of the project schedule (0.155).

This data can help to develop a composite complexity index (CI) that can be used to measure the complexity of road construction projects across Australia. It also provides some practical feedback to project managers and engineers about the complexities to focus their time and effort. As well as being able to use the Index to measure and compare their similar projects degree of complexity. These measures identified are keys that can be brought to the attention and action of project teams to improve future planning and implementation of projects.

6.2 Conception stage road construction project complexities

The complexities order of the top four weighted measures during the conception stage of a road construction project with the Importance weightings are shown as:

- 1) Definition of project objectives (0.373).
- 2) Level of project definition (0.253).
- 3) Project expectations (0.227).
- 4) Managing stakeholder expectations (0.147).

At this initial stage the ability to define the project and manage expectations of both the project itself and stakeholders are key in being able to create project successes at this stage. These measures should be the focus of the client and the project manager. These can be achieved, as seen in the previous sections through communication and transparency between all project members and gathering as much inputs as early as possible in the process.

6.3 Strategic design stage road construction project complexities

The complexities order of the top four weighted measures during the strategic design stage of a road construction project with the Importance weightings are shown as:

- 1) Level of unknowns (0.307).
- 2) Confirming the preferred option for the concept design (0.280).
- 3) Consulting appropriate stakeholders (0.220).
- 4) Strategic estimate (0.193).

During this stage not all the input information of the project is known with a lot of it being high level whether that is the survey, what the ground conditions are like as well as being able to identify all the constraints as early as possible. Not having this information can have significant consequences on the later stages of the project lifecycle. What some clients and project managers need to understand is that design implications or changes can be better managed in terms of cost and time during the early stages. By having delayed detailed inputs these can be magnified significantly by the time the project reaches the construction stage.

6.4 Concept design stage road construction project complexities

The complexities order of the top three weighted measures during the concept design stage with the Importance weightings are shown as:

- 1) Engineering and field investigation outcomes (0.422).
- 2) Developing the concept design (0.367).
- 3) Concept design estimate (0.212).

When it comes to developing the concept design stage, conducting the initial investigation works of survey, geotechnical, noise, traffic for example can allow the findings of these works to have a significant impact on the outcomes of future projects. Project managers can use the complexity index developed in this study so it can be applied and compared to similar projects in determining the areas of this stage that they need to better focus their attention too.

6.5 Detailed design stage road construction project complexities

The complexities order of the top three weighted measures during the detailed design stage with the Importance weightings are shown as:

- 1) Managing the level and scope of the project (0.345).
- 2) Developing the detailed design (0.333).
- 3) Managing project risks (0.322).

These indicated that any project scope change or scope creep is a particular concern when it comes to large construction projects. Additions may want to be made by the client due to political or community pressure. There also needs to be consideration for the construction contractor building the design in that they are trying to minimise the scope in order to be able to maximise profits. By bring up these items of measurement up it can provide some practical benefits for the client and project manager to focus more efforts into controlling these areas.

6.6 Construction stage road construction project complexities

The complexities order of the top three weighted measures during the construction stage with the Importance weightings are shown as:

- 1) Managing construction activities and services (0.403).
- 2) Managing site risks (0.339).
- 3) Managing construction contracts (0.257).

The key wording in the three measures above was managing when it comes to constructing a road infrastructure project. The ability of the constructor to best manage and control activities, risk and contracts are keys in being able to reduce time delays and improve cost efficiency. These appropriate leadership measures can be taken by stakeholders using this study in being able to help decrease future project complexity risk in construction. For contractors who typically construct major government projects the complexity index can help facilities tendering, goal setting and risk assessment processes.

6.7 Finalisation stage road construction project complexities

The complexities order of the top three weighted measures during the finalisation stage of a road construction project with the Importance weightings are shown as:

- 1) Finalising and handover of the completed works (0.361).
- 1) Identifying ongoing maintenance works and planning (0.361).
- 2) Post completion review (0.279).

These measures help provide some practical feedback to project managers and technicians on the sort of complexities they need to concentrate on in terms of time and effort, as well as also being able to provide a complexity index that can be used to compare the complexity level of their comparable projects.

6.8 Stakeholder impacts

6.8.1 Stakeholders that have the most influence on a projects objectives

The data presented in the report indicates that the project owner (client) is the most influential stakeholder when it comes to setting and amending project objectives, with the responsibility at the end of the day settling with them.

While this is the case the other stakeholders listed in particular the community who may be impacted by a large construction project, are able to apply pressure to local politicians who in turn return serve to the project client. It is then up to them to manage these pressures and produce an appropriate solution which will not be to the detriment of the project. The ability to manage these pressures through a communication, mitigation or appropriate action approach will help ensure project success.

6.8.2 Stakeholders that accept the highest risk allocation on a project

The data in this report indicates that the stakeholders that accept the highest risk allocation on a project are:

- 1) Project owner (client).
- 2) Project manager.
- 3) Contractor.

These are all the highest advocates of risk allocation when it comes to projects particularly large ones. The data could not confirm why these three stakeholders are the highest risk advocates however from the literature review from Ward (2008). It typically comes from the principal and agent dynamic associated on most construction projects. Both these two manage risks differently to one another with the project manager finding himself the middle man in this type of situation which is consistent with the results found. Further research could be conducted to identify how to best manage this dynamic in future road construction projects.

6.8.3 Objectives of a project changing due to stakeholders inputs

The data indicated from the panel members that in the majority of projects that they had been involved in there had been a change to the objectives due to the input or decision of a particular stakeholder with their being a 94% agreeance within the group.

These changes were most likely to come from the most influential stakeholders as indicated in section 5.8.1. This confirms that changes to objectives and in effect the scope, create issues surrounding time pressures, cost, project timeframes which can be magnified if they are made later in the project lifecycle process.

6.8.4 Stage of a projects lifecycle that is most important to managing stakeholder inputs

The project lifecycle data indicated that the earlier to initial stages of the project lifecycle are the most important in being able to manage stakeholder inputs, they were determined in the order as follows with Importance weightings:

- 1) Concept design (0.378).
- 2) Strategic design (0.344).
- 3) Conception of the project (0.278).

Managing inputs earlier when the project is just getting up and running, allows the project manager to adopt, consider and investigate change or feedback without costing a significant amount of time or money to the project.

Engaging stakeholders as early as possible doesn't produce any surprises or anger against the project team which is typically difficult to manage later during the detailed design or construction.

6.8.5 Stakeholders involvement in construction projects

The results and analysis surrounding stakeholder involvement in construction projects indicated that stakeholders do not align themselves with the project objectives. This is believed to be due to difference of opinions or individuals having their own personal agendas surrounding what they believe the project should look or function like. These individuals typically don't have the best interests of the project at heart. There was also a significant agreeance that different stakeholders have different interest levels and perspectives while also perceiving risks differently.

It is also documented in Ward (1999) that increasing the number of stakeholders increases the project complexity creating uncertainty surrounding a number of different factors. From this it is the responsibilities of both the client and the project manager to best manage these types of situations. Whether that be through increased communication or earlier stakeholder engagement, whatever the case it is important that these statements be managed appropriately.

6.9 Project uncertainties and risks

6.9.1 Project lifecycle stage that holds the most project uncertainty

The data results indicated that the earlier stages of the project lifecycle are most likely to hold the most project uncertainty as shown below with their Importance weightings:

- 1) Conception of the project (0.467).
- 2) Strategic design (0.355).
- 3) Concept design (0.178).

During the earlier stages the inputs used for a project are typical only desktop information which is quite high level. The earlier in the process that field studies are conducted like survey, environment, traffic, geotechnical investigations for example the lower the risk of project uncertainty. Clients and project managers need to be made aware of the consequences of delaying investigations as the costs here are significantly less versus identifying something new during construction.

6.9.2 Project risk in construction projects

The data identified that the panel was unsure as to whether or not the general public should have a greater influence over a projects direction. In the literature review it was stated that all stakeholders are important and influence projects particularly the community as was detailed in section 5.8.1.

Yes the community is a key stakeholder and their voice should be heard and considered. But at the same time they shouldn't be asked to provide a direct solution as to how to solve a problem. This appears to be a general trend beginning to form in some government organisations and currently appears to be an area of debate that will need to be managed into the future.

Other outcomes found was that internal and external stakeholders perceive risks differently. And that they sometimes manage risk for their own advantage to the disadvantage of the other which was found it be the general agreeance of the panel and was consistent with the literature reviewed.

There was a split opinion however that this very situation occurs in internal organisations, this does perhaps indicate internal companies which you would expect to work more closely as a team. So perhaps project members in some cases do manage risks for their own benefit which is an interesting concept to consider. It is therefore important for the client and project manager to be mindful of other stakeholders. As they may have a conflict of interest or have their own personal agendas they are trying to push for.

6.9.2 Stage of a project development process most likely to be overlooked

The data found in this report indicates that the earlier stages of the project lifecycle are the ones most likely to be overlooked. In terms of missing important steps or not conducting investigations and development work on the project to a sufficiently enough detail. With some project managers taking the business as usual approach or adopting the same processes they used on a previous similar project which may not be applicable to their current job. The results found with the Importance weightings were as follows:

- 1) Conception of the project (0.389).
- 1) Strategic design (0.389).
- 2) Concept design (0.222).

Taking the approach above lies in creating a number of issues later in the project process that are significant more difficult to manage. Many project managers and clients consider the later stages of a project where a more rigorous procedure needs to be followed where in fact it is actually the early stages that this approach needs to be applied.

6.10 Managing stakeholder relationships in road construction projects

When it comes to managing stakeholder relationships communication is most certainly the key in being able to achieve this. No matter the size of the project which was well represented in the results.

Develop relationships and managing expectations around issues that may arise during the duration of the project and even sometimes after, were a few of the other key factors determined. It has been mentioned previously that stakeholders influence projects significantly. So by the project manager conducted the above measures appropriately and consistently they can help to ensure a positive outcome for a project.

6.11 Project management processes in road construction projects

6.11.1 Project management processes in construction projects

The data indicated that project managers today are mainly just focused on ticking off the required steps. Taking what is referred to as a ‘business as usual’ approach particularly during the initial stages of the project which appear to be getting over looked.

There was also a strong indicator that conventional project management does not best manage stakeholder inputs, it was mentioned previously that communication is key in being able to manage stakeholders. Depending on the project, the project managers may need to take a more hands on approach. Where weekly or monthly meetings are held so that all members of the project team can be invited to see the project progress or add input, so that it is not being left to the last minute for stakeholders to be involved. Where changes are difficult to make which can be costly.

A common conception within the industry is that project managers bear the weight of risks on a project while this is true to some extent. Risks need to be managed across the whole project team and in particular by the client. Further research is needed to develop training courses that define clearer project roles and responsibilities both internally and externally.

6.11.2 Gaps in the current project management guidelines

The resulting data identified that the current project management processes in place are perhaps too convoluted to follow. This is causing particular members of the project team to miss steps or processes which are affecting project outcomes. While there does appear to be more time required to simplify the current project management processes in place. There is a ‘business as usual’ trend that is beginning to form in some project managers and project teams, which is becoming difficult to manage just through updating guidelines.

In order to avoid this trend additional training courses and improving the knowledge base of all project team members particularly at the higher level ends of management as to clearing up roles and responsibilities would be considered appropriate. While also considering the improvement of knowledge processes involved in developing and constructing a project should be considered.

Within government organisations there appears to be a level of politics involved which are impacting on the overall outcomes of construction projects. Politics in government are extremely difficult to address through guidelines. As the majority of the times they can’t be managed at either the project manager or client’s organisational level. The best approach is to ensure a sufficient amount of time has been taken in the development and thought process that is needed in constructing and developing a project. So that if and when changes occur little rework is required. Addressing political issues in construction projects is considered outside the scope of this paper but could be further investigated in future research.

7.0 Limitations and Future works

This research suffers from certain constraints, as with any other opinion-based research. It was mentioned in section 4.1, that attempts have been created to guarantee that all the participants selected meet the majority of the criteria set out in this project. This has definitely helped to improve the quality of answers given however the effects of bias, imprecise definitions and subjectivity cannot be considered as entirely controlled. However by taking a bigger panel size and increasing the interaction between respondents on a project with a more indefinite timeframe, the impacts of these constraints could be further decreased in future works.

Some of the future works were detailed as part of the conclusion in this paper. Additional research should also be conducted in order to determine differences and similarities in complexities measures, risks and stakeholder managements across different geographical locations both in Australia and globally.

8.0 References

- Aaltonen, K., Jaakko, K. and Tuomas, O. (2008). Stakeholder salience in global projects. *International Journal of Project Management*, 26(5), pp.509-516.
- Abs.gov.au. (2019). *3101.0 - Australian Demographic Statistics, Dec 2018*. [online] Available at: <https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3101.0> [Accessed 21 Jul. 2019].
- Achterkamp, M. and Vos, J. (2008). Investigating the use of the stakeholder notion in project management literature, a meta-analysis. *International Journal of Project Management*, 26(7), pp.749-757.
- Adnan H. and Morledge R. (2003) Application of Delphi method on critical success factors in joint venture projects in the Malaysian construction industry, *Paper presented at CITC-II Conference*, Hong Kong, 10-12 December.
- Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. *Construction Management and Economics*, 18(1), pp.77-89.
- Atkinson, R., Crawford, L. and Ward, S. (2006). Fundamental uncertainties in projects and the scope of project management. *International Journal of Project Management*, 24(8), pp.687-698.
- Baarda, D. B., & de Goede, M. P. M. (2006). *Basisboek Methoden en Technieken*. Groningen: Wolters-Noordhoff
- Bakens, W., Foliente, G., Jasuja, M., 2005. Engaging stakeholders in performance-based building: lessons from the Performance-Based Building (PeBBu) Network. *Building Research & Information* 33 (2), pp.149–158.
- Bosch-Rekveltdt, M. G. C. (2011). “Managing project complexity: A study into adapting early project phases to improve project performance in large engineering projects.” Delft Centre for Project Management, Delft, Netherlands. Brady, T., and Davies, A
- Bosch-Rekveltdt, M., Jongkind, Y., Mooi, H., Bakker, H. and Verbraeck, A. (2011). Grasping project complexity in large engineering projects: The TOE (Technical, Organizational and Environmental) framework. *International Journal of Project Management*, 29(6), pp.728-739.
- Bosher, L., Dainty, A., Carrillo, P., Glass, J., Price, A., (2007). Integrating disaster risk management into construction: a UK perspective. *Building Research & Information* 35 (2), pp.163–177.
- Bourne, L 2015, *Making Projects Work: effective stakeholder and communication management*, Boca Raton, FL : CRC Press is an imprint of the Taylor & Francis Group, an informa business.

Corbett, L.M., Brockelsby, J. and Campbell-Hunt, C. (2002), "Tackling industrial complexity", in Friezelle, G. and Richards, H. (Eds), *Tackling Industrial Complexity*, Institute for Manufacturing, Cambridge, pp. 83-96.

Chan, A., Yung, E., Lam, P., Tam, C. and Cheung, S. (2001). Application of Delphi method in selection of procurement systems for construction projects. *Construction Management and Economics*, 19(7), pp.699-718.

Edmonds, B. (1999), "Syntactic measures of complexity", DPhil thesis, University of Manchester, Manchester.

Fowles, J. and Jones, T. (1983). Options for the Future: A Comparative Analysis of Policy-Oriented Forecasts. *Contemporary Sociology*, 12(3), p.339.

Freeman, R. E. (1984). *Strategic Management: a Stakeholder Approach*. Boston: Pitman/Ballinger.

Gidado, K.I. and Millar, A.J.(1992) The effect of simple overlap of stages of building construction on the project complexity and contract time, *Progress of the 8th Annual conference, Association of Researchers in Construction Management*, Isle of Man, September, pp/307-317.

Gidado, K. (1996). Project complexity: The focal point of construction production planning. *Construction Management and Economics*, 14(3), pp.213-225.

Hsu, S., Weng, K., Cui, Q. and Rand, W. (2016). Understanding the complexity of project team member selection through agent-based modeling. *International Journal of Project Management*, 34(1), pp.82-93.

Hsu C & Sandford BA. (2007) The Delphi Technique: Making Sense Of Consensus. *Practical Assessment, Research & Evaluation*.

Infrastructure Australia. (2019). *Infrastructure Priority List*. [online] Available at: <https://www.infrastructureaustralia.gov.au/projects/infrastructure-priority-list.aspx> [Accessed 28 May 2019].

Jacobs, J. M. (1996). *Essential assessment criteria for physical education teacher education programs: A Delphi study*. Unpublished doctoral dissertation, West Virginia University, Morgantown.

Koivu, T., Nummelin, J., Tukiainen, S., Tainio, R. and Atkin, B. (2004), "Institutional complexity affecting the outcomes of global projects", VTT Working Papers 14, VTT, Espoo, available at: <www.vtt.fi/inf/pdf>

Landin, A., (2000). Impact of quality management in the Swedish construction process. PhD thesis, Department of Construction Management, Lund University.

Ludwig B. (2001). Predicting the future: Have you considered using Delphi methodology? *Journal of Extension*, 35(5)

Luo, L., He, Q., Jaselskis, E. and Xie, J. (2017). Construction Project Complexity: Research Trends and Implications. *Journal of Construction Engineering and Management*, 143(7), p.04017019.

Lu, Y., Luo, L., Wang, H., Le, Y. and Shi, Q. (2014). Measurement model of project complexity for large-scale projects from task and organization perspective. *International Journal of Project Management*, 33(3), pp.610-622.

Lessard, D. and Miller, R. (2001). Understanding and Managing Risks in Large Engineering Projects. *SSRN Electronic Journal*.

Masini E. (1993). *Why Future Studies?* Grey Seal, London

Mitchell, R., Agle, B. and Wood, D. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *The Academy of Management Review*, 22(4), p.853.

Mok, K., Shen, G. and Yang, J. (2015). Stakeholder management studies in mega construction projects: A review and future directions. *International Journal of Project Management*, 33(2), pp.446-457.

Neter J., Kutner M., Nachtsheim C. and Wasserman, W. (2005) *Applied Linear Statistical Models*, 5th, McGraw-Hill.

Olander, S., (2006). External Stakeholder Management. PhD Thesis, Lund University, UK.

PMI (2004), A Guide to Project Management Body of Knowledge (PMBOK), Project Management Institute, Newton Square, PA.

Porter, S. and Whitcomb, M. (2007). Mixed-Mode Contacts In Web Surveys: Paper is Not Necessarily Better. *Public Opinion Quarterly*, 71(4), pp.635-648.

Roads and Maritime, (2009). *Planning the opening of a road project guideline*. [online] Available at: <https://www.rms.nsw.gov.au/documents/about/access-to-information/pn207g.pdf> [Accessed 10 Aug. 2019].

Rodrigues, A. and Bowers, J. (1996). The role of system dynamics in project management. *International Journal of Project Management*, 14(4), pp.213-220.

Rose, K. (2005). Book Review: A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Third Edition. *Project Management Journal*, 36(1), pp.61-61.

Rowe, G. and Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting*, 15(4), pp.353-375.

Seale, C. (2012), *Researching Society and Culture* 3rd edition, London: SAGE

Smith, J., Chapman, C. and Ward, S. (1998). Project Risk Management: Processes, Techniques and Insights. *The Journal of the Operational Research Society*, 49(7), p.769.

Student.unsw.edu.au. (2019). *How Do I Cite Online Sources? / UNSW Current Students*. [online] Available at: <https://student.unsw.edu.au/how-do-i-cite-electronic-sources> [Accessed 7 Apr. 2019].

SurveyMonkey. (2019). *Understand Qualitative vs Quantitative Research / SurveyMonkey*. [online] Available at: <https://www.surveymonkey.com/mp/quantitative-vs-qualitative-research/> [Accessed 14 May 2019].

University of Southern Queensland, 2019, *Section 10 – The ‘Project Progress Report’*, Toowoomba.

Vidal, L. and Marle, F. (2008). Understanding project complexity: implications on project management. *Kybernetes*, 37(8), pp.1094-1110.

Vidal, L., Marle, F. and Bocquet, J. (2011). Measuring project complexity using the Analytic Hierarchy Process. *International Journal of Project Management*, 29(6), pp.718-727.

Verschuren, P., & Doorewaard, H. (1999). *Designing a Research Project*. Utrecht: Lemma.

Ward, S. (1999). Assessing and managing important risks. *International Journal of Project Management*, 17(6), pp.331-336.

Ward, S.C., Chapman, C.B. and Curtis, B. (1991). On the allocation of risk in construction projects. *International Journal of Project Management*, 9(3), pp.140–7.

Ward, S. and Chapman, C. (2008). Stakeholders and uncertainty management in projects. *Construction Management and Economics*, 26(6), pp.563-577.

Weisberg S. (2005) *Applied Linear Regression*, 3rd edn, John Wiley & Sons.

Whitty, S. and Maylor, H. (2009). And then came Complex Project Management (revised). *International Journal of Project Management*, 27(3), pp.304-310.

Williams, T. M. (2002). *Modelling Complex Projects*. London: John Wiley & Sons.

Wright, K. (2006). Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services. *Journal of Computer-Mediated Communication*, 10(3), pp.00-00.

Xia, B. and Chan, A. (2012). Measuring complexity for building projects: a Delphi study. *Engineering, Construction and Architectural Management*, 19(1), pp.7-24.

Yang, J., Shen, G., Ho, M., Drew, D. and Xue, X. (2011). Stakeholder management in construction: An empirical study to address research gaps in previous studies. *International Journal of Project Management*, 29(7), pp.900-910.

Ziglio E. (1996). *The Delphi method and its contribution to decision making, Gazing into the oracle: The Delphi method and its application to social policy and public health*. Jessica Kingsley Publisher, London.

Appendix A - Project Specification

ENG4111/4112 Research Project

Project Specification

For: Mitchell William Rowles

Title: Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Major: Civil Engineering

Supervisor: Dr Nateque Mahmood/ Mr Gary Elks

Sponsorship: Roads and Maritime Services (RMS)

Enrolment: ENG4111 - EXT S1, 2019, ENG4112 - EXT S2, 2019

Project Aim: This project seeks to define and identify specific factors that drive complex road construction projects and determine the influencing factors of project complexity from different stakeholder perspectives throughout different stages of the project lifecycle.

Programme: Version A, 25th March 2019

1. Conduct a review of existing literature to identify and define the factors that drive complex projects as well as those that influence a projects complexity throughout its development cycle.
2. Define and determine a projects complexity and what elements make a project complex, including stating the types of project complexity.
3. Investigate the current management guidelines used in managing complex projects to determine their current status.
4. Review uncertainty factors associated with projects within the project life including project management scope focusing on that of the project parties (stakeholders).
5. Develop a questionnaire survey tool for identifying and ranking the corresponding importance values of influencing factors of project complexities on road construction projects distinguished by the project team, clients and contractors at different stages of the project cycle within Roads and Maritime Services (RMS).
6. Conduct an empirical analysis from the findings of the data collected from the survey using SPSS Software tool.
7. Report findings in the required written formats.

If time permits and allows:

8. Development of management guidelines for addressing complexities throughout the project lifecycle from a stakeholder prospective.

Appendix B - USQ HRE Application Approved

[RIMS] USQ HRE Application H19REA215 - Notice of ethical review pathway
- Expedited Review

human.ethics@usq.edu.au

Tue 10/09/2019 1:15 PM

To: U1005218@umail.usq.edu.au <U1005218@umail.usq.edu.au>

Cc: Gary.Elks@usq.edu.au <Gary.Elks@usq.edu.au>

Dear Mitchell

RE: H19REA215 - ANALYSIS OF INFLUENCING FACTORS OF CONSTRUCTION PROJECT
COMPLEXITY FROM DIFFERENT STAKEHOLDERS

Your HRE Application has initially been risk assessed as "low". As such, your application is currently eligible to be referred to the USQ Human Research Ethics Expedited Review process for review and approval.

Once your HRE Application has been ethically reviewed, you will receive an email with advice on the review outcome and instructions on how to proceed.

Please allow up to 20 working days for the ethical review to be undertaken prior to following up with an Ethics Officer.

Kind regards,

Human Research Ethics

University of Southern Queensland
Toowoomba – Queensland – 4350 – Australia
Phone: (07) 4631 2690
Email: human.ethics@usq.edu.au

This email (including any attached files) is confidential and is for the intended recipient(s) only. If you received this email by mistake, please, as a courtesy, tell the sender, then delete this email.

The views and opinions are the originator's and do not necessarily reflect those of the University of Southern Queensland. Although all reasonable precautions were taken to ensure that this email contained no viruses at the time it was sent we accept no liability for any losses arising from its receipt.

The University of Southern Queensland is a registered provider of education with the Australian Government.
(CRICOS Institution Code QLD 00244B / NSW 02225M, TEQSA PRV12081)

[RIMS] USQ HRE Application - H19REA215 - Expedited review outcome - Approved

human.Ethics@usq.edu.au

Tue 10/09/2019 1:20 PM

To: U1005218@uemail.usq.edu.au <U1005218@uemail.usq.edu.au>

Cc: Gary.Elks@usq.edu.au <Gary.Elks@usq.edu.au>

Dear Mitchell

I am pleased to confirm your Human Research Ethics (HRE) application has now been reviewed by the University's Expedited Review process. As your research proposal has been deemed to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007), ethical approval is granted as follows:

USQ HREC ID: H19REA215

Project title: ANALYSIS OF INFLUENCING FACTORS OF CONSTRUCTION PROJECT COMPLEXITY FROM DIFFERENT STAKEHOLDERS

Approval date: 10/09/2019

Expiry date: 10/09/2022

USQ HREC status: Approved

The standard conditions of this approval are:

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

The additional conditionals of approval for this project are:

- (a) Nil.

Please note that failure to comply with the conditions of this approval or requirements of the Australian Code for the Responsible Conduct of Research, 2018, and the National Statement on Ethical Conduct in Human Research, 2007 may result in withdrawal of approval for the project.

Congratulations on your ethical approval! Wishing you all the best for success!

If you have any questions or concerns, please don't hesitate to make contact with an Ethics Officer.

Kind regards

Human Research Ethics

University of Southern Queensland
Toowoomba – Queensland – 4350 – Australia
Phone: (07) 4631 2690
Email: human.ethics@usq.edu.au

This email (including any attached files) is confidential and is for the intended recipient(s) only. If you received this email by mistake, please, as a courtesy, tell the sender, then delete this email.

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Appendix C - Questionnaire survey questions rounds 1 & 2



Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Welcome to My Survey

Consent Form

The purpose of this research project is the analysis of influencing factors of construction project complexity from different stakeholders perspectives. This is a research project being conducted by Mitchell Rowles from the University of Southern Queensland. You are invited to participate in this research project because you are experienced in the field of road construction. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about your experiences in the roads industry.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Southern Queensland representatives.

If you have any questions about the research study, please contact Mitchell Rowles. This research has been reviewed and approved according to University of Southern Queensland procedures for research ethics.

*** 1. ELECTRONIC CONSENT: Please select your choice below.**

Clicking on the "agree" button below indicates that:

- **you have read the above information**
- **you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.**
- **you are at least 18 years of age**

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

☐ **Agree**

☐ **Disagree**

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Key terms and definitions of this quiz

Stakeholders - are individuals, groups or organisations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project.

Project complexity - 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.

Internal stakeholders - are entities within a business (e.g. employees, managers, directors) specifically the project team.

External Stakeholders - are entities not within a business itself but who care about or are affected by its performance (Contractor/developer/operator).

Conventional project management - Or Traditional project management is the common practices used day to day which incorporates an arrangement of created methods utilized for planning, assessing, and controlling exercises.

REF - Review of Environmental Factors

Public Utility - is a business that furnishes an everyday necessity to the public at large. Public utilities provide water, electricity, natural gas, telephone service, and other essentials. Utilities may be publicly or privately owned, but most are operated as private businesses.

Project Development Lifecycle (For the purpose of this quiz)





Analysis of influencing factors of construction project complexity from different stakeholders perspectives

A DISSERTATION SUBMITTED BY

MR MITCHELL ROWLES

FOR THE AWARD OF

BACHELOR OF ENGINEERING (CIVIL HONOURS)

* 2. What is the highest level of education you have currently completed?

Other (please specify)

* 3. How many years of work experience or knowledge do you have in the roads engineering field?

Other (please specify)

* 4. What is your current job role?

Other (please specify)

*** 5. What is the classification of your current job role or stakeholder role?**

Other (please specify)

*** 6. Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?**

- | | |
|--|---|
| <input type="checkbox"/> Cost Constraints | <input type="checkbox"/> Construction Methods |
| <input type="checkbox"/> Technical Aspects | <input type="checkbox"/> Buildability of the design work |
| <input type="checkbox"/> Organisation (Resources) | <input type="checkbox"/> Delivery System |
| <input type="checkbox"/> Number of Stakeholders Involved (internal and external) | <input type="checkbox"/> Form of Contract |
| <input type="checkbox"/> Project Size (Number of people and budget) | <input type="checkbox"/> Knowledge based (education and training) |
| <input type="checkbox"/> Urgency of the project schedule (time management) | <input type="checkbox"/> Project duration |
| <input type="checkbox"/> Environment (Access/Location) | |

Other (please specify)

*** 7. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?**

- | | |
|---|---|
| <input type="checkbox"/> Definition of project objectives | <input type="checkbox"/> Project expectations |
| <input type="checkbox"/> Level of project definition | <input type="checkbox"/> Obtain approval to proceed |
| <input type="checkbox"/> Managing stakeholders expectations | |

Other (please specify)

*** 8. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?**

- | | |
|---|---|
| <input type="checkbox"/> Determining the design layout and its 'fixed' points | <input type="checkbox"/> Strategic estimate |
| <input type="checkbox"/> Level of unknowns (geotech, community, environment, road design accuracy, etc) | <input type="checkbox"/> Confirming the preferred option (for concept design) |
| <input type="checkbox"/> Consulting appropriate stakeholders | <input type="checkbox"/> Obtain approval to proceed |

Other (please specify)

*** 9. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?**

- | | |
|---|--|
| <input type="checkbox"/> Defining contractual terms and conditions (if required) | <input type="checkbox"/> Identifying utility impacts |
| <input type="checkbox"/> Engineering and field investigation outcomes | <input type="checkbox"/> Developing the concept design |
| <input type="checkbox"/> Selection of project team (tender selection, internal team members, etc) | <input type="checkbox"/> Concept design estimate |
| <input type="checkbox"/> Preparing the REF | <input type="checkbox"/> Obtain approval to proceed |

Other (please specify)

*** 10. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?**

- | | |
|---|--|
| <input type="checkbox"/> Managing project risks | <input type="checkbox"/> Detailed design estimate |
| <input type="checkbox"/> Managing the level and scope of the project | <input type="checkbox"/> Preparing construction contract documents |
| <input type="checkbox"/> Continuity in personnel and responsibilities | <input type="checkbox"/> Obtain approval to proceed |
| <input type="checkbox"/> Developing the detailed design | |

Other (please specify)

*** 11. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?**

- | | |
|--|--|
| <input type="checkbox"/> Managing construction activities and services | <input type="checkbox"/> Tendering and tender estimate |
| <input type="checkbox"/> Managing site risks (unknowns) | <input type="checkbox"/> Managing construction contracts |
| <input type="checkbox"/> Adjusting public utilities | <input type="checkbox"/> Managing stakeholder expectations |

Other (please specify)

*** 12. Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?**

- | | |
|---|---|
| <input type="checkbox"/> Identifying ongoing maintenance works and planning | <input type="checkbox"/> Identifying extent of liabilities |
| <input type="checkbox"/> Finalising and handover of the completed works | <input type="checkbox"/> Managing stakeholder expectations |
| <input type="checkbox"/> Post completion review (what successes and key learning's were identified) | <input type="checkbox"/> Provision of appropriate organisation arrangements |

Other (please specify)

*** 13. What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?**

- | | |
|---|---|
| <input type="checkbox"/> Politicians | <input type="checkbox"/> Project team members |
| <input type="checkbox"/> Community | <input type="checkbox"/> Environmental |
| <input type="checkbox"/> Project owner (Client) | <input type="checkbox"/> Contractor |
| <input type="checkbox"/> Project manager | |

Other (please specify)

*** 14. Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?**

☐ Project Team

☐ Project Owner (Client)

☐ Contractor

☐ Construction Team

☐ Project Manager

Other (please specify)

*** 15. Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?**

☐ Yes

☐ No

*** 16. Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?**

☐ Conception of the Project

☐ Detailed Design Stage

☐ Strategic Design Stage

☐ Construction stage

☐ Concept Design Stage

☐ Finalisation stage

Other (please specify)

*** 17. At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order**

☐ Conception of the project

☐ Detailed design stage

☐ Strategic design stage

☐ Construction stage

☐ Concept design stage

☐ Finalisation stage

Other (please specify)

* 18. Please indicate for each proposition the answer that best applies regarding dealing with project risk

	Strongly agree	agree	Neither agree or disagree	disagree	Strongly disagree	not applicable
Should the general public have more influence over a projects objectives and direction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does the above statement occur on projects managed internally by a single organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 19. What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?

- | | |
|--|--|
| <input type="checkbox"/> Conception of the Project | <input type="checkbox"/> Detailed Design Stage |
| <input type="checkbox"/> Strategic Design Stage | <input type="checkbox"/> Construction stage |
| <input type="checkbox"/> Concept Design Stage | <input type="checkbox"/> Finalisation stage |

Other (please specify)

* 20. Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

	strongly agree	agree	Neither agree or disagree	disagree	strongly disagree	not applicable
Different stakeholders have different perspectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The larger the number of stakeholders the higher the project complexity (difficultly)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Different stakeholders (internal only) perceive risks in relation to objectives differently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does a project suffer from late stakeholder engagement/involvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Different stakeholders have different interest levels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do all stakeholders align themselves with the projects objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 21. A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?

- | | |
|---|---|
| <input type="checkbox"/> Communication | <input type="checkbox"/> Minimise surprises (scope change) |
| <input type="checkbox"/> Trust | <input type="checkbox"/> Developing relationships |
| <input type="checkbox"/> Consistent message | <input type="checkbox"/> Addressing issues as and when they arise |

Other (please specify)

* 22. What do you believe is the best method of managing different stakeholder's perspectives or inputs? (This can be community or other project individuals for example)

* 23. Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

	Strongly agree	agree	Neither agree or disagree	disagree	Strongly disagree	not applicable
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does conventional project management used today best manage stakeholder inputs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly agree	agree	Neither agree or disagree	disagree	Strongly disagree	not applicable
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>* 24. What gaps exist in the current project management guidelines that could better manage complex projects?</p> <div></div>						



Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Thank you for completing part 1 of my research project quiz, part 2 will be sent out within the next week. Thanks in advance.



Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Welcome to My Survey

Consent Form

The purpose of this research project is the analysis of influencing factors of construction project complexity from different stakeholders perspectives. This is a research project being conducted by Mitchell Rowles from the University of Southern Queensland. You are invited to participate in this research project because you are experienced in the field of road construction. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about your experiences in the roads industry.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Southern Queensland representatives.

If you have any questions about the research study, please contact Mitchell Rowles. This research has been reviewed and approved according to University of Southern Queensland procedures for research ethics.

*** 1. ELECTRONIC CONSENT: Please select your choice below.**

Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

- ☐ **Agree**
- ☐ **Disagree**

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Round 2

Key terms and definitions of this quiz

Stakeholders - are individuals, groups or organisations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project.

Project complexity - 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.

Internal stakeholders - are entities within a business (e.g. employees, managers, directors) specifically the project team.

External Stakeholders - are entities not within a business itself but who care about or are affected by its performance (Contractor/developer/operator).

Conventional project management - Or Traditional project management is the common practices used day to day which incorporates an arrangement of created methods utilized for planning, assessing, and controlling exercises.

REF - Review of Environmental Factors

Public Utility - is a business that furnishes an everyday necessity to the public at large. Public utilities provide water, electricity, natural gas, telephone service, and other essentials. Utilities may be publicly or privately owned, but most are operated as private businesses.

Project Development Lifecycle (For the purpose of this quiz)



**Analysis of influencing factors of construction project
complexity from different stakeholders perspectives
Round 2**

A DISSERTATION SUBMITTED BY

MR MITCHELL ROWLES

FOR THE AWARD OF

BACHELOR OF ENGINEERING (CIVIL HONOURS)

* 2. Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

☰	Technical Aspects	<input type="checkbox"/> N/A
☰	Cost Constraints	<input type="checkbox"/> N/A
☰	Urgency of project schedule (time management)	<input type="checkbox"/> N/A
☰	Environment (Access/Location)	<input type="checkbox"/> N/A
☰	Buildability of the design work	<input type="checkbox"/> N/A

*** 3. Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)**

☰	▾	Definition of project objectives	<input type="checkbox"/> N/A
☰	▾	Level of project definition	<input type="checkbox"/> N/A
☰	▾	Managing stakeholders expectations	<input type="checkbox"/> N/A
☰	▾	Project expectations	<input type="checkbox"/> N/A

*** 4. Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)**

☰	▾	Level of unknowns (geotech, community, environment, road design accuracy, etc)	<input type="checkbox"/> N/A
☰	▾	Consulting appropriate stakeholders	<input type="checkbox"/> N/A
☰	▾	Strategic estimate	<input type="checkbox"/> N/A
☰	▾	Confirming the preferred option (for concept design)	<input type="checkbox"/> N/A

*** 5. Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)**

☰	▾	Engineering and field investigation outcomes	<input type="checkbox"/> N/A
☰	▾	Developing the concept design	<input type="checkbox"/> N/A
☰	▾	Concept design estimate	<input type="checkbox"/> N/A

*** 6. Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)**

☰	⬆ ⬇ Managing project risks	<input type="checkbox"/> N/A
☰	⬆ ⬇ Managing the level and scope of the project	<input type="checkbox"/> N/A
☰	⬆ ⬇ Developing the detailed design	<input type="checkbox"/> N/A

*** 7. Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)**

☰	⬆ ⬇ Managing construction activities and services	<input type="checkbox"/> N/A
☰	⬆ ⬇ Managing site risks (unknowns)	<input type="checkbox"/> N/A
☰	⬆ ⬇ Managing construction contracts	<input type="checkbox"/> N/A

*** 8. Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)**

☰	⬆ ⬇ Identifying ongoing maintenance works and planning	<input type="checkbox"/> N/A
☰	⬆ ⬇ Finalising and handover of the completed works	<input type="checkbox"/> N/A
☰	⬆ ⬇ Post completion review (what successes and key learning's were identified)	<input type="checkbox"/> N/A

* 9. Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

☰	⬇	Politicians	<input type="checkbox"/> N/A
☰	⬇	Community	<input type="checkbox"/> N/A
☰	⬇	Project owner (Client)	<input type="checkbox"/> N/A
☰	⬇	Project manager	<input type="checkbox"/> N/A
☰	⬇	Environmental	<input type="checkbox"/> N/A







* 10. Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

☰	⬇	Contractor	<input type="checkbox"/> N/A
☰	⬇	Project Manager	<input type="checkbox"/> N/A
☰	⬇	Project Owner (Client)	<input type="checkbox"/> N/A

* 11. Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

☰	⬇	Conception of the Project	<input type="checkbox"/> N/A
☰	⬇	Strategic Design Stage	<input type="checkbox"/> N/A
☰	⬇	Concept Design Stage	<input type="checkbox"/> N/A

* 12. Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

	 Conception of the project	<input type="checkbox"/> N/A
	 Strategic design stage	<input type="checkbox"/> N/A
	 Concept design stage	<input type="checkbox"/> N/A

* 13. Please indicate for each proposition the answer that best applies regarding dealing with project risk

	Strongly agree	agree	Neither agree or disagree	disagree	Strongly disagree	not applicable
Should the general public have more influence over a projects objectives and direction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does the above statement occur on projects managed internally by a single organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 14. Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

☰	Conception of the Project	<input type="checkbox"/> N/A
☰	Strategic Design Stage	<input type="checkbox"/> N/A
☰	Concept Design Stage	<input type="checkbox"/> N/A

* 15. Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

	strongly agree	agree	Neither agree or disagree	disagree	strongly disagree	not applicable
Different stakeholders have different perspectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The larger the number of stakeholders the higher the project complexity (difficulty)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Different stakeholders (internal only) perceive risks in relation to objectives differently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does a project suffer from late stakeholder engagement/involvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Different stakeholders have different interest levels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do all stakeholders align themselves with the projects objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*** 16. Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)**

☰	⬆⬇⬆	Communication	<input type="checkbox"/> N/A
☰	⬆⬇⬆	Developing relationships	<input type="checkbox"/> N/A
☰	⬆⬇⬆	Addressing issues as and when they arise	<input type="checkbox"/> N/A

*** 17. Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders**

	Strongly agree	agree	Neither agree or disagree	disagree	Strongly disagree	not applicable
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does conventional project management used today best manage stakeholder inputs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*** 18. Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)**

- | | |
|--|---|
| <input type="checkbox"/> Early identification of assets owners so the correct standards are followed | <input type="checkbox"/> No gaps, guidelines are thorough enough as is |
| <input type="checkbox"/> Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle | <input type="checkbox"/> Organisation collaboration |
| <input type="checkbox"/> Political interference and unrealistic expectations which can't be addressed by guidelines | <input type="checkbox"/> Efficiencies with the level of bureaucracy in government |
| <input type="checkbox"/> Closing out stakeholder issues before commencing to next stage | <input type="checkbox"/> Additional information needed on how/who manages project risks |
| <input type="checkbox"/> Managing and improving the operational performance of their own project team | <input type="checkbox"/> None of these are applicable |
| <input type="checkbox"/> Clients knowledge of project complexities | |



**Analysis of influencing factors of construction project complexity from different stakeholders perspectives
Round 2**

Thank you for completing part 2 of my research project quiz.

Appendix D - Questionnaire survey results rounds 1 & 2

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:23:48

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree,
Other (please specify):
Masters

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

20+ years

Q4 What is your current job role?

Manager

Q5 What is the classification of your current job role or stakeholder role?

Project Management

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Urgency of the project schedule (time management) ,
Buildability of the design ,
work
Delivery System

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	Definition of project objectives , Managing stakeholders expectations , Project expectations
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	Level of unknowns (geotech, community, environment, road design accuracy, etc) , Consulting appropriate stakeholders, Confirming the preferred option (for concept design), Other (please specify): Identifying constraints
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	Engineering and field investigation outcomes , Developing the concept design, Concept design estimate
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	Managing project risks, Developing the detailed design , Detailed design estimate, Other (please specify): Handover to construction
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	Managing construction activities and services , Managing construction contracts, Managing site risks (unknowns)
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	Identifying ongoing maintenance works and planning , Finalising and handover of the completed works , Post completion review (what successes and key learning's were identified)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	<div>Politicians,</div> <div>Community,</div> <div>Project owner (Client),</div> <div>Project team members,</div> <div>Environmental</div>
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	<div>Contractor,</div> <div>Project Owner (Client),</div> <div>Construction Team</div>
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	<div>Yes</div>
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	<div>Conception of the Project,</div> <div>Strategic Design Stage,</div> <div>Concept Design Stage</div>
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	<div>Conception of the project,</div> <div>Strategic design stage,</div> <div>Construction stage</div>
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	<div>Strongly disagree</div>
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	<div>Strongly agree</div>
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	<div>disagree</div>
Does the above statement occur on projects managed internally by a single organisation	<div>agree</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Finalisation stage
--	---

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	disagree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Minimise surprises (scope change), Addressing issues as and when they arise
---	---

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Understanding stakeholders objectives, explaining other stakeholders/projects objectives, explaining outcomes/consequences (+ve & -ve) in relation to the stekaholders objectives.	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
No gaps, guidelines are pretty thorough. Project Manager is always prioritising which activities occur and which don't by considering the complexity of the project and the appropriate use of resources/funds.	

#2

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:23:22

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Graduated from high school ,

Other (please specify):
Certificate IV project Management

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

6-10 years

Q4 What is your current job role?

Individual Contributor,

Other (please specify):
Project Officer

Q5 What is the classification of your current job role or stakeholder role?

Project Management

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?	Cost Constraints, Technical Aspects, Urgency of the project schedule (time management) , Environment (Access/Location) , Buildability of the design work
Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	Definition of project objectives , Managing stakeholders expectations , Project expectations
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	Level of unknowns (geotech, community, environment, road design accuracy, etc) , Consulting appropriate stakeholders, Strategic estimate
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	Preparing the REF, Developing the concept design, Concept design estimate
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	Managing the level and scope of the project , Developing the detailed design , Detailed design estimate
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	Managing construction activities and services , Adjusting public utilities , Managing stakeholder expectations

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Finalising and handover of the completed works</div> <div>Post completion review (what successes and key learning's were identified)</div> <div>Managing stakeholder expectations</div>
Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	<div>Politicians,</div> <div>Community,</div> <div>Project owner (Client)</div> <div>Project manager,</div> <div>Environmental</div>
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	<div>Project Team</div> <div>Project Manager</div> <div>Project Owner (Client)</div>
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	<div>Yes</div>
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	<div>Conception of the Project</div> <div>Strategic Design Stage,</div> <div>Concept Design Stage</div>
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	<div>Conception of the project</div> <div>Strategic design stage</div> <div>Concept design stage</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project , Strategic Design Stage, Concept Design Stage
--	---

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Developing relationships, Addressing issues as and when they arise
---	--

Q22 What do you believe is the best method of managing different stakeholder's perspectives or inputs? (This can be the community or other project individuals for example)

Face to face engagement and keeping communication lines open
--

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	disagree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?

Organisation collaboration

#3

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:39:16

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

11-15 years

Q4 What is your current job role?

Team Lead

Q5 What is the classification of your current job role or stakeholder role?

Engineer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints, Technical Aspects, Organisation (Resources), Delivery System, Knowledge based (education and training)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Managing stakeholders expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Determining the design layout and its 'fixed' points</div> <div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Defining contractual terms and conditions (if required)</div> <div>Engineering and field investigation outcomes</div> <div>Selection of project team (tender selection, internal team members, etc)</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Managing the level and scope of the project</div> <div>Continuity in personnel and responsibilities</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing site risks (unknowns)</div> <div>Managing stakeholder expectations</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Finalising and handover of the completed works</div> <div>Post completion review (what successes and key learning's were identified)</div> <div>Managing stakeholder expectations</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client), Project team members, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager, Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project, Strategic Design Stage, Detailed Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project, Strategic design stage, Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	Neither agree or disagree
Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	
	Communication, Developing relationships, Addressing issues as and when they arise
Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Providing a level of communication that is straight forward and forthcoming while referring back to the intent of the projects objectives.	
Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree
Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
I believe the current project management guidelines are far too convoluted. This results in individuals overlooking/dismissing crucial steps in a project's life-cycle resulting in unforeseen issues later on. Having a more succinct guideline would alleviate this issue.	

#4

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 01:46:26

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

6-10 years

Q4 What is your current job role?

Individual Contributor

Q5 What is the classification of your current job role or stakeholder role?

Environment

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Technical Aspects,

Number of Stakeholders Involved (internal and external)

,

Project Size (Number of people and budget)

,

Environment (Access/Location)

,

Buildability of the design work

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Managing stakeholders expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Strategic estimate,</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Obtain approval to proceed</div> <div>Developing the concept design</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Managing the level and scope of the project</div> <div>Developing the detailed design</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing site risks (unknowns)</div> <div>Managing stakeholder expectations</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Finalising and handover of the completed works</div> <div>Post completion review (what successes and key learning's were identified)</div> <div>Managing stakeholder expectations</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Project , Team Contractor, Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	No
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Strategic Design Stage, Concept Design Stage, Construction stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design , stage Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
--	---

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	strongly disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Consistent message Developing relationships
---	---

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Open communication and access to information	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	Neither agree or disagree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
Project Pack is not followed accurately with respect to refering back to previous stage project managers for design decisions and consultation. Information is lost when design decisions have not been recorded or tracked accurately.	

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 03:22:32

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.	Agree
--	--------------

Page 3

Q2 What is the highest level of education you have currently completed?	Associate Degree
--	-------------------------

Q3 How many years of work experience or knowledge do you have in the roads engineering field?	6-10 years
--	-------------------

Q4 What is your current job role?	Manager
--	----------------

Q5 What is the classification of your current job role or stakeholder role?	Contracts Management
--	-----------------------------

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?	Cost Constraints, Organisation (Resources) , Urgency of the project schedule (time management) , Form of Contract , Knowledge based (education and training)
---	---

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Consulting appropriate stakeholders,</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Defining contractual terms and conditions (if required)</div> <div>Engineering and field investigation outcomes</div> <div>Concept design estimate</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Continuity in personnel and responsibilities</div> <div>Preparing construction contract documents</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing construction contracts,</div> <div>Managing site risks (unknowns)</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Finalising and handover of the completed works</div> <div>Post completion review (what successes and key learning's were identified)</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Contractor
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager , Construction Team
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Strategic Design Stage, Concept Design Stage, Detailed Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Concept design stage , Detailed design stage , Construction stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
--	---

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Trust, Addressing issues as and when they arise
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Communication	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	disagree
Does conventional project management used today best manage stakeholder inputs.	disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
Efficiencies with the level of bureaucracy in government	

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 01:05:05

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

6-10 years

Q4 What is your current job role?

Client

Q5 What is the classification of your current job role or stakeholder role?

Engineer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Number of Stakeholders Involved (internal and external) ,

Project Size (Number of people and budget) ,

Urgency of the project schedule (time management) ,

Environment (Access/Location) ,

Form of Contract

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Managing stakeholders expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Determining the design layout and its 'fixed' points</div> <div>Consulting appropriate stakeholders,</div> <div>Other (please specify):</div> <div>identifying the appropriate end asset owners</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Developing the concept design,</div> <div>Identifying utility impacts</div> <div>Other (please specify):</div> <div>Manging scope creep</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Managing the level and scope of the project</div> <div>Developing the detailed design</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing site risks (unknowns)</div> <div>Managing stakeholder expectations</div> <div>Other (please specify):</div> <div>Managing scope creep</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Identifying extent of liabilities</div> <div>Finalising and handover of the completed works</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client)
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Project Manager , Project Owner (Client) , Construction Team
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project , Strategic Design Stage, Concept Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design stage , Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Strongly disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?

Conception of the Project

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	strongly disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?

Communication,
Consistent message ,
Minimise surprises (scope change)

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)

early communication

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Strongly agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?

early identification of asset owners so the correct standards are followed

#7

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:16:11

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information • you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

0-5 years

Q4 What is your current job role?

Manager

Q5 What is the classification of your current job role or stakeholder role?

Engineer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints, Technical Aspects, Environment (Access/Location), Delivery System, Project duration

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Managing stakeholders expectations</div> <div>Obtain approval to proceed</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Strategic estimate,</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Preparing the REF,</div> <div>Developing the concept design</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Obtain approval to proceed</div> <div>Developing the detailed design</div> <div>Detailed design estimate</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Tendering and tender estimate</div> <div>Managing stakeholder expectations</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Finalising and handover of the completed works</div> <div>Managing stakeholder expectations</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Project Manager , Project Owner (Client) , Construction Team
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project , Concept Design Stage, Construction stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design stage , Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Strategic Design Stage
<hr/>	
Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	strongly disagree
<hr/>	
Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Trust, Developing relationships, Addressing issues as and when they arise
<hr/>	
Q22 What do you believe is the best method of managing different stakeholder's perspectives or inputs? (This can be the community or other project individuals for example)	
Transparency in communication, and doing what you say you will do	
<hr/>	
Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree
<hr/>	
Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
Additional information on how to manage project risks, and who needs to be involved when accepting to move forward and manage a risk.	
<hr/>	

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:16:04

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information • you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree,
Other (please specify):
Masters of Business Administration

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

20+ years

Q4 What is your current job role?

Senior Manager

Q5 What is the classification of your current job role or stakeholder role?

Project Management

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Number of Stakeholders Involved (internal and external)
,
Project Size (Number of people and budget)
Environment (Access/Location)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?

Definition of project objectives ,
Level of project definition ,
Managing stakeholders expectations

Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?

Level of unknowns (geotech, community, environment, road design accuracy, etc) ,
Consulting appropriate stakeholders, Strategic estimate

Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?

Engineering and field investigation outcomes ,
Preparing the REF,
Developing the concept design

Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?

Managing the level and scope of the project ,
Developing the detailed design ,
Detailed design estimate

Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?

Managing construction activities and services ,
Tendering and tender estimate ,
Managing site risks (unknowns)

Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?

Identifying extent of liabilities ,
Finalising and handover of the completed works ,
Post completion review (what successes and key learning's were identified)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	<div>Project owner (Client),</div> <div>Project manager,</div> <div>Project team members</div>
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	<div>Project Manager,</div> <div>Project Owner (Client),</div> <div>Construction Team</div>
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	<div>Conception of the Project,</div> <div>Strategic Design Stage,</div> <div>Concept Design Stage</div>
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Strategic design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	disagree
Does the above statement occur on projects managed internally by a single organisation	agree
Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	<div>Conception of the Project,</div> <div>Strategic Design Stage,</div> <div>Finalisation stage</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	strongly disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Trust, Minimise surprises (scope change), Addressing issues as and when they arise , Other (please specify): All these apply.....
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)

Face to face meetings, regular and consistent contact

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?

Client knowledge of project complexities - 'training' the client

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 21:39:40

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Associate Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

0-5 years

Q4 What is your current job role?

Individual Contributor

Q5 What is the classification of your current job role or stakeholder role?

Road Designer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Technical Aspects,

Urgency of the project schedule (time management) ,

Environment (Access/Location) ,

Construction Methods ,

Buildability of the design work

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Determining the design layout and its 'fixed' points</div> <div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Developing the concept design, Concept design estimate</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Developing the detailed design</div> <div>Detailed design estimate</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing site risks (unknowns)</div> <div>Managing stakeholder expectations</div> <div>Other (please specify):</div> <div>Construction feedback on design</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Post completion review (what successes and key learning's were identified)</div> <div>Other (please specify):</div> <div>Post construction design and safety review</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Community, Project owner (Client) , Project manager, Project team members , Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager , Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project , Strategic Design Stage, Concept Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design stage , Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Finalisation stage
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Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	disagree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	agree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Developing relationships, Addressing issues as and when they arise
---	--

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Effective and constructive communication that occurs early and with all stakeholders is what I believe to be an effective method of managing stakeholders perspectives	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?

One of the main gaps that exist is methods of managing and improving the operational performance of their own project team. Clarifying and measuring project objectives is an effective way of enabling project managers to effectively monitor and control project activities to improve results.

#10

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:53:18

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

6-10 years

Q4 What is your current job role?

Individual Contributor

Q5 What is the classification of your current job role or stakeholder role?

Engineer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Technical Aspects, Environment (Access/Location), Delivery System, Project duration, Other (please specify): Safety

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Managing stakeholders expectations</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Strategic estimate,</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Developing the concept design,</div> <div>Identifying utility impacts</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Continuity in personnel and responsibilities</div> <div>Obtain approval to proceed</div> <div>Developing the detailed design</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing construction contracts,</div> <div>Managing site risks (unknowns)</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Finalising and handover of the completed works</div> <div>Other (please specify):</div> <div>Closing out all NCR's</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager , Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Concept Design Stage, Detailed Design Stage, Construction stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Concept design stage , Detailed design stage , Construction stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	disagree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Strongly disagree
Does the above statement occur on projects managed internally by a single organisation	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
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Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Trust, Developing relationships, Addressing issues as and when they arise
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Maintaining clear and open communication between all parties	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	Neither agree or disagree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
Mechanism to close out stakeholder issues before commencing to next stage	

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:37:19

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

11-15 years

Q4 What is your current job role?

Team Lead

Q5 What is the classification of your current job role or stakeholder role?

Surveyor

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Organisation (Resources),
Urgency of the project schedule (time management),
Environment (Access/Location)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Level of project definition ,</div> <div>Managing stakeholders expectations ,</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Consulting appropriate stakeholders,</div> <div>Strategic estimate,</div> <div>Confirming the preferred option (for concept design)</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes ,</div> <div>Developing the concept design,</div> <div>Identifying utility impacts</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Developing the detailed design ,</div> <div>Preparing construction contract documents ,</div> <div>Detailed design estimate</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services ,</div> <div>Managing construction contracts,</div> <div>Adjusting public utilities</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning ,</div> <div>Identifying extent of liabilities ,</div> <div>Finalising and handover of the completed works</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Community, Project manager, Project team members, Environmental, Contractor
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Project Team, Contractor, Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project, Strategic Design Stage, Concept Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project, Strategic design stage, Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
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Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Consistent message Minimise surprises (scope change)
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Two way communication	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	disagree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
Not sure of current project management guidelines	

#12

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: Over a day

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information • you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree,
Other (please specify):
masters

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

20+ years

Q4 What is your current job role?

Client

Q5 What is the classification of your current job role or stakeholder role?

Engineer,
Other (please specify):
program manager

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Buildability of the design ,
work
Other (please specify):
construction quality; maintainability

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	Definition of project objectives , Level of project definition , Project expectations
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	Level of unknowns (geotech, community, environment, road design accuracy, etc) , Consulting appropriate stakeholders
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	Engineering and field investigation outcomes , Developing the concept design, Concept design estimate
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	Managing project risks, Managing the level and scope of the project , Developing the detailed design
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	Managing construction activities and services , Managing construction contracts, Other (please specify): project quality
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	Finalising and handover of the completed works , Other (please specify): defect rectification and close out
Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Community, Project owner (Client) , Environmental

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Concept Design Stage, Other (please specify): stakeholder engagement
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Concept design stage , Construction stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree
Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Strategic Design Stage, Finalisation stage
Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	Neither agree or disagree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	Neither agree or disagree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	Neither agree or disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Trust, Consistent , message Developing relationships
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
timely and open communication	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
pier review of processes	

#13

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: Over a day

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

0-5 years

Q4 What is your current job role?

Client

Q5 What is the classification of your current job role or stakeholder role?

Engineer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Number of Stakeholders Involved (internal and external)
,
Project Size (Number of people and budget)
Urgency of the project schedule (time management)

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Managing stakeholders expectations</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Determining the design layout and its 'fixed' points</div> <div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Strategic estimate</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Developing the concept design, Concept design estimate</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks, Developing the detailed design</div> <div>Detailed design estimate</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing construction contracts, Managing site risks (unknowns)</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Finalising and handover of the completed works</div> <div>Post completion review (what successes and key learning's were identified)</div> <div>Provision of appropriate organisation arrangements</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager , Project Owner (Client)
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Concept Design Stage, Detailed Design Stage, Construction stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design stage , Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	Strongly disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
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Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	Neither agree or disagree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Consistent message Developing relationships
---	---

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)	
Treating stakeholders with consistency and based on the legitimacy issues raised	

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?	
It depend on what project management guidelines you are referring too	

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:26:05

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire.
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Bachelor Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

20+ years

Q4 What is your current job role?

Senior Manager

Q5 What is the classification of your current job role or stakeholder role?

Road Designer

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints,
Technical Aspects,
Urgency of the project schedule (time management) ,
Construction Methods ,
Buildability of the design work

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	<div>Definition of project objectives</div> <div>Level of project definition</div> <div>Project expectations</div>
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	<div>Determining the design layout and its 'fixed' points</div> <div>Level of unknowns (geotech, community, environment, road design accuracy, etc)</div> <div>Strategic estimate</div>
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	<div>Engineering and field investigation outcomes</div> <div>Developing the concept design,</div> <div>Identifying utility impacts</div>
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	<div>Managing project risks,</div> <div>Managing the level and scope of the project</div> <div>Developing the detailed design</div>
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	<div>Managing construction activities and services</div> <div>Managing construction contracts,</div> <div>Adjusting public utilities</div>
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	<div>Identifying ongoing maintenance works and planning</div> <div>Identifying extent of liabilities</div> <div>Finalising and handover of the completed works</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	<div>Politicians,</div> <div>Community,</div> <div>Project owner (Client) ,</div> <div>Project team members ,</div> <div>Environmental</div>
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	<div>Project Team ,</div> <div>Contractor,</div> <div>Project Owner (Client)</div>
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	<div>Yes</div>
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	<div>Strategic Design Stage,</div> <div>Concept Design Stage,</div> <div>Construction stage</div>
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	<div>Conception of the project ,</div> <div>Strategic design stage ,</div> <div>Concept design stage</div>
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	<div>disagree</div>
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	<div>Strongly agree</div>
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	<div>Neither agree or disagree</div>
Does the above statement occur on projects managed internally by a single organisation	<div>Neither agree or disagree</div>

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?	Conception of the Project Strategic Design Stage, Concept Design Stage
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Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)	
Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	strongly disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?	Communication, Minimise surprises (scope change), Developing relationships
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Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)
Communication of what a project is addressing and it's benefits

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders	
Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?
The problem elements are political interference and unrealistic expectations which can't be addresses by guidelines.

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:14:38

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in both rounds 1 and 2 of this questionnaire. • you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 What is the highest level of education you have currently completed?

Associate Degree

Q3 How many years of work experience or knowledge do you have in the roads engineering field?

16-20 years

Q4 What is your current job role?

Manager

Q5 What is the classification of your current job role or stakeholder role?

Project Management

Q6 Can you provide five project complexity measures that you consider to be most important from a large scale project you have recently worked on?

Cost Constraints, Urgency of the project schedule (time management), Environment (Access/Location), Buildability of the design work, Form of Contract

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q7 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the project conception stage?	Level of project definition , Project expectations , Obtain approval to proceed
Q8 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the strategic design stage?	Level of unknowns (geotech, community, environment, road design accuracy, etc) , Consulting appropriate stakeholders, Obtain approval to proceed
Q9 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the concept design stage?	Engineering and field investigation outcomes , Developing the concept design, Identifying utility impacts
Q10 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the detailed design stage?	Managing project risks, Managing the level and scope of the project , Developing the detailed design
Q11 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the construction stage?	Managing construction contracts, Managing site risks (unknowns) , Adjusting public utilities
Q12 Can you select three project complexities/uncertainties or identify your own that you consider to be most important during the finalisation stage?	Identifying ongoing maintenance works and planning , Identifying extent of liabilities , Finalising and handover of the completed works

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q13 What stakeholders do you believe have the most influence that will likely impact on a projects objectives and direction during its development? Can you provide five that you consider to be most important in any order?	Politicians, Community, Project owner (Client) , Project manager, Environmental
Q14 Can you provide three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project?	Contractor, Project Manager , Construction Team
Q15 Have you ever been involved in a project, where the objectives have changed during the course of its development, due to a stakeholders (internal or external) input?	Yes
Q16 Can you select three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs?	Conception of the Project , Strategic Design Stage, Concept Design Stage
Q17 At what stage of a projects development lifecycle do you believe holds the most project uncertainty? Can you please select your three project lifecycle stages that you consider most important in any order	Conception of the project , Strategic design stage , Concept design stage
Q18 Please indicate for each proposition the answer that best applies regarding dealing with project risk	
Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	agree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives

Q19 What stage of the project development process do you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first. Can you please provide three project lifecycle stages in which you believe this occurs in?

Strategic Design Stage,
Concept Design Stage

Q20 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Q21 A vital part of any projects success comes from developing and maintaining good relationships with stakeholders. Can you please select your three most important elements that you believe best assists in managing stakeholder relationships?

Communication,
Developing relationships,
Addressing issues as and when they arise

Q22 What do you believe is the best method of managing different stakeholder’s perspectives or inputs? (This can be the community or other project individuals for example)

Communication and transparency

Q23 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q24 What gaps exist in the current project management guidelines that could better manage complex projects?

?

#1

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:10:38

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	2
Cost Constraints	3
Urgency of project schedule (time management)	4
Environment (Access/Location)	5
Buildability of the design work	1

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	4
Managing stakeholders expectations	2
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	2
Strategic estimate	4
Confirming the preferred option (for concept design)	3

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	2
Developing the concept design	1
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	2
Managing the level and scope of the project	3
Developing the detailed design	1

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	2
Managing site risks (unknowns)	1
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	1
Finalising and handover of the completed works	3
Post completion review (what successes and key learning's were identified)	2

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	1
Community	3
Project owner (Client)	2
Project manager	5
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	3
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	1
Concept Design Stage	2

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	1
Concept Design Stage	2

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	3
Addressing issues as and when they arise	2

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Clients knowledge of project complexities
- ,
- Organisation collaboration
- ,
- Efficiencies with the level of bureaucracy in government

#2

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:07:42

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	1
Cost Constraints	3
Urgency of project schedule (time management)	4
Environment (Access/Location)	5
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	3
Level of project definition	1
Managing stakeholders expectations	4
Project expectations	2

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	2
Consulting appropriate stakeholders	3
Strategic estimate	4
Confirming the preferred option (for concept design)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	2
Developing the concept design	1
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	3
Managing the level and scope of the project	1
Developing the detailed design	2

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	2
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	2
Community	3
Project owner (Client)	1
Project manager	4
Environmental	5

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	1
Concept Design Stage	2

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	strongly disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Clients knowledge of project complexities
- ,
- Organisation collaboration
- ,
- Efficiencies with the level of bureaucracy in government

#3

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:21:14

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	2
Cost Constraints	4
Urgency of project schedule (time management)	5
Environment (Access/Location)	1
Buildability of the design work	3

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	2
Level of project definition	1
Managing stakeholders expectations	4
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	3
Strategic estimate	2
Confirming the preferred option (for concept design)	4

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	3
Managing the level and scope of the project	2
Developing the detailed design	1

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	2
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	2
Community	1
Project owner (Client)	4
Project manager	5
Environmental	3

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	2
Strategic Design Stage	3
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	3
Strategic design stage	1
Concept design stage	2

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Strongly agree
Does the above statement occur on projects managed internally by a single organisation	agree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	3
Developing relationships	1
Addressing issues as and when they arise	2

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Strongly agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Clients knowledge of project complexities
- ,
- Organisation collaboration
- ,
- Efficiencies with the level of bureaucracy in government

#4

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:14:45

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	4
Cost Constraints	5
Urgency of project schedule (time management)	1
Environment (Access/Location)	2
Buildability of the design work	3

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	4
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	2
Consulting appropriate stakeholders	1
Strategic estimate	4
Confirming the preferred option (for concept design)	3

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	2
Developing the concept design	1
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	2
Managing the level and scope of the project	1
Developing the detailed design	3

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	3
Managing site risks (unknowns)	1
Managing construction contracts	2

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	3
Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	2

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	1
Community	2
Project owner (Client)	5
Project manager	4
Environmental	3

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	Strongly disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	Strongly agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

Early identification of assets owners so the correct standards are followed
,
Political interference and unrealistic expectations which can't be addressed by guidelines
,
Closing out stakeholder issues before commencing to next stage

Collector: Email Invitation 1 (Email)
Time Spent: 00:20:16

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	4
Cost Constraints	1
Urgency of project schedule (time management)	5
Environment (Access/Location)	2
Buildability of the design work	3

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	4
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	4
Consulting appropriate stakeholders	1
Strategic estimate	3
Confirming the preferred option (for concept design)	2

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	2
Managing the level and scope of the project	1
Developing the detailed design	3

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	2
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	1
Finalising and handover of the completed works	2
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	3
Community	2
Project owner (Client)	4
Project manager	5
Environmental	1

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	not applicable

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	2
Developing relationships	1
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.

Strongly agree

Does conventional project management used today best manage stakeholder inputs.

Neither agree or disagree

Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.

agree

The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.

Strongly agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed**
- ,
- Closing out stakeholder issues before commencing to next stage**
- ,
- Clients knowledge of project complexities** ,
- Organisation collaboration** ,
- Additional information needed on how/who manages project risks**

#6

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 02:58:42

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	5
Cost Constraints	1
Urgency of project schedule (time management)	3
Environment (Access/Location)	4
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	3
Project expectations	4

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	3
Consulting appropriate stakeholders	4
Strategic estimate	2
Confirming the preferred option (for concept design)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	1
Managing the level and scope of the project	3
Developing the detailed design	2

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	3
Managing construction contracts	2

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	4
Community	2
Project owner (Client)	1
Project manager	5
Environmental	3

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	1
Project Manager	2
Project Owner (Client)	3

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	disagree
Does the above statement occur on projects managed internally by a single organisation	agree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	3
Addressing issues as and when they arise	2

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	disagree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Closing out stakeholder issues before commencing to next stage
- ,
- Clients knowledge of project complexities
- ,
- Efficiencies with the level of bureaucracy in government

Collector: Email Invitation 1 (Email)
Time Spent: 00:13:09

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	1
Cost Constraints	4
Urgency of project schedule (time management)	5
Environment (Access/Location)	3
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	4
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	2
Strategic estimate	3
Confirming the preferred option (for concept design)	4

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	2
Managing the level and scope of the project	1
Developing the detailed design	3

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	2
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	3
Post completion review (what successes and key learning's were identified)	1

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	5
Community	2
Project owner (Client)	1
Project manager	3
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	3
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	disagree
Does the above statement occur on projects managed internally by a single organisation	disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	1
Concept Design Stage	2

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	2
Developing relationships	1
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	disagree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed
- ,
- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Clients knowledge of project complexities
- ,
- Organisation collaboration
- ,
- Efficiencies with the level of bureaucracy in government

Collector: Email Invitation 1 (Email)
Time Spent: 03:27:00

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	3
Cost Constraints	1
Urgency of project schedule (time management)	2
Environment (Access/Location)	5
Buildability of the design work	4

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	3
Project expectations	4

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	3
Consulting appropriate stakeholders	1
Strategic estimate	4
Confirming the preferred option (for concept design)	2

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	3
Managing the level and scope of the project	1
Developing the detailed design	2

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	2
Managing site risks (unknowns)	3
Managing construction contracts	1

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	1
Finalising and handover of the completed works	2
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	5
Community	3
Project owner (Client)	1
Project manager	2
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Strongly agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Strongly agree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	strongly agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	2
Developing relationships	1
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Managing and improving the operational performance of their own project team
- ,
- Clients knowledge of project complexities
- ,
- Efficiencies with the level of bureaucracy in government
- ,
- Additional information needed on how/who manages project risks

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 04:14:26

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	3
Cost Constraints	4
Urgency of project schedule (time management)	5
Environment (Access/Location)	1
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	3
Managing stakeholders expectations	4
Project expectations	2

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	4
Strategic estimate	3
Confirming the preferred option (for concept design)	2

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	3
Managing the level and scope of the project	2
Developing the detailed design	1

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	2
Managing site risks (unknowns)	1
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	3

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	1
Community	2
Project owner (Client)	3
Project manager	5
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	3
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	disagree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	disagree
Does the above statement occur on projects managed internally by a single organisation	disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	2
Strategic Design Stage	1
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	disagree
Does a project suffer from late stakeholder engagement/involvement	strongly agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

Closing out stakeholder issues before commencing to next stage

Collector: Email Invitation 1 (Email)
Time Spent: 00:17:00

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	1
Cost Constraints	3
Urgency of project schedule (time management)	4
Environment (Access/Location)	5
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	3
Project expectations	4

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	3
Strategic estimate	4
Confirming the preferred option (for concept design)	2

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5

Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6

Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	1
Managing the level and scope of the project	2
Developing the detailed design	3

Q7

Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	2
Managing site risks (unknowns)	1
Managing construction contracts	3

Q8

Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	1
Finalising and handover of the completed works	2
Post completion review (what successes and key learning's were identified)	3

Q9

Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	1
Community	3
Project owner (Client)	2
Project manager	5
Environmental	4

Q10

Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	1
Project Owner (Client)	3

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	2
Strategic Design Stage	1
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficulty)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	Neither agree or disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	agree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed
- ,
- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Closing out stakeholder issues before commencing to next stage
- ,
- Efficiencies with the level of bureaucracy in government

Collector: Email Invitation 1 (Email)
Time Spent: 01:31:12

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	3
Cost Constraints	5
Urgency of project schedule (time management)	2
Environment (Access/Location)	4
Buildability of the design work	1

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	3
Managing stakeholders expectations	4
Project expectations	2

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	3
Consulting appropriate stakeholders	4
Strategic estimate	2
Confirming the preferred option (for concept design)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)	
Engineering and field investigation outcomes	2
Developing the concept design	1
Concept design estimate	3
Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)	
Managing project risks	2
Managing the level and scope of the project	3
Developing the detailed design	1
Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)	
Managing construction activities and services	N/A
Managing site risks (unknowns)	N/A
Managing construction contracts	N/A
Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)	
Identifying ongoing maintenance works and planning	N/A
Finalising and handover of the completed works	N/A
Post completion review (what successes and key learning's were identified)	1
Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)	
Politicians	3
Community	5
Project owner (Client)	1
Project manager	2
Environmental	4
Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)	
Contractor	3
Project Manager	2
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	agree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	agree
Does the above statement occur on projects managed internally by a single organisation	agree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	disagree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	3
Addressing issues as and when they arise	2

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	agree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Closing out stakeholder issues before commencing to next stage
- ,
- Managing and improving the operational performance of their own project team
- ,
- Clients knowledge of project complexities
- ,
- Additional information needed on how/who manages project risks

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: Over a day

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that:

- you have read the above information
- you voluntarily agree to participate in round 1 and 2 of this questionnaire
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	5
Cost Constraints	1
Urgency of project schedule (time management)	2
Environment (Access/Location)	4
Buildability of the design work	3

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	2
Managing stakeholders expectations	4
Project expectations	3

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	2
Consulting appropriate stakeholders	4
Strategic estimate	3
Confirming the preferred option (for concept design)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	2
Developing the concept design	3
Concept design estimate	1

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	1
Managing the level and scope of the project	2
Developing the detailed design	3

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	N/A
Managing site risks (unknowns)	2
Managing construction contracts	1

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	1
Finalising and handover of the completed works	2
Post completion review (what successes and key learning's were identified)	N/A

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	5
Community	3
Project owner (Client)	1
Project manager	2
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	1
Project Manager	2
Project Owner (Client)	3

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	Neither agree or disagree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	Neither agree or disagree
The larger the number of stakeholders the higher the project complexity (difficultly)	Neither agree or disagree
Different stakeholders (internal only) perceive risks in relation to objectives differently	Neither agree or disagree
Does a project suffer from late stakeholder engagement/involvement	Neither agree or disagree
Different stakeholders have different interest levels	Neither agree or disagree
Do all stakeholders align themselves with the projects objectives	Neither agree or disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	3
Addressing issues as and when they arise	2

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	Neither agree or disagree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	Neither agree or disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Managing and improving the operational performance of their own project team
- ,
- Clients knowledge of project complexities

#13

COMPLETE

Collector: Email Invitation 1 (Email)
Time Spent: 00:14:47

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	1
Cost Constraints	2
Urgency of project schedule (time management)	5
Environment (Access/Location)	4
Buildability of the design work	3

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	4
Managing stakeholders expectations	3
Project expectations	2

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	2
Consulting appropriate stakeholders	3
Strategic estimate	4
Confirming the preferred option (for concept design)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	2
Concept design estimate	3

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	2
Managing the level and scope of the project	3
Developing the detailed design	1

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	3
Managing construction contracts	2

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	2
Finalising and handover of the completed works	3
Post completion review (what successes and key learning's were identified)	1

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	3
Community	2
Project owner (Client)	4
Project manager	5
Environmental	1

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	3
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	2
Strategic Design Stage	1
Concept Design Stage	3

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	1
Strategic design stage	2
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	disagree
Does the above statement occur on projects managed internally by a single organisation	disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	strongly agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	strongly agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	agree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Early identification of assets owners so the correct standards are followed
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Managing and improving the operational performance of their own project team
- ,
- No gaps, guidelines are thorough enough as , is
- Additional information needed on how/who manages project risks

Collector: Email Invitation 1 (Email)
Time Spent: 00:09:01

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	4
Cost Constraints	1
Urgency of project schedule (time management)	5
Environment (Access/Location)	3
Buildability of the design work	2

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	2
Level of project definition	4
Managing stakeholders expectations	3
Project expectations	1

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	2
Consulting appropriate stakeholders	3
Strategic estimate	1
Confirming the preferred option (for concept design)	4

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	1
Developing the concept design	3
Concept design estimate	2

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	1
Managing the level and scope of the project	2
Developing the detailed design	3

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	2
Managing site risks (unknowns)	1
Managing construction contracts	3

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

Identifying ongoing maintenance works and planning	3
Finalising and handover of the completed works	2
Post completion review (what successes and key learning's were identified)	1

Q9 Can you rank the five stakeholders who you believe have the most influence that will likely impact on a projects objectives and direction during its development? (With 1 being the most important and 5 being the least)

Politicians	2
Community	3
Project owner (Client)	1
Project manager	5
Environmental	4

Q10 Can you rank the three stakeholders who you believe accept the highest risk allocation (project risks) in the delivery of a project? (With 1 being the most important and 3 being the least)

Contractor	2
Project Manager	3
Project Owner (Client)	1

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q11 Can you rank the three stages of a projects development lifecycle that you believe is most important in managing both internal (project team) and external (community, political) stakeholders inputs? (With 1 being the most important and 3 being the least)

Conception of the Project	3
Strategic Design Stage	2
Concept Design Stage	1

Q12 Can you rank the three stages of a projects development lifecycle that you believe holds the most project uncertainty? (With 1 being the most important and 3 being the least)

Conception of the project	2
Strategic design stage	1
Concept design stage	3

Q13 Please indicate for each proposition the answer that best applies regarding dealing with project risk

Should the general public have more influence over a projects objectives and direction	Neither agree or disagree
Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Neither agree or disagree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

Q14 Can you rank the three stages of the project development process that you believe is most likely to be over looked or skipped through without sufficient detailing or design being completed first? (With 1 being the most important and 3 being the least)

Conception of the Project	1
Strategic Design Stage	2
Concept Design Stage	3

Q15 Please indicate for each proposition the answer that best applies from a recent large project you have worked on (consider both external and internal stakeholders)

Different stakeholders have different perspectives	agree
The larger the number of stakeholders the higher the project complexity (difficultly)	agree
Different stakeholders (internal only) perceive risks in relation to objectives differently	Neither agree or disagree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q16 Can you please rank your three most important elements that you believe best assists in managing stakeholder relationships? (With 1 being the most important and 3 being the least)

Communication	1
Developing relationships	2
Addressing issues as and when they arise	3

Q17 Please indicate for each proposition the answer that best applies regarding the project management process of managing stakeholders

Project management today is mainly concerned with ticking off the required steps to get things done, with the assumption that it was thoroughly completed.	agree
Does conventional project management used today best manage stakeholder inputs.	Neither agree or disagree
Professional guidelines often fail to distinguish between strategic, whole project considerations, and lower level operational procedures.	Neither agree or disagree
The project manager is regarded as a convenient recipient of project risk, providing psychological relief to the project owner.	disagree

Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

Political interference and unrealistic expectations which can't be addressed by guidelines

Collector: Email Invitation 1 (Email)
Time Spent: 00:10:28

Page 1: Welcome to My Survey

Q1 ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information• you voluntarily agree to participate in round 1 and 2 of this questionnaire• you are at least 18 years of age If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree

Page 3

Q2 Can you rank the five project complexity measures that you consider to be most important from a large scale project you have recently worked on? (With 1 being the most important and 5 being the least)

Technical Aspects	2
Cost Constraints	1
Urgency of project schedule (time management)	3
Environment (Access/Location)	5
Buildability of the design work	4

Q3 Can you rank the four project complexities/uncertainties that you consider to be most important during the project conception stage? (With 1 being the most important and 4 being the least)

Definition of project objectives	1
Level of project definition	3
Managing stakeholders expectations	4
Project expectations	2

Q4 Can you rank the four project complexities/uncertainties that you consider to be most important during the strategic design stage? (With 1 being the most important and 4 being the least)

Level of unknowns (geotech, community, environment, road design accuracy, etc)	1
Consulting appropriate stakeholders	4
Strategic estimate	3
Confirming the preferred option (for concept design)	2

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

Q5 Can you rank the three project complexities/uncertainties that you consider to be most important during the concept design stage? (With 1 being the most important and 3 being the least)

Engineering and field investigation outcomes	3
Developing the concept design	1
Concept design estimate	2

Q6 Can you rank the three project complexities/uncertainties that you consider to be most important during the detailed design stage? (With 1 being the most important and 3 being the least)

Managing project risks	3
Managing the level and scope of the project	2
Developing the detailed design	1

Q7 Can you rank the three project complexities/uncertainties that you consider to be most important during the construction stage? (With 1 being the most important and 3 being the least)

Managing construction activities and services	1
Managing site risks (unknowns)	3
Managing construction contracts	2

Q8 Can you rank the three project complexities/uncertainties that you consider to be most important during the finalisation stage? (With 1 being the most important and 3 being the least)

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Finalising and handover of the completed works	1
Post completion review (what successes and key learning's were identified)	3

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Do external partners (contractors) and internal clients (principal) perceive risks levels differently	agree
Do internal or external parties manage risks or uncertainty for their own benefit, at the disadvantage of the other, impacting on the overall project goals	Strongly agree
Does the above statement occur on projects managed internally by a single organisation	Neither agree or disagree

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Different stakeholders (internal only) perceive risks in relation to objectives differently	strongly agree
Does a project suffer from late stakeholder engagement/involvement	agree
Different stakeholders have different interest levels	agree
Do all stakeholders align themselves with the projects objectives	disagree

Analysis of influencing factors of construction project complexity from different stakeholders perspectives Round 2

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Q18 Can you select up to a maximum of five the most relevant gaps that you believe exist in the current project management guidelines that could better manage complex projects? (Select at least 1 or up to a maximum of 5 that you consider applicable)

- Current guidelines too convoluted, resulting in individuals overlooking crucial steps in a projects lifecycle
- ,
- Political interference and unrealistic expectations which can't be addressed by guidelines
- ,
- Managing and improving the operational performance of their own project team
- ,
- Efficiencies with the level of bureaucracy in government