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# Feasibility assessment of projects for risk of failure: how feasibility assessment are done for infrastructure projects

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# Chapter 1: Introduction

There is currently little empirical understanding in the construction project management literature on the way that feasibility assessments for infrastructure projects are done in practice by project owners. The primary research question investigated in this study was: How are feasibility assessments done in practice? To answer this question, a comprehensive and intensive research method was required which informed the choice of a case study research strategy.

The purpose in this study is to show how feasibility assessments for large infrastructure projects are done in practice, and how both the role of feasibility assessment in recognising risk of failure and the extent to which risk is recognised. Because there is currently little empirical explanation in the project management literature on the way that feasibility assessments of major infrastructure projects are done in practice, a similar type of study had to be sought. Although no major empirical work has been reported that indicates how feasibility assessments are used to recognise risk, Laryea and Hughes 2009 in 'Commercial reviews in the tender process of contracts' considered a similar problem by showing the extent to which clients amend standard form contracts in practice, the focus of the amendments, and how contractors respond to the amendments when putting together a bid.

Two cases were arbitrarily selected for the study. The first case chosen was the Hybrid Road to Light Rail project located in Gauteng (Case Study A). The second case was the Gautrain project which is also located in Gauteng (Case Study B). The feasibility assessment for Case Study A was done over a period of two years (2010 to 2011) whereas that of Case Study B took place over three years (1998-2000). The research entailed an initial phase of gaining access to the documentation and the text of interviews with professionals involved in carrying out the feasibility assessment for the two projects.

In the case of Case Study A, three professionals conducted the feasibility assessment for the project. They led a larger team of eight subject-matter experts, each of whom was interviewed by a professional to obtain their views on the project. Each interview lasted 60-90 minutes and took place during the period of the feasibility assessment between 2010 and 2011. Further documents relating to the feasibility assessment of the project, which included the minutes of three meetings and the overall feasibility assessment report, were also collected for analysis. The key question that the

researcher sought to answer was how the professionals went about conducting the feasibility assessment for the project.

In the case of Case Study B, access to the original feasibility assessment documentation was denied to the researcher. However, a summary of the feasibility assessment report containing the key findings relating to aspects such as the assessment process, social acceptability, technical feasibility and economic feasibility among others was publicly available on the Gautrain website. In addition, a book had been published which contained significant information on the feasibility assessment of the project. Also, one retrospective interview was conducted in 2015 with a senior executive manager, who had been involved in the building of the project, to confirm aspects of the feasibility assessment process. The data obtained was subjected to content analysis.

## 1.1 Background

Avoiding project failure has received intense scrutiny within the discipline of project planning and management. Making essential choices at the front –end decision-making phase is of critical importance (Williams and Samset 2010). Identifying key issues or difficulties at this initial stage is likely to have the largest impact on long–term success or failure. Williams and Samset (2010) p38 observe that although the management and governance of many projects has shown considerable improvement in recent years, the reputation of projects and project management is that they are generally unsuccessful. Large, complex, infrastructure development projects can appear to be successful initially. In some cases the outcome of a project is popularly judged to be a failure, a 'white elephant' for which the cost of upkeep is much greater to the owner than its value (Williams and Samset 2010; Duvenhage and Clarke 2014).

Flyvbjerg et al (2003), commenting on project outcomes, stress the need to assess the viability of megaprojects before proceeding with them. Flyvbjerg et al (2003) insist that: 'A risk exists that actual project viability may be substantially different from forecast viability'. Flyvbjerg et al (2003) p.32 quote the Oxford-based Major Projects Association as concluding that 'too many projects proceed that should not have begun'. As part of project planning, projects should be assessed for their viability before they are implemented. Flyvbjerg (2014) states further that in megaprojects, consistent overestimating of project benefits and underestimating of project costs occurs.

Feasibility assessment is the process that is used in project management to establish viability and avoid project failure. The process is widely recommended as a means to establish viability (Hofstrand and Holtz-Clause 2009, Bowen et al 2010, CIDB Practice Note #22b 2011 p8, CIDB Infrastructure Toolkit 2012, Kernaghan 2012, Watermeyer 2014).

Williams and Samset (2010) p41 state that project planners need to have a broad and long-term perspective and allow different concepts to be considered. Therefore project planners need to know how to implement the feasibility assessment process, and know the extent to which the process detects risk of failure, before they can confidently recommend to a client to proceed with a particular project.

Although guides have been developed to assist planners to achieve successful projects by providing theory to guide the risk management planning and risk identification

processes, as well as logical pathways to guide project managers through the delivery processes to the decision to proceed with the project, the problem in explaining the entire process of feasibility assessment is that current literature appears to be limited to recommending the need for feasibility assessment and prescribing how risks could be identified, rather than explaining how the process is carried out. Literature does not clearly indicate how feasibility assessors actually detect risk of failure in project concepts, nor the extent to which risk is detected by assessors. The guides also do little to explain how the feasibility assessment process is actually carried out, nor the extent to which risk is detected in the process.

The aim of this study is to investigate how feasibility assessments are carried out in practice. At the heart of the feasibility assessment process are the people whose actually make feasibility assessments, i.e. the feasibility assessors. After investigating the factors of risk that feasibility assessors recognise, how the concept of feasibility assessment relates to the theory of risk management planning and risk identification of projects, and what the concept of feasibility means to people who use the term, research will attempt to establish how feasibility is assessed in practice and the extent to which risk factors are identified.

Although the notion of feasibility assessment of a proposed project is widely recommended in literature related to project management (Kernaghan 2012, Mishra 2011, Bowen et al 2010, Hofstrand and Holtz-Clause 2009, Colozza 2008, Nokes and Kelly2007, Kolmanovsky and Siverguina2002, Flyvbjerg et al 2003, Balba et al 1998, Capko and Anwar 1996, Bryson and Bromily1993, Posten1983, and Justis and Kriegsman1979), little explanation is given in these studies about how the process is actually carried out in practice.

In 2004, South Africa's National Treasury began to seek a common approach to assist built environment professionals and managers achieve good quality service delivery of infrastructure projects. The result was National Treasury's 'Infrastructure Delivery Management System', or IDMS, which was finally completed in 2012. Kenneth Brown, Chief Procurement Officer of National Treasury in 2016, described the IDMS as: 'a model for best practice delivery of infrastructure management within the public sector...the IDMS was birthed and informed by the answers to questions posed to a project- is it suitable, is it *feasible*, is it credible and does it deliver value for money?' One of the components of the IDMS was the 'Standard for Infrastructure Procurement

and Delivery Management', or SIPDM. According to Brown (as was reported in *Civilution,* February 2016), National Treasury required the SIPDM to be implemented by all organs of the South African state as from 1 July 2016.

Other guides prescribe how project managers should conduct feasibility assessments (for example Claase 2012, Kernaghan 2012, Hofstrand and Holtz-Clause 2009), but little guidance on the way that the feasibility assessment process is actually conducted in practice has been found in the literature. Interpretation of the words used in the guides might be ambiguous. A dictionary definition of 'feasible' as 'practicable, possible, easily or conveniently done' (COD 2006) might be sufficient for the layman, nevertheless deeper perceptions, assumptions, values and objectives about the concept of feasibility assessment might exist when the words are used in a project context. Execution of a project may be *im*practicable, *im*possible, and *not* easily or conveniently done.

Failure is described in COD (2006) as 'lack of success'. 'Assessment' is defined as 'evaluate or estimate'. As a working definition, 'feasibility assessment' is interpreted as the prime activity involved in carrying out a feasibility study. However, ambiguity exists in the way the words 'feasibility assessment' are widely used, as suggested in the project descriptions for a variety of projects such as those described by Colozza (2003), Kolmanovsky and Siverguina (2002), and Balba et al (1998).

The study is structured as follows: Chapter One is the introduction, background and general research approach. Chapter Two reviews literature to explore themes in the world in which feasibility is assessed, and derives factors of risk from the themes. In Chapter Three, theory applicable to feasibility assessment is reviewed and the meaning people ascribe to the concept of feasibility assessment is derived. Chapter Four is the methodology of the research process. Chapter Five is data collection, analysis and results. Chapter Five is a discussion of the results. Chapter Six, the conclusion, gives the implications of the exploration, the contribution of the study to project management research, the limitations of the research, and suggestions for further research.

## 1.2 Research aim and objectives

The primary research question investigated is: how are feasibility assessments done in practice? The specific objectives are:

- To investigate how feasibility assessments of project concepts are actually carried out in practice.
- To ascertain the extent to which feasibility assessors recognise the risk of failure in project concepts.

## 1.3 General research approach

The overall problem that is being investigated is how feasibility assessments are done in practice and to what extent feasibility assessors recognise risk of failure in project concepts. The feasibility assessments emphasized in this study are technical feasibility assessments. Other kinds of feasibility assessment, such as those required for determining financial feasibility and ecological feasibility, are not emphasized because until a project is found to be technically feasible, other feasibility assessments will have no practical significance.

A four- stage iterative research approach is taken. Firstly, literature review is used to gain an initial understanding of the complex world in which feasibility assessment is practiced, and to identify those contextual themes that influence feasibility assessment. Themes reviewed in turn lead to risk factors affecting a project which feasibility assessors might recognise. Secondly, the depth and complexity of the feasibility assessment process is investigated in theory. Theory is found that guides the risk management planning and risk identification process of projects, and a logic pathway is found that guides the delivery processes for project managers to the decision to proceed with the project. Thirdly, documentary analysis establishes the meaning and purpose ascribed to the phrase ‘feasibility assessment’ by various people who use the term. Fourthly, the understanding gained is used in research to explore and compare how the actual feasibility assessment process is done and the extent to which risk of failure is detected.

## 1.4 Parameters of the study

The parameters of the study are current project management practice in the process of feasibility assessment, emphasizing technical feasibility. The study is restricted to finding out how and to what extent feasibility assessors detect risk of failure in two large infrastructure development project concepts, both feasibility assessments being located in the Gauteng province of South Africa. Unit of analysis is the actual feasibility assessment process used by project managers to detect risk of failure in the large infrastructure development projects. Because the study is restricted to finding out how and to what extent feasibility assessors detect risk of failure in these two project concepts, other types of project in other countries may need other processes to detect risk of failure, so results might not generalize to other types of project. The feasibility assessments studied emphasize technical feasibility. Other kinds of feasibility assessment, such as those required for financial feasibility and ecological feasibility, have not been emphasized, because until a project is found to be technically feasible, other feasibility assessments have no practical significance. The period covered in the study is 2008 to 2015.

## Chapter 2: Contextual themes and risk factors for feasibility assessment

The purpose of the Chapter Two literature review is to explore the contextual themes related to feasibility assessment, and to identify the risk factors feasibility assessors predominantly recognise. Factors are influences contributing to results (COD 2006). The knowledge area explored is a a broad exploration of sources of project management literature and a miscellaneous collection of scientific papers on diverse subjects, each of which use the word ‘feasible’ in their content.

Origin and development of the discipline of project management, complexity of the environment in which projects are initiated, and the need to assess viability of projects to avoid risk of failure, are reviewed. Feasibility assessment as a means to assess viability is considered. Guidance on project risk management practice is sought. Identifying risk as a contribution to determining feasibility is emphasized. Decisions on how to proceed with a project after retrospective assessment of risk are explored, followed by concerns underpinning decisions to proceed taken after feasibility assessment. The themes are used in turn to derive risk factors that might be recognised by assessors when they assess the feasibility of projects.

Themes are explored to illustrate the context, depth, diversity of views and the bounded rationality of the people who interpret the concept of feasibility assessment. The list of themes is not suggested as being fully comprehensive, nor is it a recommendation for a decision-making process, but simply a logical way to organize the themes identified, a process that has been very clearly explained by Williams and Samset (2010) in their discussion on Issues in front-end decision making on projects. Themes in turn provide risk factors recognised by expert assessors when they are assessing feasibility.

The chapter commences with a broad exploration of miscellaneous sources containing the word ‘feasibility’ in their text and titles. Exploration provides understanding about how the concept of feasibility assessment is perceived by various parties. Appreciation of themes and risk factors affecting feasibility assessment continues with the theory and meaning of concepts related to feasibility assessment, as widely understood by a

wide range of people. Exploration provides an underpinning for an investigation of how the feasibility assessment of projects is actually carried out in practice.

## 2.1 Origin and development of the discipline of project management

Dvir and Lechler (2003) state that project management, as a discipline, emerged in the world in the 1950's and 1960's, with the development of network techniques such as program evaluation and review technique (PERT) and critical path method (CPM). Project planning, focussing on scheduling and budgeting, dominated project management research and discussion. The Project Management Institute (PMI) established in 1969, provided guidelines in the form of the project management body of knowledge (PMBoK) and its later revisions. Kerzner (2003) elaborated discussion on a system approach to planning, scheduling and controlling in project management.

The theme of the origin and development of the discipline of project management in the world suggests that participants in the feasibility assessment process assess risks to projects in the context of a particular field of expertise. The theme provides 'assessment of risk in context' as a factor in determining feasibility.

## 2.2 Complexity of the environment in which projects are initiated

Complexity of the environment in which projects are initiated could cause uncertainty as to the goal of a chosen project. Assessors should be clear at the initial stage about the goals of the project they are viewing, as indicated by commentators on the theory of project management (Flyvbjerg et al 2003, Dvir and Lechler 2004, Laryea 2008, Williams and Samset 2010), who indicate that the environment in which projects exist are complex. Projects' complexity in a typical management environment is well explained in the following quotation from Linehan and Kavanagh in Williams and Samset (2010): "Projects are complex, ambiguous, confusing phenomena wherein the idea of a single clear goal is at odds with reality".

Projects are initiated in complex and dynamic environments, resulting in circumstances of high uncertainty and risk (Mulholland and Christian 1990, quoted in Laryea 2008 p14), and are often both complicated technically and require diverse skills in their implementation (Williams and Samset 2010 p41).

The theme of the complexity of the environment in which projects are carried out suggests that the initial choice of project on which the project team should focus is important. ‘Initial choice of project’ is suggested as a risk factor that assessors view in determining feasibility.

## 2.3 Need to assess viability of projects to avoid risk of failure

The project team might neglect to assess viability of a project. ‘Viability’ has been indicated by some writers as a synonym for ‘feasibility’ (see Hofstrand and Holtz-Clause 2009). Commentators on project outcomes, including Williams and Samset (2010) and Flyvbjerg et al (2003), suggest that large infrastructure development projects are often unsuccessful: ‘Many such projects have strikingly poor performance records in economy, environment and popular support,’ observes Flyvbjerg et al (2003) p3. That commentator’s observations imply that a project’s intended performance had not been considered by assessing its viability widely before proceeding with implementation.

The theme of the need to assess viability of projects to avoid risk of failure indicates ‘risk neglect’ as a risk factor to be recognised in investigating the feasibility of a project.

## 2.4 Feasibility assessment as a means to assess viability

The project team might ignore strengths and weaknesses of a project in their optimism to prove viability. Feasibility study has the objective of uncovering strengths and weaknesses of projects (Justis and Kriegsman 1979). Strengths and weaknesses are risks to projects. Dvir and Lechler (2004) give the objective of determining feasibility as: ‘reducing uncertainty’ and 'understanding strengths and weaknesses [of a project]'. Feasibility assessments, which are carried out within a feasibility study, are defined by Kernaghan (2012) as 'analysis or research into the practicality of a proposed plan…the early stages of technical analysis will help identify areas of strengths and weaknesses in the proposed project’ (Kernaghan 2012). A project should be judged as feasible before owners, built environment professionals and project managers take the decision to proceed with the project, states Flyvbjerg et al (2003), who further warns that assessment could be affected by appraisal optimism, resulting in a factor of ‘undue optimism’ in judging uncertainty and risk.

The theme of feasibility assessment as a means to assess viability suggests that if known areas of strength and weakness are ignored and the project is recommended to proceed nevertheless, then ‘undue optimism’ is a risk factor to be considered in recognising feasibility.

## 2.5 Guidance on project risk management practice

Management of risk is acknowledged in project management guides as a key element to effective project management. Risks to projects are identified through project risk management, state Nokes and Kelly (2007) p207. Guidance to project risk management practice is sought from two main sources: Nokes and Kelly (2007)’s ‘The Definitive Guide to Project Management’; and *Civilution* (2016)’s ‘Focus on National Treasury’s Standard for Infrastructure Procurement and Delivery Management’, shortened here to SIPDM. Both sources refer to the ‘Guide to the Project Management Body of Knowledge’, shortened here to ‘PMBoK Guide’.

Nokes and Kelly (2007) offers a guide to project management practice written from the point of view of the project manager, and is designed as a reference for project managers to use while managing projects. Project risk management is indicated as a knowledge area of project management. Project risk is identified and analysed through project risk management. Identifying risk is one of the skill sets inherent in the knowledge area of project risk management. The objectives of project risk management are to increase the probability and impact of positive events and decrease the probability of events adverse to project objectives, state Nokes and Kelly (2007). According to Nokes and Kelly (2007) p4, one of the emerging world standards for project management is the Project Management Institute (PMI)’s approach, known as the Project Management Body of Knowledge’, or PMBoK. The PMBoK Guide is also the United States National Standard (ANSI) for project management. Nokes and Kelly (2007) follow the PMI methodology. Project risk management is given as one of the nine knowledge areas of project management, as articulated in the PMI’s PMBoK Guide. Guidance on project risk management forms part of the PMBoK Guide. Nokes and Kelly (2007 p274 *Figure 11.1*) offer a conceptual framework of the risk management planning process, adapted from the PMBoK Guide.

*Civilution* (2016)’s ‘Focus on National Treasury’s Standard for Infrastructure Procurement and Delivery Management’ focusses on South Africa’s National

Treasury's SIPDM, which had to be implemented by all organs of state from 1 July 2016. The SIPDM, sought to establish a common approach to assist built environment professionals and managers achieve good quality service delivery of infrastructure projects. The SIPDM cites the PMBoK Guide as providing further insights and information (Civilution 2016 p40). The SIPDM's Stage 4 Gate 4 comprises the 'accepted concept report on feasibility'. The SIPDM was intended to contribute to the Infrastructure Delivery Management System (IDMS), which had been developed by National Treasury in 2012. The IDMS provided a logic pathway which included guidelines from CIDB Practice Note #22b (2011) and CIDB Infrastructure Toolkit (2012). The logic pathway provides guidance in delivery processes for project management. Although both the Practice Note and Toolkit mention feasibility, neither the IDMS nor its guidelines define feasibility assessment and its objectives specifically, nor do they indicate the process of how the feasibility of projects is actually assessed in practice.

The theme of guidance on project risk management practice assists with the theoretical approach to be used to appreciate feasibility assessment as part of risk assessment. No risk factor is obvious from the theme.

## 2.6 Identifying risk as a contribution to determining feasibility

Identifying risks in the feasibility assessment process first needs a state of risk to be perceived by participants. Commentators on project outcomes, on the theme of the need to assess viability of projects, have promoted the need for feasibility studies as a way to reduce risk and confusion about the outcome of those projects. Commentators on project outcomes, as well as guides to project management, give 'determining feasibility' as being an important part of realizing successful and valuable projects. Identifying and analysing risk to projects thus becomes a theme contributing to determining feasibility.

Risk analysis is not straightforward. Construction management literature cited by Laryea and Hughes (2011) indicated that unsystematic approaches using experience and intuition have been used by contractors for assessing risk, rather than analytical approaches. Although analytical approaches proposed by academic researchers for risk analysis have become prolific, Laryea and Hughes (2011) found that most analytic risk models for contractors were hardly derived from the kind of information commonly

used in practice. Most analytic risk models were developed because of the mathematical modelling ability of the writers, rather than the exigencies of actual bidding practice, and were rarely used in practice. Although guides to project management indicate models that can be used to assess risk, the models give little indication of how risk is accounted for in practice (Laryea and Hughes 2011). The theme of identifying risk as a contribution to determining feasibility suggests that 'perception of risk by the participant' is a factor to be recognised when determining feasibility. The risk factor 'perception of risk by the participant' emphasizes the importance of risk identification and risk management as a part of the feasibility assessment process.

## 2.7 Decisions to proceed with a project after retrospective assessment of risk

At some stage of the planning process it is necessary to take a decision to proceed with a project. Essentially, feasibility studies involve making decisions with scant information (Williams and Samset 2010). However, the calculation of uncertainties and the likelihood of risks is crucial to the estimation in any project, as explained by Williams and Samset (2010) p45: 'It is clear that carefully extracted qualitative information about a well-thought out project concept can provide reliable and valid input to the decision [to proceed] for the whole of the front-end phase.'

Knowledge in an assessor's mind about uncertainty and risk affecting a project concept is qualitative information. Knowledge as a retrospective sense of risk in the mind of the assessor allows the assessor to recognise whether or not to proceed with a project. Claase (2012) p2 continues the same thinking about a project concept by observing: 'If feasibility studies are intended [as a means] to provide knowledge, then based on this knowledge, the eventual go/no-go decision [on a project] is made'.

The theme of deciding how to proceed with a project after qualitative calculation of uncertainty and risk, using scant information available at the front–end, suggests that a 'retrospective sense of risk' in an assessor's mind is a risk factor in recognising the potential for ultimate success of the project.

## 2.8 Concerns underpinning decisions to proceed taken as a result of feasibility assessment

Decisions dependent upon the outcomes of feasibility assessment are underpinned by concerns about bias by the assessors (Williams and Samset 2010). Decisions to proceed with a project after feasibility assessment should not suffer from any ambiguity as to how the concept of feasibility assessment is understood by assessors. Concerns that might underpin decisions are two themes that appear in Williams and Samset (2010) and in Flyvbjerg (2009):

Firstly, the people involved are not supremely rational decision makers. Williams and Samset (2010) p45 quote Simon 1972 as asserting that 'real managers are human beings and at best display "bounded rationality". They are limited in the extent to which they can make a fully rational decision. Not only are they are lacking complete information about the present and have uncertainty about the future, but they are also limited in the extent to which they can solve complex problems'.

Secondly, one of the reasons for bounded rationality is the existence of cognitive biases that are natural to humans. Evidence for cognitive bias was offered by Flyvbjerg (2005) as optimism bias in megaprojects. Flyvbjerg acknowledges that his own thinking on cognitive biases was developed from the 1974 psychological work of Tversky and Kahneman.

The themes of bounded rationality and cognitive bias underpinning decisions taken as a result of feasibility assessment illustrate that project managers who are trying to reach a decision to proceed with a project should take into account the bounded rationality and biases of the people who undertake feasibility assessments. The risk factor to be recognised is that 'assessment leads to the decision to proceed'.

## 2.9 Discussion of the themes and risk factors

The chapter commenced with a broad exploration of miscellaneous sources containing the word 'feasibility' in their text and titles. Exploration provides an understanding about how the concept of feasibility assessment is perceived by various parties. Appreciation of themes and risk factors affecting feasibility assessment continues with theory and meaning of concepts related to feasibility assessment, as widely understood by a wide

range of people. Appreciation provides an underpinning for an investigation of how the feasibility assessment of projects is actually carried out in practice.

The purpose of the chapter was to explore themes related to the feasibility assessment process, identified from a variety of views. Themes in turn led to risk factors that might be recognised by assessors when they assess the feasibility of projects. Views on the origin and development of the discipline of project management, complexity of the environment in which projects are initiated, and the need to assess viability of projects to avoid risk of failure, were explored. Feasibility assessment as a means to assess viability was considered. Guidance on project risk management practice in recognising risk was sought. Identifying risk as a contribution to determining feasibility through those risk factors that feasibility assessors might recognise was highlighted. Decisions on how to proceed with a project after retrospective assessment of risk were considered, together with concerns underpinning decisions to proceed after feasibility assessment.

Eight themes affecting feasibility assessment were explored. Themes illustrate the context, depth, diversity of views, and the bounded rationality of people who undertake feasibility assessments. The literature is organized as a logical progression. More themes may exist, but were not encountered in this review. The eight themes are elaborated as follows:

1. Origin and development of the discipline of project management (indicating ‘assessment of risk in context’, i.e. context, as a risk factor)
2. Complexity of the environment in which projects are initiated (indicating ‘initial choice of project’ as a risk factor)
3. Need for the viability of projects to be assessed (indicating ‘risk neglect’ as a risk factor)
4. Feasibility assessment as a means of assessing viability (indicating ‘undue optimism’ as a risk factor)
5. Guidance on project risk management practice (no risk factor suggests itself from the theme)
6. Identifying risk as a contribution to determining feasibility (indicating ‘perceptions of risk by participant’ as a risk factor)

7. Decisions on how to proceed with a project after retrospective assessment of risk (indicating importance of 'retrospective sense of risk' as a risk factor)
8. Concerns about making decisions (indicating 'assessment leads to the decision to proceed' as a risk factor)

The themes consider variously the context, depth, project stage, diversity of views, theoretical approach, guidance, importance of risk identification, and the bounded rationality of the people who make feasibility assessments, and result in seven risk factors that feasibility assessors might recognise when assessing the feasibility of projects. Risk factors indicated were: assessment of risk in context, initial choice of project, risk neglect, perceptions of risk from participant, undue optimism, retrospective sense of risk, and assessment leading to the decision to proceed.

This discussion is of themes and risk factors for feasibility assessment, theory that guides feasibility assessment of projects, and the meaning people attribute to the concept of feasibility assessment. Common meanings among different people provide underpinning for investigating how the feasibility of projects is actually determined in practice. Different stakeholders have different perceptions of reality, different understanding of the problem, different assumptions, values and objectives (Williams and Samset 2010 p41). Meanings for the concept of feasibility assessment are explored to better understand theory. Kernaghan (2012) suggests that feasibility assessment does not assess 'should the project be done?' Kernaghan's suggestion might be a clue to further understanding why feasibility is not assessed.

Suggestions by various sources of the documents and information needed for feasibility assessment do not give a thorough and clear explanation of what documents and information are really needed. Views seem to be more the individual views of each source author, rather than a consistent view among all sources. The shortcoming of lack of clarity on documents and information needed for feasibility assessment emphasise the need to question how feasibility assessments are actually carried out in practice, and what information is actually used to conduct a feasibility assessment.

The most useful feasibility assessments are carried out by assessors outside of the project (Flyvbjerg et al 2003).It is very difficult or even impossible at the initial planning stage for project managers to know precisely which activities have to be carried out in

order to complete the project (Dvir and Lechler 2004). Further objectives of feasibility assessment are given in the opinions of Kernaghan (2012), Hofstrand and Holtz-Clause (2009), and Capco and Anwar (1996), which could be investigated in further research.

**Table 1.1 Risk factors for feasibility assessment suggested by contextual themes**

| Risk factor | Contextual theme | Reference |
|---|---|---|
| 1.Assessment of risk in context | Origin and development of the discipline of project management i.e. context | Dvir and Lechler 2004<br>Kerzner (2003) |
| 2.Initial choice of project | Complexity of the environment in which projects are initiated i.e. depth | Williams and Samset (2010)<br>Laryea (2008)<br>Dvir and Lechler (2004)<br>Flyvbjerg et al (2003) |
| 3.Risk neglect | Need to assess viability at an early stage of the project | Williams and Samset (2010)<br>Hofstrand and Holz-Clause (2009)<br>Flyvbjerg et al (2003) |
| 4.Perceptions of risk from participant | Guidance in identifying risk as a contribution to determining feasibility i.e. diversity of views | National Treasury SIPDM (2015)<br>Nokes & Kelly (2007)<br>Laryea and Hughes (2001) |
| 5.Undue optimism | Feasibility assessment as means to assess viability as a theoretical approach | Kernaghan (2012)<br>Dvir and Lechler (2004)<br>Flyvbjerg (2003)<br>Justis and Kriegman (1979) |
| 6.Retrospective sense of risk | Decisions to proceed after retrospective assessment of risk | Claase (2012)<br>Williams and Samset (2010) |
| 7.Assessment leading to the decision to proceed | Decisions to proceed with a project | Claase (2012)<br>Williams and Samset (2010)<br>Flyvbjerg (2005) |

# Chapter 3: Meaning, purpose and objective of feasibility assessment

The meaning, purpose and objective of feasibility assessment as it is understood by people is complex but primarily involves deciding if a plan or concept can be easily and conveniently done after uncovering its strengths and weaknesses. A literature review was carried out to determine how the purpose and objective of feasibility assessment is generally seen in an historical survey of project management literature. Referenced data sources that were used to define the purpose and objective of feasibility assessment include: Watermeyer (2014); Kernaghan (2012); Claase (2012); CIDB Inform Practice Notes #22b (2011); CIBD Infrastructure Delivery Management Toolkit version 11 (2012); Mishra (2011); Bowen et al (2010); Hofstrand and Holtz-Clause (2009); Dvir and Lechler (2004); Colozza (2003); Flyvbjerg et al (2003), plus eight other earlier sources which have lesser influence on the definition of the purpose and objective of the feasibility assessment of projects.

**Table 3.1 – Definition of the meaning, purpose and objective of feasibility assessment of projects**

| CONTEXT | | | CONCEPT | | | INFORMATION |
|---|---|---|---|---|---|---|
| **Study source** | **Date of publication** | **Field of expertise examined** | **Excerpts indicating the purpose of feasibility assessment** | **Excerpts indicating the objective of feasibility assessment** | **Excerpts indicating why feasibility is <u>not</u> assessed** | **Excerpts indicating information and documents needed for feasibility assessment** |
| Watermeyer | 2014 | Infrastructure delivery<br>-Guide to procurement strategy | Minimizing gaps between achieved and projected outcomes | Deciding to proceed with the projects | Optimism bias.<br>Strategic mis-representation | Not indicated |
| Kernaghan | 2012 | International development<br>-Guide to obtain funding | Analysis into the practicality of a proposed plan.<br>Identifying areas of strength and weakness. | •Will the project work?<br>•Can the project be done technically?<br>•Can it be done here and now?<br>•Can the methodology be improved on? | <u>Why should</u> the project be done | (Documents indicating : )<br>Does technology exist?<br>Has the technology been used before?<br>What assistance is required?<br>What are the constraints and risks to implementation? |
| Claase | 2012 | Business management<br>-Knowledge management | Examine and / or evaluate the possible future success or failure of prospective endeavours (p.1)<br>Insight into the probable success or failure of a prospective endeavour | Answer the go / no go question | Not defined | Definition of the endeavour.<br>Scope of the endeavour<br>Stakeholders of the endeavour |
| CIDB Infrastructure Delivery Management Toolkit | 2012 | Infrastructure delivery<br>-Projects | Critically reviewing the plan and identifying and assessing gaps and major risks | Deciding to implement infrastructure improvements | Not defined | Not indicated |
| CIDB Inform Practice Notes #22B | 2011 | Infrastructure delivery<br>-Projects | (Stage 1 Indirectly : )<br>Identify the best way of achieving objectives and value for money whilst taking into account risks and constraints<br><br>Interrogating outstanding risks<br><br>(Stage 3 : )<br>Establishing the feasibility of satisfying the strategic brief;<br><br>Establishing the feasibility of satisfying the package requirements and package definition.<br><br>(Stage 4 : )<br>Establishing the feasibility of satisfying the strategic brief & producing a risk report | (Gate 1 output :)<br><br>Acceptance by the client of the concept report.<br><br>(This is also the output of Stage 4, package definition)<br><br>(Gate 3 output :)<br>Acceptance by the client of the strategic brief.<br><br>(Gate 4 output:)<br>accepted feasibility report | Technical feasibility assessment has already taken place | Preliminary investigations.<br>Stake holder consultations.<br><br>Desk top studies.<br><br>Specialist advice to establish feasibility of satisfying the strategic brief. |
| Mishra et al | 2011 | Business management<br>-Projects | Evaluating the potential of projects | Obtaining success criteria and factors | Not defined | Not obtained |
| Bowen et al | 2010 | Medicine<br>-Preventive medicine | A series of questions and methods (p.5) | Determining whether an intervention should be recommended | Not defined | Acceptability;<br>Demand;<br>Implementation;<br>Practicality;<br>Adaption; |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Integration; Expansion |
| Hofstrand and Holtz-Clause | 2009 | Agriculture -Guide to agricultural extension | Analysis of the viability of an idea | Answering the question : 'Should we proceed with the idea?' | We know it's feasible; analysis has already been done. Resistance to change | Not indicated |
| Nokes & Kelly | 2007 | Project management -Guide | Not defined | Not defined | Not defined | Not indicated |
| Dvir and Lechler | 2004 | Project management - Guide to project planning | Understanding strength and weaknesses at the origination and initiation stage | Reducing uncertainty about the project | Not stated | 1.Importance (of the project) 2.Level of experience (of the project team) 3.Personnel constraints (manpower) |
| | | | | | | 4.Parallel projects 5.Technical risk 6.Breakthroughs (technical breakthroughs that would make the project obsolete) |
| Flyvbjerg et al | 2003 | Project management -Project planning and management | Comparing the outcomes of historical case studies. Risk analysis | A means of uncovering factors influencing project failure | Appraisal optimism. Strategic mis-representation. Optimism bias | Historical project case studies are important |
| Colozza | 2003 | Engineering -Aerospace engineering | Not defined | Establishing capabilities | Not defined | Technical power factor design capacity |
| CIOB (Chartered Institute of Building code of practice) | 2002 | Project management | Specifying project objectives, outlining options and selecting most suitable option through value and risk assessment | Interlinking feasibility with strategy (is not always clear) | Not defined | Historical case study is important |
| Kolmanovsky and Silverguina | 2002 | Engineering -Mechanical Engineering | Not defined | Generate operating policies | Not defined | Background info for feasibility assessments |
| Pfleeger | 2000 | Information -Science article | 'Risk Management' | Using precedents to identify risk factors | Not defined | Historical precedents 1.Strengths and weaknesses 2.Costs and benefits |
| Balba et al | 1998 | Medicine -Micro biology | Not defined | Determining feasibility before full-scale project | Not defined | Case description of projects |
| Capko and Anwar | 1996 | Medicine -Medicine and business guide | Detailed analysis of a company conducted to predict a future course of action | Will a plan work? Is it worth doing economically? | Not defined | Not stated |
| Bryson and Bromily | 1993 | Business management -Strategic planning guide | Resolving technical uncertainty | Establish contextual variables influencing planning | Not defined | Not stated |
| Posten | 1985 | Business management -Project planning guide | Requirements analysis and specification | Evaluate the project's potential for success | Not defined | Not stated |

## 3.1 Theories affecting recognition of risk of failure

Themes contributed to theory that assisted answering the research questions (Rubin & Rubin 2005 p.245). Theory here is the theory of risk assessment used as a means to avoid failed projects. When focussing on recognising risk of failure of projects, two theories or control frameworks that should be explained to provide context for managing risks for feasibility assessments are 'Theory of risk management planning and risk identification of projects' and 'Logical pathway for guidance in delivery processes for project management methodology'. The theories are expressed visually by the use of figures.

Theory of project risk management planning as portrayed in project management guides was explored. Risk identification of projects was found to be appropriate as theory for investigating feasibility assessment, because of the apparent similarity of identifying risk with determining feasibility. Risk management planning and risk identification of projects support the process of feasibility assessment. Further, a logic pathway supports the delivery processes for project managers to the decision to proceed with the project.

In the context of project management in the environment of complex projects, and at the stage at which there is a need to assess the viability of a project, commentators and guides insist that a project should be judged as feasible. The intent of the research here was to find theory that assists feasibility assessment. Theory framing the feasibility assessment process is explored. The question asked is what theoretical assumptions and framework of theory apply to feasibility assessment.

The importance of identifying risk as a contributor to assessing feasibility has been emphasized in project management literature because of the similarity of identifying risk with determining feasibility, so guides to project risk management were reviewed to find the theory of how risk management of projects should be planned, and to establish the framework of theory that supports risk identification in projects. The guides indicated the approach for project managers to take when using risk identification as a way of establishing the feasibility of a project. The guides provided a figure which indicated the documents, resources and processes relevant to risk identification in projects, including the inputs, tools and techniques, and outputs to the process. Risk management planning therefore provided a lens through which feasibility assessment was viewed. Guides also provided a logic pathway for guidance in delivery processes

for project management. The pathway mapped aspects of the delivery processes and ended in the decision to proceed with the project.

Theory of risk management planning and risk identification of projects used in this study is adapted from the PMBOK Guide, explained by Nokes and Kelly (2007) p.274 and 277 as 'identifying and evaluating risks, planning responses, and ensuring that plans translate into action if the risks crystalize'. The process focusses on how to manage risks, not what the risks are. Identifying and managing particular risks comes in subsequent processes. Nokes and Kelly (2007) p.278 suggest that risk planning should involve interviewing subject-matter experts to identify project risks, after which quantitative risk analysis can be started.

Theory, shown here as the third part of the study, is the theory of risk assessment used as a means to avoid failed projects. The first figure displayed is intended to provide context for managing risks for feasibility assessments. The second figure displayed is intended to explain and provide a logical pathway for guidance in delivery processes for project management methodology.

*The figure displayed in this study is explained to provide context for managing risks for feasibility assessments.* ***Figure 3.1 Theory of risk management planning and risk identification of projects*** *combines Nokes and Kelly (2007)'s Fig 11.1 on their p.274, with their Fig 11.2 on p.277. Nokes and Kelly (2007) in turn adapted their figures from the PMBOK Guide (2004).*

*Figure 3.1 shows the risk management planning and risk analysis processes combined. The figure starts with the inputs required to plan risk, which comprise the project management plan, the project scope statement, enterprise environmental factors, and organizational process assets, etc. The purpose is showing how risks will be identified, analysed, monitored, controlled and reviewed. Inputs are then processed using 'tools and techniques'. Tools and techniques include planning meetings and risk analysis. After processing, the outputs of the process result in the risk management plan, which includes the risk register.*

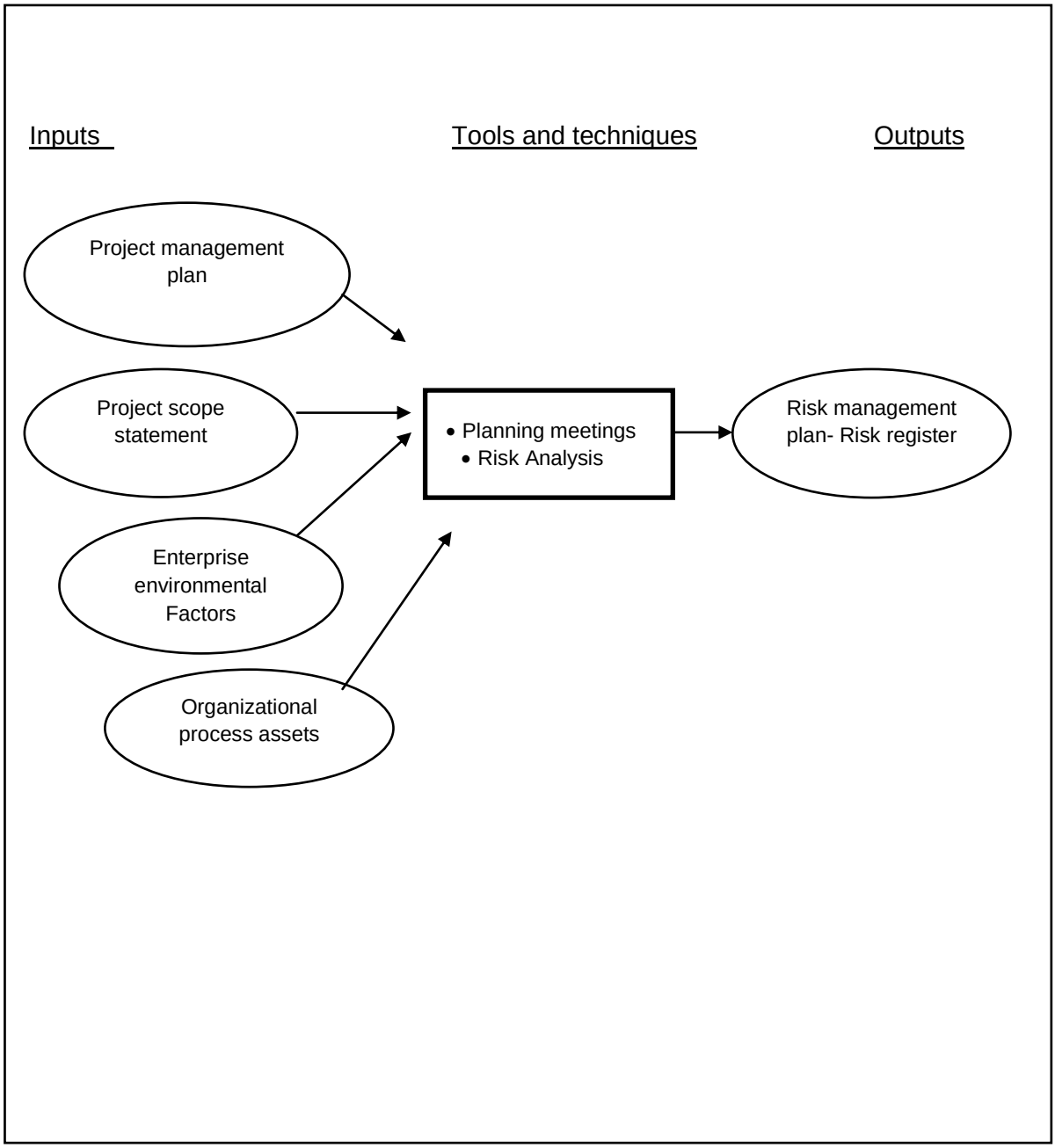



**Figure 3.1 Theory of risk management planning and risk identification of projects**

The second theory discussed is the **Logical pathway for guidance in delivery processes for project management methodology for the IDMS.**

The figure displayed is intended to explain and provide a logical pathway for guidance in delivery processes for project management methodology, as indicated in the Infrastructure Delivery Management System (IDMS), which is in turn explained in the CIDB Infrastructure Toolkit (2012) p.5. The Toolkit undertakes to provide 'how to' guidelines for delivery processes and uses a body of knowledge to assist strategy, construction procurement and performance management.

The IDMS is a model commissioned by SA's National Treasury as 'a model for best practice delivery of infrastructure management' (Toolkit 2012 p1). The IDMS is described as 'a tool for users to navigate through the delivery management processes via "roadmaps"' (Toolkit 2012 p3). CIDB Practice Note # 22b (2011) p7 explains gates or 'gateways' as requirements that different decision makers accept the outputs of each stage before proceeding with the next.

*The figure shown is adapted from the model represented in the CIDB Infrastructure Delivery Management Toolkit (2012)'s Figure 2: 'Delivery Processes', which is displayed on the Toolkit's page 6. An extract from the part of the model which shows Delivery Processes for Project Management (Layer Two), which involves three levels of the IDMS, has been simplified and is displayed in this study as* ***Figure 3.2 Logical pathway for guidance in delivery processes for project management methodology for the IDMS.***

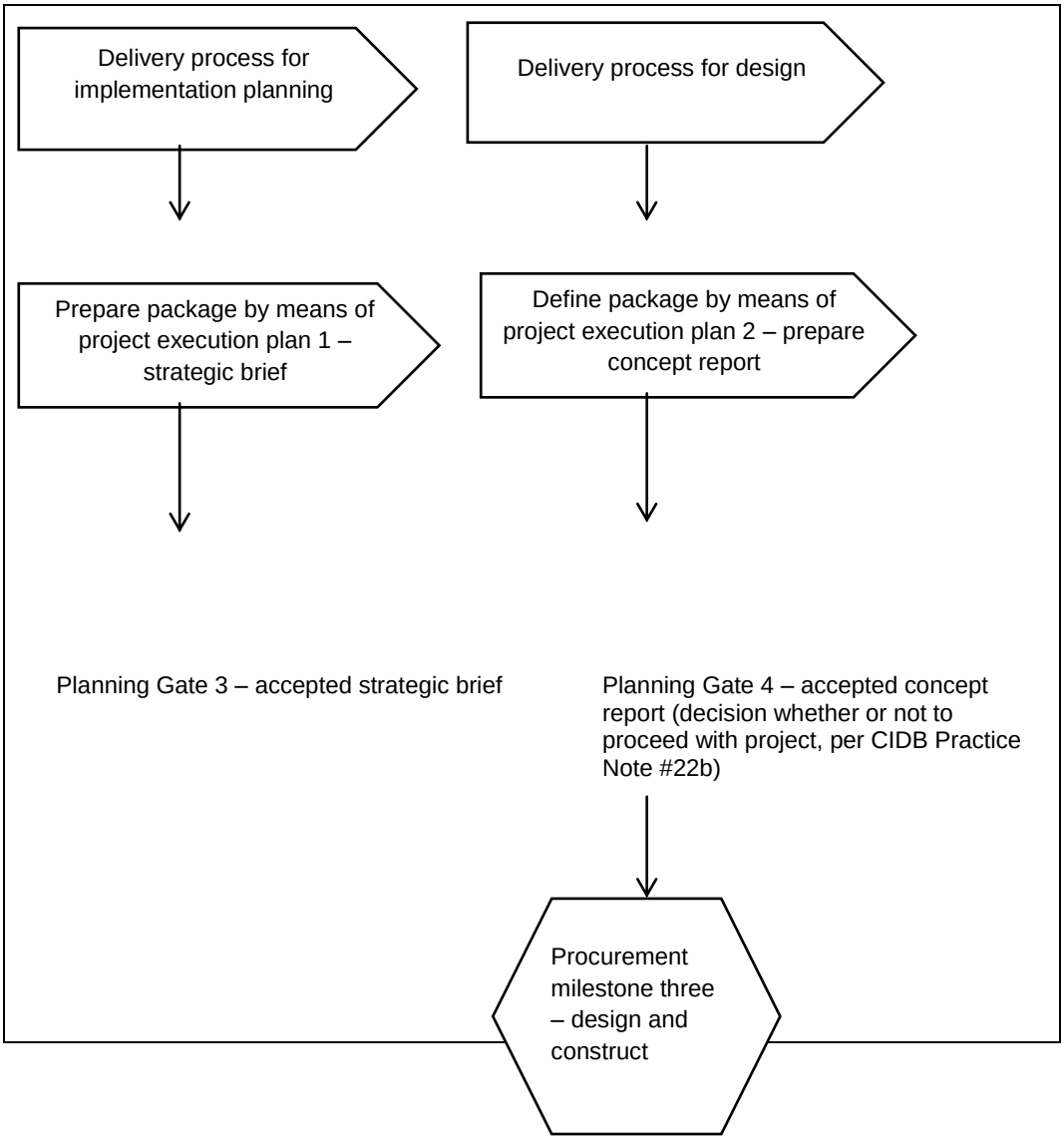



**Figure 3.2 Logical pathway for guidance in delivery processes for project management methodology for the IDMS**

# Chapter 4: Research approach

This chapter outlines the research problem, research strategy, research design and the methodology employed to explore the problem of finding out how the feasibility assessment process for infrastructure development project concepts are carried out in practice and the extent to which such feasibility assessments recognise risk of failure.

## 4.1 Research problem

The research problem is that little explanation exists in project management guides, practice notes and literature on how feasibility assessment is done in practice, nor the extent to which risk factors are recognised by feasibility assessors. Guides to the feasibility assessment process, while prescribing how feasibility assessments should be done in theory, do not clearly indicate how feasibility assessment is done in practice, nor the extent to which risk factors affecting failure are recognised by assessors. Guides provide a theory of risk management planning and a logical pathway for guidance in delivery processes to indicate how to establish risks to a project, but not how the process is done in practice.

## 4.2 Research strategy

The research aim is to explore how the feasibility assessment processes for large infrastructure development projects are done in practice in South Africa. The first research objective is a qualitative comparison of the process of feasibility assessment used in practice for two projects. The qualitative question asks: ‘how is feasibility assessment for large infrastructure development projects done in practice in South Africa?’ The second research objective, arising from the first objective, is quantitative analysis of the extent to which specific risk factors affecting project failure are recognised during the feasibility assessment process in each of the observed projects. The quantitative question asks: ‘to what extent are specific risk factors recognised by feasibility assessors?’

An evaluation of available research strategies including action research, grounded theory, ethnographic research and case studies are evaluated in **Table 4.1 Evaluation of potential research strategies for how feasibility assessments are done**.

**Table 4.1 Evaluation of potential research strategies for how feasibility assessments are done**

| Research strategy | Epistemological standpoint | Sensitivity for capturing the assessment process variable, i.e. how feasibility assessments are done | Sensitivity for capturing the risk response variable, i.e. how expert assessors recognise risk |
|---|---|---|---|
| Experiment | Positivism | Experiments are often highly structured, one-off, and artificial in nature. They may not help to capture the whole feasibility assessment process | Risk is a concept influenced by human perception. Experiment may be unable to capture the humanistic elements prompting risk response, and changes in risk attitudes over time. |
| Survey | Objectivism | Surveys are often highly structured, cross-sectional, and shallow in nature. Hence, may not be suited for capturing the whole feasibility assessment process. Surveys may result in what people claim to do rather than what they may actually do. | Surveys rely on respondents' accounts and their ability to relate past events well. Risk response may vary over time. Some of the risk may be included so undetectably in assessments that even the assessor does not realize it. Hence, survey may not be appropriate. |
| Case study | Realism | Case studies can be based on a longitudinal or cross-sectional time horizon. Hence, making it suited for capturing the whole feasibility assessment process. Its flexibility allows the use of appropriate methods such as observation to explore naturally. | The potential use of various methods including observation offers a reliable means of seeing what assessors actually do and to shadow some live assessment processes in order to map risk factor recognition. |
| Action research | Subjectivism | Action research entails planned interventions and hypothetico-deductive analysis. Hence, it could be difficult to implement this kind of research in a real life feasibility assessment process. | The use of planned interventions and then monitoring the effect of that intervention to discern whether or not it has produced the expected outcome may be difficult in real life and perhaps not be best suited for capturing risk response as it naturally happens in the feasibility assessment process. |
| Grounded theory | Pragmatism | Grounded theory research has the features required to help capture the feasibility assessment process by expert assessors. However, the main concern here is not to generate theories but to provide a descriptive account of what assessors actually do. | Grounded theory is well suited for studies of human interaction, and exploratory research. Hence, it provides an appropriate and natural means to potentially capture risk response attitudes in the feasibility assessment process. |
| Ethnography | Interpretivism | With its longitudinal nature and potential application of several methods, ethnography provides a major means of capturing the feasibility assessment process used by project owners. Its main strength of ecological validity is derived from the use of participant observation. Features described in relation to an observation case study may apply here. | Ethnographic research is credited with a focus on naturalism through the use of direct observation which would provide a useful means of identifying the mechanisms and times experts take account of risk in assessments. It also provides a viable means of understanding the humanistic elements and behaviours affecting experts' risk response at the assessment stage. |

### 4.2.1 Case study with content analysis

Case study as a strategy is a way of doing social science research in which the focus on a contemporary phenomenon within a real-life context (Yin 2009). Schramm (1971) points out that 'the essence of a case study is that the study tries to illuminate a decision or set of decisions- why they were taken, how they were implemented, and with what result' (Schramm 1971, quoted in Yin 2009 p.87). Eisenhardt (1989), quoted in Perminova (2011) explains case study thus: 'In building theories from case study research, the construct has to be developed on the basis of an iterative process'. Flyvbjerg (2006) states that case study is widely used to produce canonical texts (i.e. general laws).

Case study of real cases of feasibility assessments enables data to be obtained to explore and compare the qualitative reality of how project management professionals in current practice actually use feasibility assessments to detect risk of failure of project concepts. The extent to which risks to a particular project are recognised are contained quantitatively in the document sources which support the feasibility assessment process.

Content analysis is a data collection method for studying documents and communication artefacts, such as texts of various formats. Content analysis examines patterns in communication in a replicable and systematic manner. One of the key strengths of using content analyses is its unobtrusive nature. Systematic reading or observation of texts or artefacts results in the researcher assigning labels (called codes) to indicate the presence of meaningful pieces of content. By systematically labelling the content of a set of texts, patterns of content are analysed qualitatively to analyse meanings of content within texts, or quantitatively using statistical methods.

## 4.3 Research design and methodology

The research aim is to explore qualitatively how feasibility assessments are done in practice, and quantitatively the extent to which risk factors affecting project failure are recognised by feasibility assessors. To achieve this aim, a comprehensive and intensive research method required literature review and case study research as strategy to gather data, and content analysis as a means to study that data.

The concept of the design of the study is an exploration of how feasibility assessments are done in practice and the extent to which risks to projects are recognised. The importance of identifying risk is stressed repeatedly in the analysis of the meaning,

purpose and objective of feasibility assessment. *(See Table 3.1 – Definition of the purpose and objective of feasibility assessment of projects)*

Two theoretical principles, namely first identifying risk factors and then quantifying the extent of their recognition, will be applied here to establish how the process is done in practice. *(See Figure 3.1- Theory of risk management planning and risk identification of projects, and Figure 3.2- Logical pathway for guidance in delivery processes for project management methodology for the IDMS)*

As a guide to identifying risk, Nokes and Kelly (2007) p 278 suggest that risks to a project are recognised by interviewing subject-matter experts to identify project risks qualitatively. After subject-matter experts have been interviewed and project risks recognised, quantitative risk analysis establishes the extent of particular risk factors. Exploration in this study will thus focus on how risks to projects are identified. Data to support the exploration will be obtained from relevant interview transcripts and documentary reports.

The research design to be used is accordingly multiple case studies, selection of qualitative and quantitative data collected from the case studies, followed by content analysis of the data. *(Research design and methodology used here is assisted by Mouton (2011), p.105, p.123, p.165-170)*

# Chapter 5: Data collection, results and analysis

Two cases of the feasibility assessment processes that took place for proposed transport infrastructure development projects that were assessed for feasibility in the Gauteng Province of South Africa between 1998 and 2011 were selected because they were convenient to obtain. Both projects were intended for construction in the Gauteng Province of South Africa, Gauteng being the most economically active region of South Africa. Most large infrastructure development projects in South Africa can be expected to originate in Gauteng. Criteria for selection of the cases were that each project had to be large, with a potential value exceeding R 10 billion, and to be technically complex in execution.

Data from case studies of the feasibility assessments done for the two infrastructure development projects had already been collected by the researcher. Extensive documentation from each case had been collected. Artefacts comprising documents and interviews pertaining to feasibility assessment of each proposed project were part of the collection. Artefacts comprising nine semi-structured feasibility assessment interviews and twelve feasibility report documents were selected from the overall data collection of the two case projects, on the basis that each artefact mentioned risks to the project. Data Collection Instruments were prepared for each project. The Data Collection Instruments listed the source documents, each of which contained evidence comprising statements showing risk recognition. The resulting source document artefact collection included minutes of meetings held to assess project feasibility, plus interviews with individual subject-matter experts on aspects of that particular project's feasibility. The Data Collection Instruments give the date, subject aspect and field of expertise relating to the source document of each of the expert views collected. The dates are either the date that a document was published, or the date on which an interview was conducted. The data was separated for Case Study A on the feasibility assessment of Project A (three report documents and eight feasibility assessment interviews) and those applicable to Case Study B on the feasibility assessment of Project B (nine report documents and one interview).

Data sources to answer the first qualitative research objective were extracts from subject-matter interviews and assessment reports which originated from different

experts. Data sources to answer the second quantitative objective were specifically the content of documents collected from each case study.

## 5.1 HRtLR Project - Case Study A

In Case Study A, data from documents supporting the project feasibility study assessment, including the original feasibility assessment interviews, were collected from the records of the feasibility study conducted for Project A, a large transport infrastructure development project concept which utilised a patented road-to-rail mechanism. The project was called by its promoters the 'HRtLR Project'. Feasibility assessment meetings and interviews with subject-matter experts were conducted during the feasibility study. The researcher had participated in the HRtLR Project feasibility assessment process as a project manager working with the project management firm handling the feasibility study during the period of the HRtLR Project feasibility study. As a participant, he attended meetings and conducted some of the feasibility assessment interviews. With the permission of the firm, he was able to gather and store copies of relevant interviews, diaries and documents as artefacts from the feasibility study.

*(Data Collection Instrument used for Case Study A, given in CASE STUDY A CODES AND UNDERLINING and placed in the Appendix)*

## 5.2 Gautrain Project – Case Study B

In the case of Case Study B, the feasibility assessment of Project B, also a large infrastructure development project concept called by its promoters the Gautrain Project, access to the original feasibility assessment documentation was denied to the researcher. However, a summary of the feasibility assessment reports containing the key findings relating to aspects such a social acceptability, technical feasibility and economic feasibility of the project among others was publically available in documents available on the Gautrain website (www.gautrain.co.za, accessed 19 August 2013). In addition, a book on the Gautrain project had been published which contained significant information on the feasibility assessment for the project (Jensen 2011: *'Gautrain: for people on the move*'). A single interview was conducted by the researcher in 2015 for about 80 minutes with a senior general manager who was involved with the building of the project to confirm retrospectively the content of the documents given on the website.

*(Data Collection Instrument used for Case Study B is given in CASE STUDY B CODES AND UNDERLINING and placed in the Appendix)*

## 5.3 Quantitative data analysis

Quantitative data analysis was conducted to find evidence of the extent to which risk factors affecting failure of a project are recognised by feasibility assessors during the feasibility assessment process. The content of statements in documents collected from each case study which indicated recognition of a specific risk factor by an assessor was first underlined, then labelled, counted and the extent of their occurrence analysed. Key variable is the extent to which risk factors are recognised, because the effectiveness of the assessment of the feasibility of the project risk will depend largely upon the extent to which risk factors are recognised.

Content analysis of quantitative aspects of extracts from text source documents is carried out here by coding statements in the documents that indicate recognition of risk factors by each assessor. The frequency of occurrence indicates the extent of recognition of risk factors by feasibility assessors for each project.

The detailed method used for coding of the documents for quantitative content analysis is as follows: statements in the documents which indicate recognition of risk factors are underlined and coded, with seven codes each representing a particular risk factor. The occurrence of each factor is underlined and tagged in the text with a number from 01 to 07. The codes range from '01' for 'assessment of risk in context' to '07' for 'assessment leads to decision to proceed'. Analysis comprises counting the statements captured in each document, arranging the counts on a table, and totalling the occurrence of each statement which supported a particular risk factor.

Extent to which feasibility assessors recognise the risk of failure in the project concept of Project A is given in **Table 5.2 Extent to which feasibility assessors recognise the risk of failure in the concept of Project A**.

Extent to which feasibility assessors recognise the risk of failure in the project concept of Project B is given in **Table 5.3 Extent to which feasibility assessors recognise the risk of failure in the concept of Project B**.

Occurrence of statements from both Case Study A and Case Study B which recognise each of the theoretical factors of risk, ranked quantitatively in order of occurrence are given in **Table 5.4- Occurrence of statements in practice from Case Study A and Case Study B which recognise each of the theoretical factors of risk, ranked quantitatively in order of occurrence.**

**Table 5.2 Extent to which feasibility assessors recognise the risk of failure in the concept of Project A**

| | Construct : | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **Expert text source** : (11no sources) | Date | Assessment of risk in context | Initial choice of project | Risk neglect | Perceptions of risk from participant | Undue optimism | Retrospective sense of risk | Assessment leads to decision to proceed |
| Kick-off meeting minutes | 26.10.2010 | 3 | 5 | 1 | 1 | Nil | Nil | 2 |
| Motor vehicle manufacturer | 10.11.2010 | 1 | 1 | Nil | 2 | 1 | 1 | Nil |
| Transport economist | 12.11.2010 | 1 | 1 | Nil | 2 | Nil | 3 | Nil |
| Architect | 25.01.2011 | 1 | 1 | Nil | 3* | Nil | 3 | Nil |
| Mechanical engineer | 04.02.2011 | Nil | Nil | Nil | 6 | Nil | 3 | 1 |
| Civil engineer | 10.03.2011 | Nil | Nil | Nil | 4 | Nil | 3 | Nil |
| Structural engineer | 18.03.2011 | Nil | Nil | 1 | 6 | Nil | 8 | 1 |
| Urban planner | 25.01.2011<br>26.02.2011 | Nil | 1 | Nil | 3 | Nil | 3 | 1 |
| Project manager | 28.03.2011 | Nil | Nil | Nil | 3 | Nil | 3 | 1 |
| Feasibility report meeting | 31.03.2011 | Nil | 1 | Nil | 4 | Nil | Nil | Nil |
| Feasibility finalization meeting | 31.03.2011 | 2 | Nil | Nil | Nil | Nil | Nil | 1 |
| | Total (88) | 8 | 10 | 2 | 33 | 1 | 27 | 7 |

- *Two statements of the architect are mutually contradictory but have been counted as a single perception

**'Nil' indicates that no perception was made.**

**Table 5.3 Extent to which feasibility assessors recognise the risk of failure in the concept of Project B**

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **Text source : (10no sources)** | Date | Assessment of risk in context | Initial choice of project | Risk neglect | Perceptions of risk from participant | Undue optimism | Retrospective sense of risk | Assessment leads to decision to proceed |
| On the overview after completion – Jensen | October 2011 | 7 | - | - | 3 | 1 | 1 | - |
| On the assessment process – Gautrain Management | 19/08/2013 | 2 | 1 | - | 5 | - | 3 | 3 |
| On what constitutes feasibility – Gautrain Management | 19/08/2013 | 2 | - | - | 1 | - | - | 2 |
| On economic feasibility – Gautrain Management | 19/08/2013 | - | - | 2 | 3 | - | 1 | - |
| On feasibility requirements from Government's perspective | 19/08/2013 | - | - | - | 5 | - | - | 2 |
| On feasibility requirements of the private sector | 19/08/2013 | - | - | - | 3 | - | - | 3 |
| On feasibility requirements of National Treasury | 19/08/2013 | 2 | - | - | 1 | - | - | 2 |
| On optimising the system design – Gautrain Management | 19/08/2013 | - | - | - | 2 | - | - | - |
| On programme milestones – Jensen | October 2011 | 1 | 1 | - | 3 | - | - | 1 |
| Interview with Executive Manager, Gautrain | 13/05/2015 | 1 | - | - | 6 | - | - | - |
| | Total (75): | 15 | 2 | 2 | 32 | 1 | 5 | 18 |

**Table 5.4**

**Occurrence of statements in practice from Case Study A and Case Study B which recognise each of the theoretical factors of risk, ranked quantitatively in order of occurrence:**

During the initial period of assessment for Project A

| Rank | Statement | Occurrence of statements in the initial period |
|---|---|---|
| | | |
| 1. | Perceptions from participant | 33 |
| 2. | Retrospective sense of risk | 27 |
| 3. | Initial choice of project | 10 |
| 4. | Risk in context | 8 |
| 5. | Decision to proceed | 7 |
| 6. | Risk neglect | 2 |
| 7. | Undue optimism | 1 |
| | | |
| Total of statements for Project A | | 88 |

During the initial period of assessment for Project B

| Rank | Statement | Occurrence of statements in the initial period |
|---|---|---|
| | | |
| 1. | Perceptions from participant | 32 |
| 2. | Decision to proceed | 18 |
| 3. | Risk in context | 15 |
| 4. | Retrospective sense of risk | 5 |
| 5. | Initial choice of project | 2 |
| 6. | Risk neglect | 2 |
| 7. | Undue optimism | 1 |
| | | |
| Total of statements for Project B | | 75 |

Retrospectively for both Projects A and B after the initial period of assessment

| Rank | Statement | Occurrence of statements after the initial period |
|---|---|---|
| | | |
| 1. | Perceptions from participant | 42 |
| 2. | Retrospective sense of risk | 14 |
| 3. | Decision to proceed | 14 |
| 4. | Initial choice of project | 8 |
| 5. | Undue optimism | 8 |
| 6. | Risk neglect | 6 |
| 7. | Risk in context | 4 |
| | | |
| Total of statements after the period of assessment | | 96 |

## 5.4 Qualitative data analysis

Data originating from the case studies which revealed details of the feasibility assessment process used for each project was selected and analysed to compare qualitative similarities and differences in the process. Qualitative comparison of the process is followed by quantitative analysis of the extent to which risk factors affecting project failure are recognised during feasibility assessment.

Data to answer the first qualitative research objective was extracted from subject-matter interviews and assessment reports which originated from experts when they were involved with the feasibility assessment process. Data to answer the first qualitative research objective was analysed by identifying and tabulating extracts from subject-matter interviews and assessment reports which originated from experts when they were involved with the feasibility assessment process.

The full narrative of Case Study A, which is recounted in the main body of the study, indicates that the approach to determining feasibility of the project is discussed by the assessing project managers when kicking-off the study. Subject-matter experts are then interviewed, mostly to identify risks to the project. Results of the discussions and interviews are recorded in document transcripts. Extracts as quotes from discussion and interview documents of Case Study A and Case Study B are compared qualitatively in **Table 5.6 - Comparison of the process of feasibility assessment in practice**.

**Table 5.6 - Comparison of the process of feasibility assessment in practice**

| Aspect | Case Study A | Case Study B |
|---|---|---|
| How the brief was obtained | Owner selected an outside consulting firm and delivered the specs to them | A pre-feasibility study was conducted by unknown persons. A project leader and team of consultants was appointed from within by the owner to carry out a conceptualization report |
| What constitutes feasibility | Analysing, reviewing, understanding, resolving and evaluating the practicality, gaps, risks, constraints, viability, strengths and weaknesses and potential | General factors that should be present to make the project possible and those criteria for Government to accept the project as feasible |
| What expert skills were utilized to determine feasibility | Expert skills in Vehicle manufacture<br>Expert skills in Transport economics<br>Expert skills in Design and architecture<br>Expert skills in Mechanical engineering<br>Expert skills in Structural engineering<br>Expert skills in Urban planning<br>Expert skills in Project management | Constitutional and social responsibilities of provincial government<br>Cost-benefit studies<br>Expert skills in traffic survey<br>Expert skills in environmental impact<br>Expert skills in social development |
| What protocol was used to obtain the view of the assessors | Does the assessor understand the project?<br>Have flaws in the project concept been detected?<br>Would the flaws affect project planning?<br>Does the perception of flaws reduce uncertainty about the outcome of the project?<br>Is the existence of flaws in the concept enough to stop the project?<br>How should the design be changed to accommodate flaws? | Is the project possible?<br>Is it affordable?<br>Is it needed?<br>Will it be acceptable?<br>Is it beneficial?<br>Will it be worthwhile, considering the input needed to implement it?<br>Is this project appropriate for funding from Government investment funds?<br>What is the best way to implement the project? |
| What the feasibility study showed | Views of the project assessors<br>Flaws in the project concept<br>Predictions on the project outcome if implemented | Economic feasibility<br>Government's perspective<br>Private sector perspective<br>National Treasury perspective<br>Optimization of the system design |
| Additional investigations that were done | None have been done up to this time | Feasibility study was revised every time there were fundamental changes to the project. The views that were revised were<br>-Value for money<br>-A public sector comparator<br>-Affordability |

## 5.5 Narrative of the feasibility assessment processes used in the projects

### 5.5.1 HRtLR Project- the feasibility assessment process of Project A

The first case chosen is the Hybrid Road to Light Rail project (HRtLR Project**)** located in Gauteng (Case Study A). The feasibility assessment took place over a period of two years (2010-2011). The research entailed on initial phase of gaining access to the documentation and professionals involved in carrying out the feasibility assessment for the project. Three professionals led a larger team of eight people who conducted the feasibility assessment of the project were interviewed for 60-90 minutes between 2010 and 2011.

Case Study A is a case of the feasibility assessment process used within a feasibility study of a large, complex, transport infrastructure project concept. Feasibility assessment of Project A began with the receipt by a consulting project management firm of a brief to carry out the initial feasibility study, based on a conceptual design provided by a client, who was also the project's owner. The firm followed through with interviews conducted by firm members with outside experts, to obtain the outside experts' opinion of the feasibility of the project. The process ended with a meeting to finalize the feasibility report.

In Case Study A, data from documents supporting the project feasibility study assessment, including the original feasibility assessment interviews, were collected from the records of the feasibility study conducted for Project A, a large infrastructure development project concept. Feasibility assessment meetings and interviews with feasibility experts were conducted during the feasibility study. The researcher had participated in Project A feasibility assessment process as a project manager working with the project management firm during the period of the Project A feasibility study. As a participant, he attended meetings and conducted some of the feasibility assessment interviews. With the permission of the firm, he was able to gather and store copies of relevant interviews, diaries and documents. Documents were made available to the researcher by the project owner.

*(Transcripts of the feasibility assessment interviews obtained from Project A together with copies of relevant documents and other interviews have been placed in the Appendix to this study)*

The consulting project management firm briefed by the project owner to carry out the feasibility study for Project A was located in Gauteng province, South Africa. The firm was associated with a specialized civil engineering organization established in Johannesburg in 1934. The directors of the firm were all experienced construction and project managers, who had collectively managed a large number of diverse and complicated construction projects throughout Africa and the Middle East, in the fields of mining, dams, roads and pipelines.

Project A was chosen as a project in a case study of the feasibility assessment process because it involved the feasibility assessment of a large, complex infrastructure project with unique features that suggested that only experts with subject-matter knowledge and experience could intuitively assess feasibility, in the absence of having precedent information. The actual physical location of the project had not been decided at the time of the feasibility study, because by the nature of the project it could have been located in any large city in the world which had a traffic congestion problem. The feasibility study was carried out in Gauteng.

At the request of the project owner, a consulting project management firm conducted an initial feasibility study of Project A, a proposed novel, complex transport infrastructure project concept named the Hybrid Road to Light Rail (HRTLR) project. The objective of the HRTLR project was to provide a means for road vehicles to convert to rail vehicles, in order to alleviate road congestion. The initial feasibility study was conducted between October 2010 and March 2011 in Gauteng, South Africa.

The feasibility assessment process of Project A commenced on 26 October 2010 with the receipt by the project management firm of the request from a client to carry out a feasibility assessment of a novel transport infrastructure project concept. Aspects of the concept had been patented. The client held rights to the patent. The request from the client to carry out a feasibility assessment was accompanied by a sketch drawing, a written description of the project, and an outline specification of the project. These documents were delivered to the senior project manager's office at the firm by a representative of the client.

Immediately after receiving the documents, the senior project manager called a meeting of the firm's project managers to introduce the project to them and to kick-off the feasibility assessment process. Four project managers attended the meeting, at

which it was decided that aspects of the proposed project to be investigated were the technical, financial, environmental and public acceptability aspects. The project manager specializing in project costing stated that the technical and public acceptability aspects should be finalized and more information obtained before financial costing could be done.

The definition of what constitutes feasibility for Project A was articulated by the senior project manager at the kick-off meeting for the feasibility study as follows: 'We have to analyse, review, understand, resolve and evaluate the practicality, gaps, risks, constraints, viability, strengths and weaknesses, and potential, of this project.'

The method used by the firm to establish the feasibility of the project was in effect a field survey. One of the project managers undertook to recruit experts with specialized skills, who were willing to be interviewed, to help with the assessment. Other project managers contributed what they thought the specialised skills should be, based on what the project managers could understand of the requirements of the concept design. Specialized publications that could be of assistance in assessing the project were also to be obtained, to be reviewed to assist in assessing feasibility.

The protocol to be applied by the project managers to assist the expert assessor interviews was agreed as follows: -

- Does the assessor understand the project?
- Have flaws in the project concept been detected?
- Would the flaws affect project planning?
- Does the perception of flaws reduce uncertainty about the outcome of the project?
- Is the existence of flaws in the concept enough to stop the project?
- How should the design be changed to accommodate flaws?

Specialized skills that the project managers decided should be examined for views on the feasibility of Project A were expertise in the fields of hybrid vehicle manufacture, transport economics, urban design and architecture, mechanical engineering, structural engineering, urban planning, and project management. A diary showing dates and times of the activities relating to feasibility assessment of the project was kept by one of the firm's project managers.

Over the next eight weeks, approaches were made to seventeen subject-matter experts to participate in undertaking feasibility assessment of the project. Seven of these experts were interviewed by project managers of the firm. Consent to be

interviewed was obtained and a date and time agreed. The same routine was followed with each expert.

Thereafter, a sketch drawing, description and outline specification was delivered to each expert at their place of work, to enable them to get an idea of what they were going to be interviewed about. Two or three days after the drawing and specification had been delivered, each expert was interviewed as to their views on the feasibility of the project by a project manager. The protocol used in the semi-structured interviews was the protocol that had been devised by the project managers at their kick-off meeting. The records of the interviews with the participating experts contained each expert's own views on the feasibility of the project. Internal perceptions of each expert included evidence of risk factors affecting the project. Perceptions of the experts were integrated into the output of the feasibility assessment study for Project A.

After the project managers were satisfied that sufficient opinion and views on the technical and public acceptability of the project had been collected, the interviews and meetings were analysed to detect factors of risk relating to feasibility of the project. After a first appraisal of the collected information, understandings of the assessors appeared to be diverse and complex, particularly if the feasibility assessors had used intuitive and undefinable understandings, based on their own experiences, to reveal risks to the proposed project.

Personal constructs as presented by Kelly (1955) in 'The Psychology of Personal Constructs' was the method used by the project managers to recognise what expert assessors understood and what they predicted would happen in the future to the project under review. A variant of Kelly's Repertory Grid Technique was used to array the constructs on a matrix table to allow the project managers to look for patterns across a broad set of views obtained from the expert assessors. Advice on design improvements of the concept and planning considerations were also extracted from the views of the assessors.

The firm's project managers gathered on 31 March 2011 at the same meeting venue as they had previously, in order to finalize initial assessment of the feasibility of constructing the project. The qualifications of the expert assessors who had been interviewed as to the feasibility of the project were reviewed and placed on record in the feasibility report to the client. The views of the expert assessors which had been extracted from the matrix table were presented as findings in the feasibility report. The findings of the assessors were broadly categorized into what the assessors themselves

had expressed as their views, predominantly statements of their perceptions of risk, followed by a retrospective sense of risk, the existence of technical flaws and public acceptability in the project concept, and predictions about how the project might turn out if implemented.

No financial estimate was done at the feasibility assessment stage for Project A. The feasibility report on the project was completed in April 2011. It is not clear from the feasibility report by the project management firm that the report actually concluded that the project was feasible. There was no recommendation in the report to the client as whether or not to proceed with the project.

Interviews of the professionals and team who conducted the feasibility assessment for the project were transcribed and analysed using content analysis. Documents relating to the feasibility assessment for the project, which included the feasibility assessment report and minutes of three meetings which took place during the period of the assessment, were also collected and analysed. The key question was how the professionals went about conducting the feasibility assessment for the project i.e. what they did they do and how did they recognise risk factors.Views of the different assessors formed the views expressed in the feasibility report for Project A.

The research aim in this study is to investigate how feasibility assessments of project concepts are actually carried out in practice, and to ascertain the extent to which expert feasibility assessors recognise risk of failure in project concepts. Records of the feasibility assessment process from Project A comprise text sources. The content of the text sources from the Project A records is analysed to find statements by participants recognizing risk factors. Recognition of risk factors is assumed to indicate risk of failure in the minds of the participants. Statements that recognised risk factors were looked for in the content of those text sources that were used for the feasibility assessment process. Text sources comprised feasibility assessment interviews and minute documents originating from Project A. Variables analysed are the frequency at which recognition of risk factors occurred.

Feasibility assessment documents originating from Case Study A were coded by marking each text where risk factors were recognised by the expert. The factors marked are: assessment of risk in context, initial choice of project, risk neglect,

perceptions of risk, undue optimism, retrospective sense of risk, and assessment leading to the decision to proceed. Recognitions of the factors are then counted. The extent to which risk was recognised by assessors is indicated by the frequency at which statements recognising risk factors occur in the text sources for each feasibility assessment.

### 5.5.2 Gautrain Project- the feasibility assessment process of Project B

The second case chosen is the Gautrain project which is also located in Gauteng (Case Study B). The case study took place over three years (1998-2000). An outline of Project B, the Gautrain Rapid Rail Link - a project for which the feasibility study was undertaken by the project owner- follows. The outline is condensed from a statement made by the then South African Minister of Transport, Mr Sbu Ndebele, introducing the Gautrain Project. The outline is contained in an insert on page vii of Jensen (2011). Italics have been added for emphasis:

> 'In February 2000… the Gauteng Provincial Government announced the Gautrain Rapid Rail Link … as [a] Spatial Development Initiative project embarked on… to stimulate long-term economic growth and create jobs in the Province…the wider goal was to address the transport needs between two major cities and their international airport… It was decided that the project should be developed as a Public Private Partnership (PPP) project and as such it was necessary to do a very comprehensive *feasibility study*. After the feasibility of the project was proven and a procurement process completed, Cabinet in December 2005 undertook to contribute 50 % of the government's portion of the construction cost of the project and required that the Gautrain should be fully integrated into the broader public transport network of Gauteng… Using the best technology available in the world today, Gautrain offers passengers a public transport service that is safe, reliable, predictable and affordable.'

In the case of Case Study B, the feasibility assessment for Project B, access to the feasibility assessment documentation was denied to the researcher. However, a summary of the feasibility assessment report containing the key findings relating to aspects such as social acceptability, technical feasibility and economic feasibility of the

project among others was publically available on the Gautrain website. In addition, a book on the Gautrain project had been published which contained significant information on the feasibility assessment for the project. In addition, one interview was conducted in 2015 for about 80 minutes with a senior general manager who was involved with the building of the project, to confirm the content of the website.

Because It was not possible for this researcher to obtain data for Case Study B directly from the feasibility assessments of Project B, access to confidential information in the project owner's offices was denied to the researcher by the owner's managers. The outcome of the internal feasibility assessment processes carried out by the owner using anonymous assessors, available in the public domain on the Gautrain website, gives views on the feasibility of the project expressed in these public documents. The narrative of the feasibility assessment process is also indicated. Accordingly, documents used to obtain text data for this study were the developer's own sponsored book about the project authored by Jensen (2011): 'Gautrain: for people on the move', and the Gautrain General Feasibility Report (2013).

Although the original input data was not made available to the researcher, a telephone interview with a senior executive manager of Project B conducted by the researcher on 13 May 2015 confirmed that the questions asked of expert assessors during the Project B feasibility assessment process matched those indicated in the public record of the Project B feasibility assessment.

The project management team used by the owner to assess the Gautrain Project were employed by the owner of the project directly, as a government organization. The government organization had not previously carried out a similar project, states Jensen (2011). Detailed information on the experience make-up of the team was not given in the publically-released documents. Although specialized outside consultants were used by the team to assess certain aspects of the project, their names were not specifically linked to specific reports in the feasibility assessment.

The process of feasibility assessment for Project B began in 1998 at the start with a pre-feasibility study. The feasibility assessment process used by the project team is described in Jensen (2011):

‘The feasibility assessment process for the project had commenced in 1998 with a pre-feasibility study which was completed in 1999. In February 2000, the project owner, which was the Provincial Government, announced the project to the public. A project leader was appointed, who was initially also head of the province’s Public Transport, Roads and Works department. In April 2000 a small team of technical consultants were appointed to carry out a conceptualization report. A decision was taken to make the project a Public Private Partnership (PPP), which made the PPP unit of National Treasury an important part of the project. *[What the initial information was that was used to carry out the conceptualization report is not clear from the documents examined- RGS]*

A comprehensive feasibility study was done, which was revised every time there were fundamental changes to the project. The studies looked at value for money, a public sector comparator, and affordability. An investigation into constitutional and social responsibilities of provincial government and the required finances was carried out. A number of benefit-cost studies were done. Specialized skills that were brought in were experts in local and international traffic survey, environmental impact and social development.’

The purpose of feasibility assessment as expressed by the Gautrain project team was indicated in the Gautrain General Feasibility Report 8/19/13 INTRODUCTION, which states:

‘The following questions are typically asked when considering whether or not a project is feasible:

- Is the project possible?
- Is it affordable?
- Is it needed?
- Will it be acceptable?
- Is it beneficial?
- Will it be worthwhile, considering the input needed to implement it?
- Is this project appropriate for funding from Government investment funds?
- What is the best way to implement the project?’

The above questions have been taken as the protocol used by the Gautrain project team to interrogate the perspectives of various stakeholders and role-players to avoid implementing a project that would prove to be not feasible.

What the Gautrain project team considered to be the purpose of feasibility assessment was given in the Gautrain General Feasibility Report 8/19/13 3.2 under the heading 'WHAT CONSTITUTES FEASIBILITY': 'Feasibility can be considered firstly as the general factors that should be present to make the project possible (in terms of the broad description of feasibility) and secondly as those criteria that have to be met for Government to accept the project as feasible'.

On 13 May 2015, a probing retrospective personal interview with the executive manager representing the owner of the Gautrain project (Project B) was conducted by this researcher. The interview confirmed what the project team had indicated in the General Feasibility Report to be the purpose and objective of feasibility assessment for Project B.

The feasibility report on the proposed project was completed in July 2000, and the decision was then taken by the owner to proceed with the project. Project B was approved by Government in 2006 at R 25 billion (source: www.gautrain.co.za)

Project B was chosen because it was a large, novel, complex, land transport infrastructure project. Although the project was located in Gauteng, the physical location of the project is not relevant to a study on the feasibility assessment process, because by the technical nature of the project it could have been located between large cities anywhere in the world having a traffic congestion problem. Findings resulting from a study on the feasibility assessment process could thus be generalizable to other large, novel, complex, land transport infrastructure projects having the objective of reducing traffic congestion.

Records of the feasibility assessment process from Project B comprise text sources. The content of the text sources from the Project B records is analysed qualitatively to find statements by participants indicating how feasibility assessments are carried out, and quantitatively to find the extent that risk factors are recognised.

Themes that were investigated in the literature review of my study illustrated context, depth, project stage, diversity of views, theoretical approach, guidance, importance of risk identification, and the bounded rationality of people who undertake feasibility assessments. Risk factors influencing the successful feasibility of the project concept were derived from the themes. The risk factors derived were: assessment of risk in context, initial choice of project, risk neglect, perceptions of risk, undue optimism, retrospective sense of risk, and assessment leading to the decision to proceed.

Factors indicate how people interpret what they encounter. Factors are taken here as influences that contribute to a result. The influence contributing to a result is recognition of risk. Recognition of the risk factors is therefore assumed to show how risk of failure is recognised by assessors.

For Case Study B, the content of the text records of the anonymous expert views contained in the project reports (Jensen 2011 and Gautrain General Feasibility Report 8/19/13) are examined. Each record contains an expert's views on the feasibility of the project, including statements showing the recognition of risk factors. Statements are examined using content analysis to determine the extent risk is recognised.

In the Gautrain General Feasibility Report (2013), the project team indicated views relevant to assessing the feasibility of their project as: the overview after completion, the assessment process, what constitutes feasibility, economic feasibility, feasibility requirements from Government's perspective, feasibility requirements from the perspective of the private sector, feasibility requirements of the PPP-unit of National Treasury, and optimisation of the system design. (*These views correspond to the 'views examined' in Case Study A- RGS)*

Views of the different assessors formed the views expressed in the feasibility report for the Gautrain project. The research aim in this study is to investigate qualitatively how feasibility assessments of project concepts are actually carried out in practice, and to ascertain quantitatively the extent to which expert feasibility assessors recognise risk of failure in project concepts.

Records of the feasibility assessment process from Project B comprise text sources. Text sources for Project B are drawn from the Gautrain General Feasibility Report 8/19/13 (2013). Additional text sources were drawn from Jensen (2011). Text sources collected comprise feasibility assessment summaries originating from the public records of Project B. The Gautrain General Feasibility Report contains the summarized views of experts on aspects of the feasibility of the project. Views were expressed as statements. There is little indication of the identities of the experts whose views were used in the general feasibility report.

The content of the text sources from the Project B records is analysed to find statements by participants recognizing risk factors. Recognition of risk factors is assumed to show recognition of risk of failure in the minds of the participants. Statements that recognised risk factors were looked for in the content of those text sources that were used for the feasibility assessment process. Variables analysed are the frequency at which recognition of risk factors occurred.

Feasibility assessment documents originating from Case Study B were coded by marking each text where risk factors were recognised. The factors marked are: assessment of risk in context, initial choice of project, risk neglect, perceptions of risk, undue optimism, retrospective sense of risk, and assessment leading to the decision to proceed. Statements showing recognition of each factor were then counted. The extent to which risk was recognised by assessors was indicated by the frequency at which statements recognising risk factors occur in the text sources for each feasibility assessment.

The count of statements made by assessors recognising risk factors is displayed on a quantitative data matrix table. The count shows the extent to which risk factors are recognised in the feasibility assessment of Project B during the period of the assessment. Extent of the statements of recognition of risk factors for Case Study B is shown in **Table 5.3**.

## 5.6 Results of analysis for the extent to which risk factors are recognised in both Case Study A and Case Study B

Data from Case Study A and Case Study B was observed using quantitative content analysis of text source documents obtained from each case study project. Text source documents comprise feasibility assessment interviews, minute documents and executive reports originating from each project. Statements that recognised risk factors influencing the successful feasibility of each project concept are looked for in the content of the text sources. Variables observed are the frequency at which risk factors are recognised.

How and to what extent feasibility assessors detect risk of failure in project concepts in Case Study A corresponds largely with the views collected by the project management firm to detect the risk of project failure in the concept of Project A. Specialized skills that the project managers who conducted the feasibility study decided were relevant to the feasibility of the project were in the fields of expertise of hybrid vehicle manufacture, transport economics, urban design and architecture, mechanical engineering, structural engineering, urban planning, and project management. Seven experts were interviewed by project managers of the firm to obtain their views on the feasibility of the project. Views by each expert included their own individual recognition of risk factors that would affect the project. The extent of the expressed views of the experts were displayed on a matrix table and used for the output of the feasibility assessment process for Project A. The display matrix table for Project A showing the extent to which feasibility assessors recognise risk of failure in project concepts is displayed in **Table 5.2**.

It was not possible for this researcher to conduct a live observational study of case study Project B, access to their offices being denied by the project owner. However, the outcome of the internal feasibility assessment process which was carried out by the owner, using anonymous sources, has been published in the public domain as views on the feasibility expressed by the sources. Views were analysed for recognition of risk factors. The sequence of the feasibility assessment process is indicated in these public documents. Text documents obtained were Jensen (2011) and the Gautrain General Feasibility Report (2013).

Sources of views occurring in the texts for the Case B project (these correspond to the 'views examined' in Case Study A) which were considered by the project team as being relevant to the feasibility of the project were: the overview after completion, the assessment process, what constitutes feasibility, economic feasibility, feasibility requirements from Government's perspective, feasibility requirements from the perspective of the private sector, feasibility requirements of the PPP-unit of National Treasury, and optimisation of the system design.

For analysing Case Study B, a matrix table was used by the researcher to collect the input used by the Project B management team for the Project B feasibility report. Content analysis of statements made in the published documents was carried out. Content of the matrix table represents the content of the feasibility report. Views of the various assessors formed the views expressed in the feasibility report. The data display matrix table for Project B is included here as **Table 5.3**.

Using the same method as previously, the extent of occurrence of statements which supported the factors of risk for Case Study A and Case Study B were collected from additional interviews with participants who viewed both projects retrospectively. Details may be found in the data display matrix table for retrospective views is located in the data collection file for 'Feasibility assessment of projects for risk of failure' but the table has not been included here for reasons of brevity. However a count of statements by participants viewing factors of risk to the successful feasibility of both projects A and B taken retrospectively has also been included in **Table 5.4**. The extent of occurrence of statements in documents obtained from Case Study A and Case Study B which support recognition of each of seven theoretical risk factors are displayed quantitatively in the table. The display is separated into Project A and into Project B during the initial period of assessment, and retrospectively for both projects after the initial assessment. The method by which the statements are counted, both during the period of assessment and retrospectively, was the same for each period i.e. a count of statements by participants which recognise factors of risk to the successful feasibility of the project.

Statements recognising each of the risk factors of are then ranked quantitatively in order of occurrence. Comparison of the extent to which statements from each project

recognise factors of risks to feasibility, both initially and retrospectively, is profiled in **Table 5.5**.

The results of the quantitative comparison of the extent to which feasibility assessors recognise risk of failure show the extent to be the frequency at which statements indicating recognition of certain risk factors occur in those text documents that support a particular feasibility assessment.. A coding scheme marking perception statements of risk factors in the documents was used. Extent of recognition of risk factors was confirmed quantitatively using content analysis. The extent to which risk factors are recognised was confirmed by interpreting, counting and comparing perception statements made by participating assessors that were recorded in interview documents and meeting minutes during the course of the two case studies. The study found that the predominant risk factor recognised by assessors was 'perception of risk'. Content analysis showed that this factor was predominant at both the initial stage, and also when viewing the project retrospectively. Other risk factors, such as 'initial choice of project', 'risk in context' and 'decision to proceed', played a relatively minor role in determining feasibility, when viewed both initially and retrospectively.

## 5.7 Qualitative comparison of how the process of feasibility assessment is carried out in practice in Case Study A and Case Study B

How the process of feasibility assessment is carried out in practice for both Case study A and Case Study B is compared qualitatively here. Qualitative observation of the cases enables the researcher to make a comparison of how feasibility of the project was established in Case A as compared to Case B. The purpose is to look for differences between the two cases. Comparison of the exploration into how the process of feasibility assessment of projects is carried out in both Case Study A and Case Study B are displayed in **Table 5.6**.

# Chapter 6: Discussion of results

The overall aim of the study was to examine from current practice in the South African construction industry context how feasibility assessments are conducted and to what extent feasibility assessors recognise risk of failure in large infrastructure development project concepts.

The study was organized into four parts. The first part explored the context in which feasibility assessment is carried out and derived risk factors that affect failure of projects. The second part was a review of project management literature to determine the meaning, purpose and objective of feasibility assessment, as understood by people generally. The third part discussed theories which affected recognition of risk of failure of projects. The fourth part was a case study exploration of the feasibility assessment process done in practice for two large infrastructure development projects, each of which took place in the Gauteng Province of South Africa, and which used content analysis to analyse quantitatively the extent to which risk factors affecting failure were recognized by feasibility assessors in the case study projects, then qualitative differences in the two approaches.

## 6.1 Risk factors for feasibility assessment

The first part of the study explored the context in which feasibility assessment is carried out and derived risk factors that affect failure of projects. The study commenced with a broad exploration of context by using miscellaneous sources containing the word ‘feasibility’ in their text and titles. Exploration provided an understanding about how the concept of feasibility assessment is perceived by various parties. Appreciation of themes and risk factors affecting feasibility assessment led to a derivation of theory and meaning of concepts related to feasibility assessment, as widely understood by a wide range of people. Appreciation provided an underpinning for investigation of how the feasibility assessment of projects is actually carried out in practice.

The purpose initially was to explore themes related to the feasibility assessment process, identified from a variety of views. Themes led in turn to risk factors that might

be recognised by assessors when they assess the feasibility of projects. Views on the origin and development of the discipline of project management, complexity of the environment in which projects are initiated, and the need to assess viability of projects to avoid risk of failure, were explored. Identifying risk as a contribution to determining feasibility through those risk factors that feasibility assessors might recognise was highlighted in the literature. Feasibility assessment as a means to assess viability was considered. Guidance from project risk management practice in recognising risk was sought. Decisions on how to proceed with a project after retrospective assessment of risk were considered, together with concerns underpinning decisions to proceed after completing the feasibility assessment process.

Eight themes affecting feasibility assessment were explored. Themes illustrated the context, depth, diversity of views, and the bounded rationality of people who undertake feasibility assessments. The literature was organized as a logical progression. More themes could exist, but were not encountered in this review. The eight themes explored are elaborated as follows:

1. Origin and development of the discipline of project management (indicating 'assessment of risk in context', i.e. context, as a risk factor)
2. Complexity of the environment in which projects are initiated (indicating 'initial choice of project' as a risk factor)
3. Need for the viability of projects to be assessed (indicating 'risk neglect' as a risk factor)
4. Feasibility assessment as a means of assessing viability (indicating 'undue optimism' as a risk factor)
5. Guidance on project risk management practice (no risk factor suggested itself from the theme)
6. Identifying risk as a contribution to determining feasibility (indicating 'perceptions of risk by participant' as a risk factor)
7. Decisions on how to proceed with a project after retrospective assessment of risk (indicating importance of 'retrospective sense of risk' as a risk factor)
8. Concerns about making decisions (indicating 'assessment leads to the decision to proceed' as a risk factor)

The themes considered variously the context, depth, project stage, diversity of views, theoretical approach, guidance, importance of risk identification, and the bounded rationality of the people who make feasibility assessments, and resulted in seven risk

factors that feasibility assessors might recognise when assessing the feasibility of projects.

Risk factors suggested by contextual themes in the referenced literature were: assessment of risk in context[1], initial choice of project[2], risk neglect[3], perceptions of risk from participant[4], undue optimism[5], retrospective sense of risk[6], and assessment leading to the decision to proceed[7].

*(See Table 1.1 'Risk factors for feasibility assessment suggested by contextual themes')*

## 6.2 Meaning, purpose and objective people attribute to the concept of feasibility assessment

The second part of the study was a review of project management literature to determine the meaning, purpose and objective of feasibility assessment, as generally understood by people.

A difficulty in making sense of the concept of feasibility assessment is that the meaning people attribute to the term 'feasibility assessment' is unclear. The meaning as used in various contexts, was determined here. Research was concerned with finding the meaning that different people attribute to feasibility assessment. The objective was to find some common understanding of the meaning used in a variety of broad- based sources. The method used to find common understanding of the meaning was content analysis of documentary text sources originating from a broad spread of disciplines. The content of the documentary text sources was then analysed for meanings within an interpretive paradigm.

Obtaining a clear definition of the meaning people attribute to feasibility assessment required the complexity of the subject to be taken into account. Rather than conducting a limited opinion survey through interviews, insights of meaning were drawn as excerpts taken from a wide collection of writings by different people who use the word 'feasibility', or its synonyms, when they are writing about a variety of complex and unrelated subjects. A wide-ranging, broad-based literature search was conducted first, as preparation for sourcing material suitable for content analysis. The dictionary definition of the word 'feasible' is given in the COD (2006) as 'practicable, possible, achievable, attainable, easily or conveniently done', so any of these words could be taken as synonyms for feasibility. 'Feasibility assessment' was interpreted here as the prime activity involved in carrying out a feasibility study.

The first step in gathering insights was a search of the literature for published scholarly articles which originated in diverse fields, but which contained the words 'feasibility' and 'feasibility assessment', or their synonyms, in their papers. The literature search for sources was wide. 'Google Scholar' searches of articles containing the words 'feasibility' and 'feasibility assessment' in their text and titles were undertaken. The searches revealed 1 290 000 results. A more selective search of articles contained both in 'Scopus' and in 'Google Scholar' was then undertaken, which revealed 212 articles with the phrase 'feasibility assessment' in both their titles and their text, based on their abstracts. The search was longitudinal, with dates of writing extending for 35 years ranging from 1979 to 2014, and lateral, by encompassing seven different fields of discipline.

Most of the articles involved medical procedures. Nevertheless, brief reviews of a convenient selection of three articles, each from a research field other than medicine, were added to determine if they had any relevance to detecting risk in projects through feasibility assessment. Further descriptions of feasibility assessment, technical feasibility assessment, and feasibility studies were found in planning guides and practice notes.

Meaning and purpose people attribute to the concept of feasibility assessment, and the documents and information needed for the process, was clarified. The aim here was to clarify the meaning of the concept, and find the information and documents needed for feasibility assessment. Multiple sources provided insights into the meaning. Excerpts (i.e. quotes) were taken from a wide sample of published scholarly articles and other sources from diverse fields, each of which contained the words 'feasibility' and 'feasibility assessment in their text. Meanings and purpose for the concept of feasibility assessment were found. Excerpts also showed what information and documents the same sources considered to be needed to assess the feasibility of a project.

*(See Table 3.1 – 'Definition of the meaning, purpose and objective of feasibility assessment of projects' earlier)*

### 6.4.0 Case study exploration of the feasibility assessment process

The fourth part of the study was a case study exploration of the feasibility assessment process done in practice for two large infrastructure development projects, each of which took place in the Gauteng Province of South Africa. Content analysis was used to analyse quantitatively the extent to which risk factors affecting failure were

recognized by feasibility assessors in the case study projects. Case studies were then compared qualitatively.

### 6.4.1 Quantitative comparison of the extent to which feasibility assessment recognises the risk of failure in project concepts

The quantitative extent to which risk factors affecting failure were recognised by feasibility assessors in each case study project was analysed and the projects compared. Extent to which feasibility assessment recognises the risk of failure in project concepts is indicated by the extent to which feasibility assessors recognise factors indicating risk of failure. The extent in each of the two case study project concepts given in Tables 5.2, 5.3 and 5.4 earlier is summarised in **Table 5.5 Comparison of analysis of Case A and Case B for the extent of recognition of risk.**

Table 5.5 is a bar chart which compares the extent assessors recognize risks to feasibility. Comparison of the collected data is displayed as a vertical bar chart histogram, with Case Study A in blue (“A”) and Case Study B in purple (“B”); Retrospective view is given in red for both projects (“R”). Heights of columns are taken from Table 5.4.

**Table 5.5 Comparison of analysis of Case Study A and Case Study B for the extent of recognition of risk**

| | A B R | A B R | A B R | A B R | A B R | A B R | A B R |
|---|---|---|---|---|---|---|---|
| 50 | | | | | | | |
| 40 | | | | | | | |
| 30 | | | | | | | |
| 20 | | | | | | | |
| 10 | | | | | | | |
| 0 | | | | | | | |
| | Assess-ment of risk in context | Initial choice of project | Risk neglect | Percep-tions from participant | Undue optimism | Retrospec-tive sense of risk | Assess-ment leads to decision to proceed |

### 6.4.2 Shortcomings and sources of error

Shortcomings and sources of error in the quantitative content analysis could exist. Risk factors other than those captured may occur. Coding might not capture all statements indicating recognition of risk factors from within the documents selected. Other relevant documents may exist in the entire collections of case study documents, other than those selected for coding. Some documents may contain duplications of statements made in other documents, for example, in summaries of already-existing documents.

### 6.4.3 Qualitative feasibility assessment in practice

The research objective was to find out how feasibility assessments of project concepts are actually carried out in practice. As a research strategy, cases of the actual feasibility assessment process used for two large, complex transport infrastructure development projects were studied. The case studies provided findings from the initial feasibility assessment process undertaken by firms of project management professionals for the project owner. The process was undertaken to establish the feasibility of the large infrastructure project concepts before substantial work on the projects commenced. Two different cases were chosen to give increased validity to any research findings. The period covered by the research into the two cases was 2008 to 2013.

The research aim here is to examine from current practice how feasibility assessments are carried out. Interpretation follows through a qualitative comparison of two case studies, taken from current practice, on how feasibility assessors detect risk of failure in project concepts. In each case, a feasibility study had been carried out by a project management firm to assess the feasibility of an infrastructure project concept. The feasibility assessment process had been undertaken by each firm to establish the feasibility of a project before substantial work on the project commenced. The process used by each organization was explored, using observation, interview and documentary analysis. The process used by each firm was then compared. The two case studies of the feasibility assessment process are compared qualitatively in **Table 5.6 Comparison of the process of feasibility assessment in practice.**

# Chapter 7: Conclusions

Avoiding project failure has received intense scrutiny within the discipline of project planning and management. The aim was to explore qualitative aspects of how feasibility assessment for large infrastructure development projects is done in practice in South Africa, and the extent to which risk factors affecting project failure are recognised by feasibility assessors during feasibility assessments.

## 7.1 Layout of the study

Feasibility assessment of projects for risk of failure was laid out in four parts. The first part was the introduction. The second part explored the context in which feasibility assessment is carried out and derived risk factors that affect failure of projects. The third part reviewed project management literature to determine theory, meaning, purpose and objective of feasibility assessment, as understood by people generally. The fourth part was a quantitative and qualitative case study exploration of the feasibility assessment process done in practice for two large transport infrastructure development projects, each of which took place in the Gauteng Province of South Africa, and which used content analysis to analyse the extent to which risk factors affecting failure were recognized by feasibility assessors in the case study projects.

## 7.2 Context in which feasibility assessment is carried out and risk factors that affect failure of projects.

Firstly, literature on project management and feasibility assessment was reviewed and organized into themes that provided the context in which feasibility assessment of projects are carried out. Themes led to risk factors as pointers to the extent to which feasibility assessors recognise risk of failure. Seven risk factors that were suggested by contextual themes in the referenced literature were found to be: assessment of risk in context[1], initial choice of project[2], risk neglect[3], perceptions of risk from participant[4], undue optimism[5], retrospective sense of risk[6], and assessment leading to the decision to proceed[7]. The indices number each risk factor. Risk factors were arrayed in **Table 1.1 Risk factors for feasibility assessment suggested by contextual themes.**

## 7.3 Theory, meaning, purpose and objective of feasibility assessment

Thirdly, theories which affect recognition of risk of failure of projects were discussed. Theory identified through project management guides provided lenses through which the feasibility assessment process was viewed. The theoretical framework in which feasibility assessment is located was considered to be risk identification, risk identification being part of project risk management. Theories of risk management planning and risk identification of projects were valid as theories because of the similarity of identifying risk with determining feasibility. The theory of risk management planning and risk identification of projects, and the logic pathway for guidance in delivery processes for project management, both explain the theory and meaning of the process of feasibility assessment. The theoretical framework used to frame research into the feasibility assessment process was the theory of risk identification in the risk management planning process. Theory frames the risk management planning and risk identification process of projects, and a logic pathway frames the delivery processes for project managers to the decision to proceed with the project. Although the framework shown in this study as **Figure 3.1 Theory of risk management planning and risk identification of projects,** and the logical pathway shown as **Figure 3.2 Logical pathway for guidance in delivery processes for project management methodology**, both guide the study on feasibility assessment, neither the theory nor the logic pathway indicate specifically how the meaning of the concept of feasibility assessment itself is understood or defined by the people who use the term, nor how the purpose or objective of feasibility assessment is understood by the same people. The meaning, purpose and objective of feasibility assessment were therefore kept as the generally- understood meanings derived in this study.

Generally-understood meanings for the purpose and objective of feasibility assessment were synthesized from excerpts taken from a variety of text sources. People chosen as feasibility assessors each attribute their own meaning to the concept of feasibility assessment. Because projects are complex entities, feasibility assessors themselves are chosen from a variety of different disciplines. The problem is that, as a result of the variety of disciplines, the meaning understood for the phrase ‘feasibility assessment’ is not clear and might be ambiguous. The objective here was to clarify the meaning and reduce ambiguity in the concept of feasibility assessment, and to identify the documents and information needed for feasibility assessment. Meaning, purpose

and objective of feasibility assessment is found in **Table 3.1 – Definition of the meaning, purpose and objective of feasibility assessment of projects**.

The general meaning, purpose and objective of feasibility assessment was found to be analysing, reviewing, understanding, resolving and evaluating the practicality, gaps, risks, constraints, viability, strengths and weaknesses, and potential, of a project to decide if the plan or concept of the project can be done and can be implemented after uncovering its strengths and weaknesses.

Reviewing the excerpts on meaning in context indicates that various authorities regard feasibility assessment in slightly different ways. The difference of views may arise from their different contextual standpoints, because of their particular fields of discipline. For example, authors concerned with the field of delivery of infrastructure are particularly concerned with identifying gaps and constraints in the project concept (such as shown in Watermeyer 2014, CIDB Infrastructure Toolkit 2012, and CIDB Inform Practice Note #22, 2011).

Generalizing the meaning, purpose and objective of the concept of feasibility assessment to indicate a common definition as analysing, reviewing, understanding, resolving and evaluating the practicality, gaps, risks, constraints, viability, strengths and weaknesses, and potential of a project showed that each of these characteristics has elements of risk assessment within them. Some examples of elements are questions such as: 'is it practical or is it not practical?', 'Are there gaps in the information available?', 'Are there constraints to the viability of a project?' Accordingly, conceiving feasibility assessment as a kind of risk identification is confirmed as a way of answering the specific question of what defines feasibility assessment of projects. Slightly differing meaning of the concept of feasibility assessment given by different sources might arise from different internal constructs from which the sources view what constitutes 'feasibility'.

Constructs of meaning, purpose and objective are expressed slightly differently by various users of the term. Exploration reveals a spread of purposes ranging from 'deciding to proceed with the project', to 'evaluating the potential of a project' and 'uncovering strengths and weaknesses'. Comparison of the excerpts from the twenty sources suggests a collective view as: 'decide if the project plan or concept will work and can be implemented after uncovering its strengths and weaknesses'. Purpose can

be further refined to answering a major uncertainty question: ‘should we proceed with the proposed project concept?’

The question why feasibility is not assessed’ indicates that feasibility is not assessed because of ‘appraisal optimism’, ‘optimism biases’ and ‘strategic misrepresentation’. Some sources indicate that feasibility assessment does not assess ‘should [the project] be done?’ Others indicate that feasibility assessment does not assess the ‘design development stage’, which takes place after technical feasibility assessment. Project leaders might not wish to do feasibility assessment because ‘we know it’s feasible; the market analysis has already been done’. Reasons given for not doing feasibility assessment outweigh what sources state is not assessed in a feasibility assessment.

Information and documents needed for feasibility assessment were explored under the heading ‘information’. Excerpts did not give a thorough and clear explanation of what documents and information are needed for feasibility assessment. Views are more the individual views of each source, based on their own context, rather than a consistent opinion. Information and documents needed for feasibility assessment are indicated as providing answers the questions: What is the definition and scope of the endeavour and what are the identities of stakeholders? Does the technology exist? Has the technology been used before? What assistance is required? Do the necessary skills exist? What are the constraints and risks to implementation? What is the background information, in the form of case descriptions of projects, required to compute uncertainties? Overview of the project requires answers to additional questions: What is the importance of the project? What is the level of experience of the project team? What are the personnel constraints? What projects are running in parallel? What is the technical risk? What are the technical breakthroughs that would make the project obsolete?

Documents needed comprise preliminary investigations, stakeholder consultations, desk-top studies, and specialist advice establishing the feasibility of satisfying the strategic brief. Documents containing information needed include historical case studies of the strengths and weaknesses of similar projects. Shortcoming in finding out what documents and information are needed suggests the need to question how feasibility assessments are actually done in practice, and the information actually used to conduct a feasibility assessment.

General comments on the difficulty of feasibility assessment were made by sources in addition to those shown on Table 3.1. Two examples are: 'The most useful feasibility assessments are carried out by assessors outside of the project' (Flyvbjerg et al 2003 p60, p112); and 'It is very difficult or even impossible at the initial planning stage for project managers to know precisely which activities have to be carried out in order to complete the project' (Dvir and Lechler 2004).

## 7.4 Quantitative and qualitative case study exploration of the feasibility assessment process done in practice

Fourthly, data from two case studies, each of large infrastructure development projects that were conveniently available to the researcher, were selected to explore the process of feasibility assessment in practice *at the operational level*, both quantitatively and qualitatively.

On the quantitative question, the extent to which feasibility assessors recognise risk of failure in the case study projects, extent was shown by content analysis to be the frequency at which statements indicating recognition of risk factors occurred in the text documents that supported each feasibility assessment. The extent to which risk factors were recognised by participating experts was determined by counting perception statements made during the course of the two case studies. The predominant risk factor recognised by assessors was found to be 'perception of risk'. This factor was predominant at both the initial stage, and also when viewing the project retrospectively. Other risk factors, such as 'initial choice of project', 'risk in context' and 'decision to proceed', played a relatively minor role in determining feasibility when viewed both initially and retrospectively. Comparison of the quantitative extent to which risk factors are recognised in Case Study A as against Case Study B was given in a vertical bar chart **Table 5.5- Comparison of analysis of Case Study A and Case Study B for the extent of recognition of risk**.

Findings from the qualitative part of the study indicate that feasibility assessments are conducted by appointing and commissioning experts to examine various aspects of the project concept. Each expert conducts a feasibility assessment relating to their area of expertise and provides a report. Ultimately the reports are then collated into an overall feasibility assessment report for the project. Each feasibility study was undertaken by a team of professionals who consulted various subject-matter experts on the feasibility of a project. The processes used in each case were compared qualitatively to find out

how feasibility assessment was done. The qualitative comparison was shown in **Table 5.6 - Comparison of the process of feasibility assessment in practice**.

On the question of how feasibility assessments are actually carried out in practice, observations were made during qualitative comparison of the two cases, each by a different project management organization. Similar processes were used by the two organizations to establish feasibility. Comparison of how feasibility of the project was established at the operational level in practice showed the use of the same approach to establishing feasibility, namely that overall aspects of each project concept were presented to people with expert skills, who then used their experience and intuition to identify risk of failure to the project. Because the two project management organizations had each assessed a different infrastructure project concept, the process used at each firm to assess the feasibility of its project contained differences related to the nature of each project concept. The project in Case Study A was a novel technical concept. The project in Case Study B was a well-understood concept. Expert skills utilized for Project A  focus on the technical feasibility of the project concept. Expert skills utilized in Project B focussed more on fitting the project into the community. The protocol used for Project A  focussed on detecting possible technical failure. The protocol used for Project B focussed on finding out if the project was acceptable to the community. The results of the feasibility study for Project A showed flaws in the project concept and predictions on the outcome. The results of the feasibility study for Project B showed why the project should be acceptable to funders.

Differences appeared to relate to the different nature of each project concept. Qualitative comparison of the cases showed that the process of feasibility assessment was driven by each firm's own interpretation of the purpose and objective of feasibility assessment.

The interesting finding that emerged from the study was that the questions asked of the experts appear to be designed to lead to a confirmation that the project **could** go ahead. The questions do not necessarily ask for their opinion on whether the project **should** go ahead. Thus it may appear that the questions asked by the owner to the experts are designed to lead to the recommendation or conclusion that the project could go ahead. While doing a feasibility assessment may demonstrate that a project could go ahead, doing a feasibility assessment would not necessarily answer the

question on whether a project should go ahead. Neither feasibility assessments answered the question: should the project be done?

## 7.5 Contribution to project management knowledge

The study establishes a definition of feasibility assessment and provides a better understanding on how the feasibility assessment process is done for large infrastructure development projects. Overall, the study confirms that the feasibility assessment process is useful as a way for project managers to recognise risk of failure before deciding to proceed with a project. However, the process depends on each assessor's own interpretation of the definition of feasibility assessment and its purpose.

## 7.6 Shortcomings and recommendations for further research

Kernaghan (2012)'s statement that feasibility assessment does not consider 'why should [the project] be done?' may be a clue to understanding what feasibility assessment does not consider. Evaluating 'should [the project] be done?' might be the clue to understanding those aspects that feasibility assessment does not measure. The single question could possibly have been split into two sub-questions. Further research is therefore suggested into the distinction between the reasons justifying why a feasibility assessment was not done, and the reasons why feasibility assessment was not considered.

A further limitation of this study is insufficient explanation of why feasibility is *not* assessed. Feasibility assessment had focussed on the question 'can a project be done?' The issue of whether or not a project *should* be done was not addressed. Differing interpretations of the purpose and objective of feasibility assessment may explain why differences in the process occur. An analysis of differing interpretations would require further research.

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# APPENDIX

APPENDIX TO FEASIBILITY ASSESSMENT OF PROJECTS FOR RISK OF FAILURE

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## Introduction to appendix

Two cases of the feasibility assessment process that took place in the Gauteng Province of South Africa were investigated. Qualitative data in the form of nine interviews and 14 report documents were collected from the cases and separated into those applicable to Case Study A on the feasibility assessment of Project A, and those applicable to Case Study B on the feasibility assessment of Project B.

In the case of Case Study A, three professionals led a larger team of eight people who conducted the feasibility assessment for Project A, each of whom was interviewed on aspects such as future trends in the industry, economic feasibility and technical assessment of the system. Documents collected relating to the feasibility assessment of the project included the feasibility report and minutes of meetings that took place during the period of the assessment.

In the case of Case Study B for Project B, a summary of the feasibility assessment reports related to aspects such as social acceptability, technical feasibility and economic feasibility among others was publically available. In addition, one interview was conducted in 2015 with a senior general manager of the client who had been involved with the building of the project.

The Data Collection Instrument lists the source documents that were selected from those collected for the investigation. Each source document contains expert views on aspects of that particular project. The collection comprises minutes of certain meetings held by the assessing firm to assess project feasibility, interviews with individual experts on aspects of project feasibility, and summaries of the feasibility reports.

The key to fundamental understanding of how feasibility assessments are done comes from understanding the extent to which factors of risk affecting the feasibility of a project are recognized by assessors, and the relative importance of each factor.

Statements made by experts, who were commissioned to examine various aspects of each project concept, were analysed quantitatively to find the extent to which factors of risk affecting the feasibility of a project were recognized. Factors investigated were: assessment of risk in context, initial choice of project, risk neglect, perceptions of risk, undue optimism, retrospective sense of risk, and assessment leading to a decision to proceed. Statements by the experts showing recognition of risk are displayed in each text as constructs made when the experts were discussing the project (a construct is taken here as 'an idea expressed in a group of words forming a phrase'). Statements made by various respondents in each case were marked in each selected document and interview. Content analysis was used to extract the extent of occurrence of constructs from the documents.

Aspects of the process of feasibility assessment used in practice in each of the two case studies were also compared qualitatively. The data collected also provided a qualitative comparison of aspects of the process of feasibility assessment used in each case.

The Data Collection Instrument gives the date, aspect subject and source document of the views extracted. The sources are documents and interviews related to the feasibility assessment of each particular project. The Data Collection Instrument is followed by 'Word' versions of transcripts of the interviews and documents that provided sources of views on feasibility assessment of that case study project.

Content Analysis of the feasibility assessment documents and interviews led to matrix tables displaying the quantitative extent to which experts recognise risk to the successful feasibility of each project, and to a qualitative comparison of the process of feasibility assessment of both projects. The results of the quantitative analysis are displayed in the text of the dissertation, in Table 5.2 for Case Study A, and Table 5.3 for Case Study B. The results of the quantitative analysis are compared in Table 5.4 and Table 5.5 for both Case Study A and Case Study B. The results of the qualitative comparison are displayed in Table 5.6 for both Case Study A and Case Study B.

# CASE STUDY A – CODES & UNDERLINING – HARD COPIES OF DOCUMENTS AND INTERVIEWS

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# Data Collection Instrument for Case Study A

| Date and Day | Time started | Time ended | Duration | Aspect Subject | Field of expertise | Source | Location | Interviewer / minute taker |
|---|---|---|---|---|---|---|---|---|
| 26.10.2010 Tues | 9:00 | 12:15 | 3hr15min | Kick-off meeting to assess HRTLR project | Project manager | Minutes of meeting | Water Genetics Offices Booysens | R. Smith/Z.B |
| 5.11.2010 Fri | 9:00 | 10:45 | 1hr45min | Future trends in hybrid vehicle | Hybrid vehicle manufacture | K. Flynn interview | Toyota / Lexus Offices Old Pretoria Road | R. Smith |
| 12.11.2010 Fri | 11:00 | 12:30 | 1hr30min | Future trends in taxi industry | Transport economics | V. Mostert interview | University of Johannesburg Auckland Park | R. Smith |
| 21.1.2011 Fri | 10:00 | 11:45 | 1hr45min | Assessment of HRTLR system | Urban design and architecture | P. Rich interview | P. Rich Offices Parktown | R. Smith |
| 4.2.2011 Fri | 8:45 | 10:15 | 1hr30min | Assessment of HRTLR system | Mechanical engineer | T. Moss interview | School of Mechanical Engineering University of Witwatersrand | R. Smith |
| 16.2.2011 Weds | 2:00pm | 4:05pm | 2hr05min | Assessment of HRTLR system | Urban planner | J. Woolcott interview | Houghton | R. Smith |
| 28.2.2011 Mon | 9:00 | 10:25 | 1hr25min | Assessment of HRTLR system | Project manager | J. M. Henrey interview | Sandton | R. Smith |
| 10.3.2011 Fri | 14:00 | 15:00 | 1hr00 | Assessment of HRTLR system | Civil engineer | John Goodman interview | C & CI Midrand | R. Smith |
| 18.3.2011 Fri | 14:00 | 15:45 | 1hr45min | Assessment of HRTLR system | Structural engineer | John Goodman interview | C & CI Midrand | R. Smith |
| 31.3.2011 Thurs | 10:10 | 13:45 | 3hr35 | Finalization meeting to assess feasibility | Project manager | Minutes of meeting | Water Genetics Offices Booysens | R. Smith/Z.B |
| 1.4.2011 Thurs | 10:00 | 13:45 | 3hr45min | Feasibility report | Project manager | Minutes of meeting | Water Genetics Offices Booysens | R. Smith/Z.B |
| 26.10.2010 Tues | 9:00 | 12:15 | 3hr15min | Kick-off meeting to assess HRTLR project | Project manager | Minutes | Water Genetics Offices Booysens | R. Smith/Z.B |
| 5.11.2010 Fri | 9:00 | 10:45 | 1hr45min | Future trends in hybrid vehicle | Hybrid vehicle manufacture | K. Flynn | Toyota / Lexus Offices Old Pretoria Road | R. Smith |
| 12.11.2010 Fri | 11:00 | 12:30 | 1hr30min | Future trends in taxi industry | Transport economics | V. Mostert | University of Johannesburg Auckland Park | R. Smith |
| 21.1.2011 Fri | 10:00 | 11:45 | 1hr45min | Assessment of HRTLR system | Urban design and architecture | P. Rich | P. Rich Offices Parktown | R. Smith |
| 4.2.2011 Fri | 8:45 | 10:15 | 1hr30min | Assessment of HRTLR system | Mechanical engineer | T. Moss | School of Mechanical Engineering University of Witwatersrand | R. Smith |
| 16.2.2011 Weds | 2:00pm | 4:05pm | 2hr05min | Assessment of HRTLR system | Urban planner | J. Woolcott | Houghton | R. Smith |
| 28.2.2011 Mon | 9:00 | 10:25 | 1hr25min | Assessment of HRTLR system | Project manager | J. Henrey | Sandton | R. Smith |
| 10.3.2011 Fri | 14:00 | 15:00 | 1hr00 | Assessment of HRTLR system | Civil engineer | John Goodman | C & CI Midrand | R. Smith |
| 18.3.2011 Fri | 14:00 | 15:45 | 1hr45min | Assessment of HRTLR system | Structural engineer | John Goodman | C & CI Midrand | R. Smith |
| 31.3.2011 Thurs | 10:10 | 13:45 | 3hr35 | Finalization meeting to assess feasibility | Project manager | Minutes | Water Genetics Offices Booysens | R. Smith/Z.B |
| 1.4.2011 Thurs | 10:00 | 13:45 | 3hr45min | Feasibility report | Project manager | Minutes | Water Genetics Offices Booysens | R. Smith/Z.B |

**KICK-OFF MEETING MINUTES**

Kick- off meeting to assess HRTLR project

*(Minutes of meeting 26.10.2010, 09.00-12.15 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB)*

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

## HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM

## Water Genetics – Project Managers

Kick-off meeting to assess the feasibility of constructing the HRTLR project for xxxxxx(Client)

Venue : Water Genetics conference room, Gunite House, 37 Koster Street, Booysens

Date : Tuesday 26 October 2010, starting 9am

Present : K. J. Cunningham (KJC)

R. Patey (RP)

R. G. Smith (RGS)

G. Gibson (GG)

Meeting as per agenda

The meeting commenced at 9:05am.

KJC welcomed the managers to the kick-off meeting for an exciting project for which Water Genetics Project Managers had been appointed to assess the feasibility of[02] KJC asked that the identity of the client be kept confidential, as it was a sensitive issue at the moment, particularly as patents affecting the project had not yet been finalized.

Water Genetics were to assist in the front-end[07] decision making during the front-end of the project. The requirements of the understanding of the role of technical professionals as experts will be of paramount importance.[01] Involvement of technical professional experts in exploring this project will be necessary.

Introduction to the project

KJC introduced the proposed project concept. The essence of the HRTLR is a mechanism involving individual 2 tonne wheeled urban transport units combined with dedicated routes to enable the transport units to avoid existing roads. The objective of the proposed transport mechanism is reduced road congestion, reduced road usage, reduced land use and reduced oil-based energy consumption of vehicles.

Advanced design and construction of the project is intended to start once feasibility had been proved,[07] political support and funding obtained, and the applicability of various patents held by the client checked out. The location of the initial construction of the project is intended initially to be in Gauteng,[01] as a complement to other urban transport initiatives currently underway, such as Gautrain and GFIP, which uses open-road electronic tolling.

Conceptual detail of the project is the use of hybrid 2-tonne wheeled transport units, which will be capable of both traveling on existing roads, and also entering and using a dedicated light-rail-route,[01] from whence electrical energy could be drawn whilst the transport units are using the route.

Water Genetics as a firm have been mandated to investigate this conceptual project for xxxxx, with a target completion data of 5 March 2011. (KJC presented to the meeting a

sketch drawing and outline specification of the Hybrid Road to Light Rail project concept).

Discussion :

GG addressed the meeting. He explained that all aspects of the proposed project, the technical, financial, environmental, and public acceptability aspects would have to be investigated.[02] Current problems with the Gauteng Highway Improvement project and the Gautrain would have to be looked at in context, and how this project would affect them.

RP said that it looked to him as though the technical aspects would have to be looked at first,[02] including the public acceptability aspects. He knew that he himself did not have adequate knowledge to do this. Once we knew the system would work, he would be able to apply a financial budget to what it would cost. To start costing it now, before technical aspects had been finalized, would be a waste of everybody's time.

KJC : Are you saying you can't cost it?

RP : I can cost it if I know what it's about. I can't cost pie in the sky. I need more information.[02] What you've given is not enough.

RGS said it seemed to him that the project should be broken up into its elements, and each element investigated separately. The question was, who could do this before Rob started on the costing budget. RGS undertook to try to locate experts who could help with the mechanical, electrical, electronic, structural and manufacturing aspects[02] but would also need more information on what the project was about.

GG said he wondered if the HRTLR concept could actually be fitted into the city.[03] Perhaps we would get a town planner's view of this aspect.

KJC, RP and RGS agreed with this idea.

General discussion

The meeting closed with general discussion on how the feasibility of the project was going to be assessed, and who was going to do what. The view was that technical feasibility should be concentrated on as a priority.[04] It was agreed that RG would lead the team in considering this aspect.

The kick-off meeting closed at 12:15pm.

Next meeting was scheduled for 5 March 2011, same place.

*End of Kick-off meeting minutes 26.10.2010, 09.00-12.15 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB*

**MOTOR VEHICLE MANUFACTURER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM

### Assessment of HRTLR system

*(Interview 10.11.2010, 9.010.45 with Kevin Flynn at Toyota / Lexus offices, interviewed by R. Smith)*

**Future trends** in land transportation using **hybrid vehicles**

A senior manager possessing technical, operational and marketing knowledge within a major manufacturer of hybrid internal-combusion / stored battery power hybrid vehicles was interviewed by the author. His opinions on future trends in hybrid production, from his perspective as one directly involved in the field at present, are related in the interview.

The approach taken by the interviewer was qualitative. No requests for opinions on quantities nor on monetary values were made. Instead, informed opinion was solicited as to general trends.

The objective of the interview was to gain insight into whether the production of hybrid vehicles was going to increase or decrease, and whether their continued production could be relied on for future transport planning.

Commitment to production, types and models that were going to be produced and possible technical changes were reviewed. Activities of other manufacturers of hybrid vehicles were considered, as well as the possibilities for pure electric storage vehicles rather than hybrid.

1.Q Does your corporation intend continuing with hybrid production?

1.A Yes for at least the next 20 to 25 years. The company has a very large commitment in capital and effort to continuing with hybrid technology.[07]

2.Q Does your company intend increasing the present model range?

2.A Yes. New models have been designed and are entering production.

3.Q Does your corporation apply hybrid technology to other types of vehicle, eg golf carts, milk floats, forklifts, boats?

3.A Yes, but on a smaller scale. Outside of my area of expertise.

4.Q Have you developed transportation-type hybrid vehicles such as busses and trucks?

4.A Yes. Trucks for cargo and buses of various sizes for human transportation.[01]

5.Q What possible and likely other power sources than petrol internal combustion could be used as the prime power source?

5.A The future seems to be hydrogen as the fuel for the hybrid system,[04] either as fuel cells or as fuel for internal combustion engine, although ways of generating the hydrogen will have to become 'cleaner'

Diesel has problems of difficult starting on stopping.

6.Q Do you see a major move by other manufacturers to hybrid, replacing conventional?

6.A Yes, other firms are already participating,[02] both by doing their own development and by licencing already developed technology from Toyota / Lexus, the largest hybrid vehicle manufacturer.

The biggest area of development is hybrid vehicle storage batteries. Under development are lithium-ion batteries. These are presently not stable enough, but promise more capacity than existing nickel-hydride or lead-acid batteries.

7.Q Is there a future for pure electric track-independent vehicles? What are the problems?

7.A. Pure electric vehicles with on-board storage batteries have limited use[06] as a result of their limited range. Probably limited to urban use, for the short "home-shopping centre-school-home" circuit.

8.Q Is there anything in the future for automated robot-controlled vehicles?

8.A The technology exists but this manufacturer is not actively pursuing it. The regimentation required of an automated vehicle is inimical to the concept of freedom to operate where and when a driver wishes,[04] which is the basis of this manufacturers present marketing.

Active safety technology is available at present, for : -

- Collision avoidance
- Stopping when getting too close to vehicle in front
- Waking driver falling asleep by automatically watching his eyes.

However, the systems are not widely used at present.

*End of Motor vehicle manufacturer interview 10.11.2010, 9.010.45 with Kevin Flynn at Toyota / Lexus offices, interviewed by R. Smith*

**TRANSPORT ECONOMIST INTERVIEW**

## Assessment of the feasibility of the HRTLR system

*(Interview with V. Mostert 12.11.2010, 11.00-12.30 at UJ by R. Smith)*

## Future trends in the taxi industry

The state of the shared taxi industry in South Africa and its receptiveness to innovative changes and resistance to change.

A senior academic researcher in transport economics, with in-depth knowledge of the taxi industry and its shortcomings, was interviewed by the author. Questions were qualitative and were used in order to determine attitudes rather than to verify statistics. The purpose of the interview was to determine whether the industry was in decline or decay and whether technical and operating improvement would be acceptable to role players.

1.Q. Do you think shared taxi industry will continue to grow in SA?

**The taxi industry will remain strong, provided that the necessary changes are made.[04] There are almost 400 different taxi associations. Lift clubs are also in effect shared taxis, so they would be included as taxi associations.**

**Present sizes of minibuses, ie. 15 to 22 passengers, appear to be suitable for the fairly low territorial densities we have in South Africa. Taxis penetrate every corner of every city, as well as remote areas of the country.[01]**

2.Q. Do you think the industry open to innovation as regards types of vehicles?

**The players in the industry, the owners and operators of taxis are extremely conservative as regards choice of equipment.[06] They know what works, hence there is a preference for known vehicles, such as the Toyota Siyaya.**

3.Q. Does the industry need or want exclusive routes to enable them to better carry out their activities.

**A very strong need exists for the administration to formalize a contract system for the rights to various taxi routes,[02] in order to minimize conflict and make more efficient use of resources.**

**There is need for a 'verkeersverbond' type of authority. This authority would be responsible for the regulation and optimization of land transport.**

4.Q. If so would operators have objections to sharing such exclusive routes with freight transportation?

**Taxi operators by their nature would not have objections to sharing their routes with freight operators,[04] provided that this sharing did not lead to congestion on the routes. Timing of the different categories of transportation on the routes might be a way of optimizing the use of a particular route.**

**The principles of 'just-in-time' management could be applied to the use of the routes.**

5.Q. Is fuel cost saving of interest to the industry?

**Most of the taxi industry is not sophisticated enough to have concerns over operating costs.[06] If the fuel price increases, this is used as a reason to increase fares. The fares are then left at the higher level when or if the fuel price drops.**

**Passengers are unhappy if there is a fare increase, but do not seem to demand a reduction of fares if the fuel price reduces.**

6.Q. Is carbon emission saving of interest?

**Again, the taxi industry is unsophisticated as regards the effects of carbon emissions. This would apply equally to owners, operators and passengers.**

7.Q. Is improved safety of interest to industry players, or just considered one of many hurdles operators must face?

**Safety is of various levels of interest to various players, ranging from being little interest to owners, some interest from operators and the greatest interest from passengers, who do not however have the power to do anything about the risks to which they are exposed.[06]**

Some other points from V. Mostert : -

a) As regards hybrid systems, some London buses are diesel / electric as an energy saving measure.

b) His son-in-law, who lives in the USA in Charlotte, North Carolina, uses a light rail system which is operated by the city.

*End of Transport economist interview with V. Mostert 12.11.2010, 11.00-12.30 at UJ by R. Smith*

**ARCHITECT INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM

### Assessment of the feasibility of the HRTLR system

*(Interview with P. Rich, 25.2.2011, 10.00 – 11.45 at his Parktown offices, by R. Smith)*

Appraisal of urban planning and architectural aspects of the HRTLR concept and impact of the HRtoLR operation to an inter-urban environment

The basic operation of the HRTLR system was sketched, explained and presented to a highly-experienced architect and urban planner. His expert opinions were then sought, as initial qualitative reactions from an expert with knowledge of the urban environment in which the HRtoLR would operate. The expert was then questioned on his reactions.

1. Q. Do you think that the existence of a HRtoLR system would be societally acceptable to urban dwellers who are not users of the system?

    - **A test case would be needed in specific installations, which may need environmental impact studies.[02] Spanish designers have evolved a 'linear city' concept which the HRtoLR may contribute to.[01] But generally, no, I can't see why the HRtoLR system should not be acceptable to urban dwellers.[04]**

2. Q. Do you think that the HRtoLR would appeal to users?

    - **I think the system would take some getting used to by users.[04]**

3. Q. Would the HRtoLR system benefit light goods transporters?

- **Conventional goods trains are not in contention at the moment as goods transporters, as their use has been squeezed out by other interests. Accordingly, <u>any system that improves the transport of goods would be beneficial to the operating of the city</u>.[06]**

4. Q. (Key Question) : Is there any obvious <u>negative</u> environmental impact from the installation of a HRtoLR system?

   - **No, at first sight. <u>There have been studies done overseas of similar parallel systems</u>.[04]**

5. Q. Is there any obvious <u>positive</u> environmental impact from the installation of an HRtoLR system?

   - **Yes.**

6. Q. Is there any obvious negative visual impact from the elevated viaduct system?

   - **No. The viaduct need not necessarily follow the highway route and pass under bridges; it could use other routes.**

7. Q. Is there any positive visual impact from the system?

   - **That depends on how its installation is handled. Care should be taken in this regard.**

8. Q. Can you at first sight envisage economic <u>benefits</u> of the HRtoLR system to users and operators?

   - **Yes, at this first sight.**

9. Q. Can you envisage <u>negative</u> economic effects arising from the HRtoLR sytem?

- **<u>Authorities tend to tax vehicles by weight, as well as by carbon emissions. This taxation would be a consideration</u>.**[06]

10. Q. Does the HRtoLR as you have seen it in outline, suggest improved transport efficiency?

    - **Yes.**

11. Q. In your opinion, would the system improve the functioning of the cities if it were implemented?

    - **Yes, it would.**

*End of Architect interview with P. Rich, 25.2.2011, 10.00 – 11.45 at his Parktown offices, by R. Smith*

**MECHANICAL ENGINEER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

### Assessment of the feasibility of the HRTLR system

*(Interview with Prof. T. Moss 4.2.2011, 8.45-1-.15 at his Wits University offices by R. Smith)*

QUESTIONS POSED TO AN EXPERT IN MECHANICAL ENGINEERING

An expert in mechanical engineering was presented with an outline of the HRTLR system. The expert was briefed as to how the HRTLR was intended to operate, and was requested to pass opinion as to the workability of aspects of the system, while taking a larger, qualitative view of the entire system.

The transition-to-rail and the rail-carrying components were to be assumed as being workable.

1. Q. Do you think that, provided that the transition and rail-carrying systems are workable, the whole of the HRTLR system could be made to work?

   - **A successful mechanical and electrical design is probably possible. I can at this stage see no reason why it could not be made to work.**[04]

2. Q. Would the technical requirements pose, in your view and at first sight, any particularly difficult mechanical engineering challenges?

- **The quality of the minibus operator or driver's skill has a bearing on how successfully the transition ramp interface would be used. Minibus taxi operator's driving skills do not appear to be good at present.[06]**

3. Q. Would the system preferably transport light goods better than people, or would there be an advantage in using the vehicles for both cargo and people?

   - **Road congestion is mostly the result of the transportation of people. If the HRTLR system were used to transport people and goods simultaneously the transport of goods might choke the system at critical times.[04]**

4. Q. Is there any obvious negative environmental impact from the installation of HRtoLR system? (same question was posed to the urban planner).

   - **The carrying rail is elevated. The hazards of working above ground level apply. Also the use electricity with live exposed contact rails makes the use of protective measures necessary.[06]**

5. Q. Would there be an obvious positive environmental impact from the adoption and installation of the HRTLR system?

   - **Use of electrical power rather than petroleum would of course result in a saving of petroleum.[04] This would be a positive benefit to energy resources if, overall, energy was saved.**

6. Q. Can you see potential safety hazards with the system as it is configured in outline? Either with the vehicles or with the viaduct?

   - **The transition ramp interface may require a higher level of driver's skill than presently exists. This aspect should be given particular attention if the design is to progress.**

7. Q. Can you see safety advantages with the use of both the HRTLR vehicles and the viaduct?

- **After the vehicles have transitioned through the interface ramp and are running on the elevated railway on the viaduct, they are removed from the risk of side impact accidents, as well as from the results of bad driving by other drivers.[04]**

8. Q. In your view is the concept design of the HRTLR unnecessarily complicated? Does it seem to utilize large resources without corresponding benefit to transport?

   - **Allowing access to the vehicles one-by-one up the ramp onto the viaduct and then having only one departure point may be a disadvantage.[06] This disadvantage might be offset by the simplicity of the system having a single viaduct between two points.**

     **Consideration might be given to devising a system to allow vehicles to enter and leave the viaduct at a series of points.**

9. Q. Can you see the HRtoLR system causing additional costs to passengers and transporters?

   - **Capital costs of the system could be contrasted against the savings resulting from the difference between the running cost of the system and the running cost of an ordinary road-carried bus system.**

10. Q. Does the HRtoLR system suggest improved land transport efficiency? (same question as to urban planner)

    - **Yes. The system is simple.[04] It will reduce the concentration of vehicle traffic where such traffic arrives at the access points to a high density route, such as a route between two urban centres. At present, such traffic concentrates on roads just where infrastructures such as parking garages and bus or train stations have to be positioned. It will reduce land use.**

11. Q. At the most basic level, in your opinion, would or would not an operating HRTLR system improve the functioning of inter-urban-land transportation? (this is the go or no-go question)

    - **Yes, it would possibly improve transport functioning.[07]**

12. Q. Without sounding like an endorsement, would your own informed opinion be that consideration should be given to developing the concept further?

- **Yes, it would. Terry Frangakis in the Department of Mechanical Engineering could be approached to assist in taking the design further.**

*End of Mechanical engineer interview with Prof. T. Moss 4.2.2011, 8.45-1-.15 at his Wits University offices by R. Smith*

**URBAN PLANNER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM

### Assessment of the feasibility of the HRTLR system

*(Interview with J. Woolcott, 26.2.2011, 2.00pm – 4.05pm at his Houghton home, by R. Smith)*

Appraisal of urban planning and architectural aspects of the HRTLR concept and impact of the HRtoLR operation to an inter-urban environment

The basic operation of the HRTLR system was sketched, explained and presented to a highly-experienced architect and urban planner. His expert opinions were then sought, as initial qualitative reactions from an expert with knowledge of the urban environment in which the HRtoLR would operate. The expert was then questioned on his reactions.

1. Q. Do you think that the existence of a HRtoLR system would be societally acceptable to urban dwellers who are not users of the system?

    - **A test case would be needed in specific installations, which may need environmental impact studies. Spanish designers have evolved a 'linear city' concept which the HRtoLR may contribute to. But generally, no, I can't see why the HRtoLR system should not be acceptable to urban dwellers.**

2. Q. Do you think that the HRtoLR would appeal to users?

    - **I think the system would take some getting used to by users.**

3. Q. Would the HRtoLR system benefit light goods transporters?

   - **Conventional goods trains are not in contention at the moment as goods transporters, as their use has been squeezed out by other interests. Accordingly, any system that improves the transport of goods would be beneficial to the operating of the city.**

4. Q. (Key Question) : Is there any obvious negative environmental impact from the installation of a HRtoLR system?

   - **No, at first sight. There have been studies done overseas of similar parallel systems.**

5. Q. Is there any obvious positive environmental impact from the installation of an HRtoLR system?

   - **Yes.**

6. Q. Is there any obvious negative visual impact from the elevated viaduct system?

   - **No. The viaduct need not necessarily follow the highway route and pass under bridges; it could use other routes.**

7. Q. Is there any positive visual impact from the system?

   - **That depends on how its installation is handled. Care should be taken in this regard.**

8. Q. Can you at first sight envisage economic benefits of the HRtoLR system to users and operators?

   - **Yes, at this first sight.**

9. Q. Can you envisage negative economic effects arising from the HRtoLR sytem?

   - **Authorities tend to tax vehicles by weight, as well as by carbon emissions. This taxation would be a consideration.**

10. Q. Does the HRtoLR as you have seen it in outline, suggest improved transport efficiency?

    - **Yes.**

11. Q. In your opinion, would the system improve the functioning of the cities if it were implemented?

    - **Yes, it would.**

*End of Urban planner interview with J. Woolcott, 26.2.2011, 2.00pm – 4.05pm at his Houghton home, by R. Smith*

**CIVIL ENGINEER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

### Assessment of HRTLR system

*(Interview with J. Goodman 10.3.2011, 14.00-15.00 at C & CI Midrand offices, by R. Smith)*

QUESTIONS POSED TO AN EXPERT IN CIVIL ENGINEERING

An expert in the civil engineering aspects of structural engineering was presented with an outline of the HRTLR system. The expert was briefed as to how the HRTLR was intended to operate, and was requested to pass opinion as to the workability of aspects of the system, while taking a larger, qualitative view of the entire system.

The transition-to-rail and the rail-carrying components were to be assumed as being workable.

1. Q. Do you think that, provided that the transition and rail-carrying systems are workable, the whole of the HRTLR system could be made to work?

**To fit the HRTLR system into existing infrastructure would be a challenge.[06] Using the raised viaduct would be more expensive than if the trackway were carried on the surface at ground level; on the other hand, the raised trackway makes better use of available land. Either method could be used. Servitudes would have to be considered.**

2. Q. Would the technical requirements pose, in your view and at first sight, any particularly difficult structural engineering challenges?

**Plenty of bridges of the same dimensions and load-carrying capacity as the HRTLR viaduct have been built. Their design and construction is no particular problem.[04]**

**The spacing of the vehicles is important in order to maximise the usage of the trackway. Closer spacing of vehicles would mean that more vehicles could travel on the viaduct.**

**Acceleration of the vehicles on the on-ramps would have to be quick, so that spacing on the trackway would be optimised. Slowing down before entering the on-ramp should be avoided.**

3. Q. Would the system preferably transport light goods better than people, or would there be an advantage in using the vehicles for both cargo and people?

**As a transportation system, it would not matter to its operation whether it carried people or light goods.**

4. Q. Is there any obvious negative environmental impact from the installation of HRtoLR system? (same question was posed to the urban planner and mechanical engineer).

**There might be community objections to the double-decker system. Noise might be a problem emanating from the rail. There may also be wind noise from the passage of the vehicles on their elevated trackways.[06]**

5. Q. Would there be an obvious positive environmental impact from the adoption and installation of the HRTLR system?

**There would be a saving on the need for other road transport and rail transport.**

6. Q. Can you see potential safety hazards in the system as it is configured in outline? Either with the vehicles or with the viaduct?

**The electrical system must be made safe to use. Maintenance teams must be able to obtain access. The automatic control system of the vehicles must prevent rear-end collisions. Earthquake effects must be considered in the designs of the viaducts and the vehicles.[04]**

7. Q. Can you see safety advantages with the use of both the HRTLR vehicles and the viaduct?

**Separating the vehicles from other traffic lanes is safer than having them combined.**

**No possibility for overtaking removes another hazard.[04]**
**Automatic control removes driver error.**

8. Q. In your view is the concept design of the HRTLR–carrying viaduct unnecessarily complicated? Does it seem to utilize large resources without corresponding benefit to transport?

**The concept design does not seem unnecessarily complicated. Cost of the elevated viaduct will of course be higher than a ground-level viaduct. But the benefits at first sight suggest that they will outweigh the costs.**

9. Q. Can you see the HRtoLR system causing additional costs to passengers and transporters? As a result of the structures required?

**Inevitably, if you build the system there will be costs. There will also be the costs of electrical power. Maintenance costs must also be considered.**

10. Q. Does the HRtoLR system suggest improved land transport efficiency? (same question as to urban planner and mechanical engineer).

**Yes. <u>The HRTLR will add to the traffic system's capacity because it can carry more traffic</u>.[04] Land usage would be more efficient (ie less land used to carry more vehicles) than conventional highways. Energy consumption would switch from petroleum fuel used to electrical use.**

**<u>The positions of the on-and-off ramps, in other words the nodes of the system, have to be selected carefully so that they do not add to congestion</u>,[06] but also that they will be convenient to use, otherwise drivers of the HRTLR vehicles may not use the viaduct system.**

11. Q. At the most basic level, in your opinion, would or would not an operating HRTLR system improve the functioning of inter-urban-land transportation? (this is the <u>go</u> or <u>no-go</u> question)

**The HRTLR system would improve the functioning of inter urban land transportation provided that the nodes were conveniently and optimally located. It is extremely important ot locate the nodes close to transport hubs.**

12. Q. Without sounding like an endorsement, would your own informed opinion be that consideration should be given to developing the concept further?

**Yes. Consideration of the HRTLR system would not be wasted effort.**

*End of Civil engineer interview with J. Goodman 10.3.2011, 14.00-15.00 at C & CI Midrand offices, by R. Smith*

**PROJECT MANAGER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

### Assessment of the feasibility of the HRTLR system

*(Interview with J. Henrey, 28.2.2011, 9.00-10.25 at his Sandton office, by R. Smith)*

QUESTIONS POSED TO AN EXPERT IN PROJECT MANAGEMENT

An expert in the project management aspects of construction was presented with an outline of the HRTLR system. The expert was briefed as to how the HRTLR was intended to operate, and was requested to pass opinion as to the workability of aspects of the system, while taking a larger, qualitative view of the entire system.

The transition-to-rail and the rail-carrying components were to be assumed as being workable.

1.Q. Do you think that, provided that the transition and rail-carrying systems are workable, the whole of the HRTLR system could be made to work?

- **Putting the system into existing infrastructure would be difficult. The viaduct that the air would be costly. If it were carried at ground level, it would be cheaper. The raised trackway makes better use of land. The design could be improved. Servitudes from different authorities would have to be considered.**

2.Q. Would the technical requirements pose, in your view and at first sight, any particularly difficult management challenges?

- **Spacing of vehicles must maximise the usage of the trackway. Wide spacing would reduce the capacity of the system. Spacing of vehicles should be optimised. Electronic controls are indicated.**

3.Q. Would the system preferably transport light goods better than people, or would there be an advantage in using the vehicles for both cargo and people?

- **It doesn't matter. Both cargoes clog our roads.**

4.Q. Is there any obvious negative environmental impact from the installation of HRTLR system? (Same question was posed to the urban planner and mechanical engineer).

- **There has to be an environmental assessment before the project proceeds.**

5.Q. Would there be an obvious positive environmental impact from the adoption and installation of the HRTLR system?

- **Saving on other transport. Saving on node infrastructure (stations, pick-up points).**

6.Q. Can you see potential safety hazards in the system as it is configured in outline? Either with the vehicles or with the viaduct?

- **Maintenance teams must be able to obtain access. Automatic control system of the vehicles mus prevent collisions. Electric systems must be made safe to use.**

7.Q. Can you see safety advantages with the use of both the HRTLR vehicles and the viaduct?

- **Separating the vehicles from other traffic lanes is safe. No overtaking removes another hazard. Automatic control helps driver errors.**

8.Q. In your view is the concept design of the HRTLR carrying viaduct unnecessarily complicated? Does it seem to utilize large resources without corresponding benefit to transport?

- **Concept design does not seem unnecessarily complicated. Cost of the elevated viaduct will be higher than a ground-level viaduct. Benefits should outweigh the costs.**

9.Q. Can you see the HRTLR system causing additional costs to passengers and transporters? As a result of the structures required?

- **Any systems will involve costs. A big cost will be the costs of electrical power. Maintenance costs must be factored in.**

10.Q. Does the HRTLR system suggest improved land transport efficiency? (Same question as to urban planner and mechanical engineer).

- **Land use would be more efficient with less land use to carry more vehicles than conventional highways. The system will add to traffic capacity because it can carry more traffic. Energy consumption changes from petroleum fuel used to electrical use.**

  **Locations of the ramps, have to be designed carefully so that they do not add to congestion, otherwise drivers might not use the system.**

  **Construction seems to be more management intensive, and I don't know if we have the capacity in this country at the moment to implement it.**

11.Q. At the most basic level, in your opinion, would or would not an operating HRTLR system improve the functioning of inter-urban-land transportation? (This is the go or no-go question).

- **If the system improves the functioning of city transport if the stations were well located optimally located. Important to locate the nodes close to transport hubs. Location, location, location.**

12.Q. Without sounding like an endorsement, would your own informed opinion be that consideration should be given to developing the concept further?

- **Yes. Anything that improves our road transport is a good thing.**

*End of Project manager interview with J. Henrey, 28.2.2011, 9.00-10.25 at his Sandton office, by R. Smith*

**STRUCTURAL ENGINEER INTERVIEW**

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

### Assessment of HRTLR system

(Interview with J. Goodman 18.3.1011, 14.00-15.00 at C & CI Midrand offices, by R. Smith)

QUESTIONS POSED TO AN EXPERT IN STRUCTURAL ENGINEERING 18.3.2011

An expert in the civil engineering aspects of structural engineering was presented with an outline of the HRTLR system. The expert was briefed as to how the HRTLR was intended to operate, and was requested to pass opinion as to the workability of aspects of the system, while taking a larger, qualitative view of the entire system.

The transition-to-rail and the rail-carrying components were to be assumed as being workable.

1. Q. Do you think that, provided that the transition and rail-carrying systems are workable, the whole of the HRTLR system could be made to work?

**To fit the HRTLR system into existing infrastructure would be a challenge.[04] Using the raised viaduct would be more expensive than if the trackway were carried on the surface at ground level; on the other hand, the raised trackway makes better use of available land. Either method could be used. Servitudes would have to be considered.**

2. Q. Would the technical requirements pose, in your view and at first sight, any particularly difficult structural engineering challenges?

**Plenty of bridges of the same dimensions and load-carrying capacity as the HRTLR viaduct have been built. Their design and construction is no particular problem.[04]**

**The spacing of the vehicles is important in order to maximise the usage of the trackway. Closer spacing of vehicles would mean that more vehicles could travel on the viaduct.[06]**

**Acceleration of the vehicles on the on-ramps would have to be quick, so that spacing on the trackway would be optimised. Slowing down before entering the on-ramp should be avoided.**

3. Q. Would the system preferably transport light goods better than people, or would there be an advantage in using the vehicles for both cargo and people?

**As a transportation system, it would not matter to its operation whether it carried people or light goods.[06]**

4. Q. Is there any obvious negative environmental impact from the installation of HRtoLR system? (same question was posed to the urban planner and mechanical engineer).

**Community objections to the double-decker system and noise problem emanating from the rail. There may also be wind noise from the passage of the vehicles on their elevated trackways.[04]**

5. Q. Would there be an obvious positive environmental impact from the adoption and installation of the HRTLR system?

**There would be a saving on the need for other road transport and rail transport.[04]**

6. Q. Can you see potential safety hazards in the system as it is configured in outline? Either with the vehicles or with the viaduct?

**The electrical system must be made safe to use. Maintenance teams must be able to obtain access. The automatic control system of the vehicles must prevent rear-end collisions. Earthquake effects must be considered in the designs of the viaducts and the vehicles.[06]**

7. Q. Can you see safety advantages with the use of both the HRTLR vehicles and the viaduct?

**Separating the vehicles from other traffic lanes is safer than having them combined. No possibility for overtaking removes another hazard.[06] Automatic control removes driver error.**

8. Q. In your view is the concept design of the HRTLR–carrying viaduct unnecessarily complicated? Does it seem to utilize large resources without corresponding benefit to transport?

**The concept design does not seem unnecessarily complicated. Cost of the elevated viaduct will of course be higher than a ground-level viaduct. But the benefits at first sight suggest that they will outweigh the costs.[03]**

9. Q. Can you see the HRtoLR system causing additional costs to passengers and transporters? As a result of the structures required?

**Inevitably, if you build the system there will be costs.[06] There will also be the costs of electrical power. Maintenance costs must also be considered.**

10. Q. Does the HRtoLR system suggest improved land transport efficiency?

(same question as to urban planner and mechanical engineer).

**Yes. <u>The HRTLR will add to the traffic system's capacity because it can carry more traffic. Land usage would be more efficient</u>[04] (ie less land used to carry more vehicles) than conventional highways. Energy consumption would switch from petroleum fuel used to electrical use.**

**<u>The positions of the on-and-off ramps, in other words the nodes of the system, have to be selected carefully so that they do not add to congestion, but also that they will be convenient to use</u>,[06] otherwise drivers of the HRTLR vehicles may not use the viaduct system.**

11. Q. At the most basic level, in your opinion, would or would not an operating HRTLR system improve the functioning of inter-urban-land transportation? (this is the <u>go</u> or <u>no-go</u> question)

**The HRTLR system would improve the functioning of inter urban land transportation provided that the nodes were conveniently and optimally located. <u>It is extremely important to locate the nodes close to transport hubs</u>.[04]**

12. Q. Without sounding like an endorsement, would your own informed opinion be that consideration should be given to developing the concept further?

**Yes. <u>Consideration of the HRTLR system would not be wasted effort</u>.[07]**

*End of Structural engineer interview with J. Goodman 18.3.1011, 14.00-15.00 at C & CI Midrand offices, by R. Smith*

**FEASIBILITY FINALIZATION MEETING MINUTE**

**Finalization meeting to assess feasibility**

*(Minutes of meeting 31.3.2011, 10.10- 12.15 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB)*

**HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY**

**HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM**

**Water Genetics – Project Managers**

Finalization to assess the feasibility of constructing the HRTLR project for xxxxxx(Client)

Venue : Water Genetics conference room, Gunite House, 37 Koster Street, Booysens

Date : Thursday 31 March 2011, starting 10am

Present : K. J. Cunningham (KJC)

R. Patey (RP)

R. G. Smith (RGS)

G. Gibson (GG)

Meeting as per agenda.

(Meeting scheduled for March 2011 had been postponed).

The meeting commenced at 10:10am.

Opening

KJC welcomed the managers to the finalization meeting for the HRLR project, for which Water Genetics Project Managers had been appointed to assess the feasibility. KJC confirmed that the identity of the client be kept confidential,[02] as it remained a sensitive issue. Patents affecting the project had now been finalized.

Finalization of the feasibility of the project

KJC reviewed the proposed project concept as a mechanism involving individual 2 tonne wheeled urban transport units combined with dedicated routes to enable the transport units to avoid existing roads. The objective of the proposed transport mechanism is reduced road congestion, reduced road usage, reduced land use and reduced oil-based energy consumption of vehicles.

Advanced design and construction of the project is intended to start once feasibility had been proved,[07] political support and funding obtained, and the applicability of various patents held by the client checked out. The location of the initial construction of the project is intended initially to be in Gauteng,[02] as a complement to other urban transport initiatives currently underway, such as Gautrain and GFIP, which uses open-road electronic tolling.

The meeting ended at 3.35 pm.

RGS/ZB

*Feasibility finalization meeting minutes 31.3.2011, 10.10- 12.15 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB*

*End of Feasibility finalization meeting minutes 31.3.2011, 10.10- 12.15 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB*

**FEASIBILITY REPORT MEETING**

## Feasibility report on HRTLR project

*(Minutes of meeting 1.4.2011, 10.00- 13.45 at Water Genetics offices Booysens. Minutes taken by R.Smith and ZB)*

## HYBRID ROAD TO LIGHT RAIL (HRTLR) FEASIBILITY

## HYBRID ROAD TO LIGHT RAIL (HRTLR) TRANSPORTATION SYSTEM

**FEASIBILITY REPORT**

RG reported on the findings of the technical feasibility conducted by interviewing outside experts.

The content of the feasibility assessments showed responses of various feasibility assessors to technical flaws in a concept design were given.

The assessors understood the problem. Levels of qualification and experience. They showed understanding of the concept. Their experience assisted in detecting flaws.

Qualifications

All seven feasibility assessors had tertiary technical qualifications, ranging from a City and Guilds diploma to PhD's. There were altogether one diploma, six BSc's, one MBA, one MA in International Relations, four MSc's and two PhD's in technical fields among

the assessors. Two were, or had been, university professors in Gauteng. Areas of expertise included managing construction or manufacturing companies at a senior level, running scientific laboratories, designing different aspects of other projects, managing projects and research in the field of international relations. Total experience of all the assessors collected in each assessor particular field was 263 years, an average of 38 years per assessor.

Findings

One assessor admitted to lacking design experience. Three said they had sources of additional information or experience on similar but not identical concept systems. One personally gave advice on six parts of the concept design. One referred the project implementer to colleagues who could assist. One assessor did not fully comprehend the concept, and a follow-up interview was conducted with him later to clarify his opinions.

In answering the question as to whether or not technical flaws were directly detected in the concept, the mechanical manufacturer pointed out that the storage capacity of batteries presently available limited range of the vehicles. This affected a vital part of the project concept. The (architect) said that a flaw, that could also be an advantage, was that authorities could use the concept project for taxation purposes. The mechanical engineer found that a high level of skill would be needed to operate the system. Another flaw was that the system did not lend itself to providing multiple departure points.

The urban planner found that the concept project appeared to be expensive to implement. The project manager was of the view that inadequate technical capacity existed at present in the country to implement the concept project as he understood it. Two assessors, the transport economist and the structural engineer, did not directly detect flaws.

As to whether the existence of flaws were detected but not directly indicated to the project implementer, the mechanical manufacturer said that the concept 'reduced the freedom of movement of users'. The architect said the system 'would take some getting used to by users'. The mechanical engineer mentioned possible safety hazards intrinsic in the system. The urban planner said that a similar system of which he had experience was expensive. Three assessors did not indirectly indicate flaws.

On the question as to how the project implementer was informed about flaws, in other words, how did the assessor point out the flaws, the mechanical manufacturer gave his

opinion as to future trends in technical developments in transport. The trends mentioned varied from the way the project concept operated. The architect commented negatively on the ease of usability of the system concept, and advised the project implementer to consider users more. The architect also suggested an alternative to details in the concept design. The mechanical engineer directly mentioned the flaw he had spotted to the project implementer. The urban planner compared the system to a similar technically-novel system of which he had experience, which he said was expensive. The structural engineer did not hint at flaws, but gave advice coming from his experience on six different aspects of the design. The project manager did not seem to understand the concept fully, but did say it was too complicated. (A follow-up interview with the project manager clarified his viewpoint). The transport economist did not spot flaws, but did give general advice, drawing from his own experience of the transport industry.

Planning considerations

The mechanical manufacturer said the project implementer should consider the supply availability of mechanical equipment. The transport economist did not point out any flaws. The architect suggested that his own experience be used by the project implementer to reduce uncertainty. The mechanical engineer said the project implementer should take the design further. The urban planner suggested that alternative routes should be considered. Although the structural engineer had not detected flaws, he did advise on design improvements. The project manager said that the design should be simplified.

Design considerations from the flaws detected

The mechanical manufacturer said that only the project implementer should be informed about the flaws. The transport economist had not detected any flaws. The architect and the mechanical engineer and the project manager said that the original designer of the concept should be informed. The urban planner said that the responsible local authorities should be informed. Although no flaws were detected by the structural engineer, he did advise that the designer be informed about improvements he had suggested.

What effect on planning was suggested by the assessors as to what action should be taken about detection of flaws?

The mechanical manufacturer did not suggest that any action be taken. Although the transport economist did not suggest any action, he did caution that the transport

industry was conservative and not responsive to change. The architect said that there was a need for the project implementer to get more input information. The mechanical engineer said that more design advice should be sought.

The urban planner implied that the project implementer should include a caution to responsible local authorities on the imposition of user charges, as part of the project planning. Because the structural engineer did not detect flaws, no planning action was suggested by him. The project manager said the designer should simplify the design.

What broad appraisal did each feasibility assessor make as to the feasibility of the project?

The mechanical manufacturer did not make a suggestion on the broad feasibility of the project. The transport economist suggested that some type of controlling authority be added to the project plan. The architect suggested that getting users to 'get used to the system' should form part of the project implementation. The mechanical engineer said the design should be taken further. The urban planner said the project was technically feasible and would improve the functioning of the city. The structural engineer said that taking the concept further would not be wasted effort. The project manager said that anything that improved road transport would be a good thing.

Observations drawing from the analysis of the content of the feasibility assessments are made here.

Firstly, on the question of whether the assessors were themselves qualified and experienced to assess the project for the existence of flaws and whether they understood the concept,[02] all were highly qualified and experienced in their fields of expertise. One assessor admitted to not having expertise in one technical field on which he was being questioned. One assessor appeared not to fully understand the concept, and became the subject of a later interview, the results of which will be reported.

Secondly, on the question of whether technical flaws were detected in the project concept, either directly or indirectly, those assessors who did detect flaws appeared to draw their observations directly from their own field of expertise and experience. For example, the architect, experienced in dealing with approvals by local authorities, noted that a flaw, that could also be an advantage, depending on the perspective of entity considering the project, was that the concept system lent itself to taxation by local authorities. Another flaw, detected by the mechanical engineer, was that a high level of operator skill would be needed by users of the system. This view draws directly from

the mechanical engineer's expertise in arranging human-machine interfaces. Indirect detection of flaws were alluded to by the mechanical manufacturer, the architect, the mechanical engineer and the urban planner. The mechanical manufacturer suggested that users might not accept the reduction in freedom of movement intrinsic in the system. The architect indirectly echoed the directly-expressed view of the mechanical engineer that user skill would be needed. The mechanical engineer elaborated his view by indicating possible safety hazards in the concept system. The urban planner hinted that his experience indicated that the implementation of the system could be expensive.

Thirdly, on the question of how the project implementer was informed by the assessor as to the existence of flaws, the mechanical manufacturer did so by giving his overall view of future trends in the road transport industry. These trends were at variance with the project concept under consideration, so the mechanical manufacturer was in effect pointing out a flaw.[04] The architect commented directly on the usability of the system, and directly advised the project implementer to consider users more. The direct approach to flaws was more interventionist than subtle. The architect also directly suggested alternatives to design details.[04] The mechanical engineer also directly mentioned the flaw of the concept system requiring high user skill levels and also that the concept system did not lend itself to multiple departure points. The urban planner informed the project implementer of the existence of flaws by pointing out a comparison of the concept system with an existing system, which had the quality of being expensive. By doing so, the urban planner implied that costliness was a flaw of the system.[04] Neither the transport economist, the structural engineer nor the project manager detected flaws, other than the project manager saying the concept was too complicated.[02] In summary then, flaws were pointed out to the project implementer by assessors by indicating variance of the concept systems with current trends (mechanical manufacturer), directly (architect and mechanical engineer) : and by comparison with an existing system (urban planner). Some assessors did not detect flaws (transport economist, structural engineer, project manager).

Fourthly, on the question of how the detection or discovery of flaws affect project planning, the architect asserted that the project implementer should obtain more input information before continuing with planning. The mechanical engineer asserted that more design advice should be sought by the project implementer to continue planning. The urban planner indicated that the project implementer should include local authorities in the planning.

The other assessors, the mechanical manufacturer, the transport economist, the structural engineer and the project manager, did not indicate how the detection of flaws would affect project planning.

Discussion with RP and GG followed.

Follow-up interview with the project manager who was one of the feasibility assessors

The project manager had said that 'he had prejudices' about using experience when finding flaws in novel projects. The project manager also differed from the structural engineer on who should be informed about flaws in the project concept. The structural engineer said 'do not inform the sponsor', whereas the project manager said 'inform only the sponsor'. The lack of comprehension of technical aspects of the novel project also suggested the need for a follow-up interview with the project manager. This was conducted on 24 August 2013 by telephone by Ronald Smith, and had duration of 40 minutes. During this interview, the project manager was asked whether, as a working construction project manager, his firm actually carries out independent feasibility assessments of new projects. 'We do not' was his reply, 'by the time we get the brief, the client pretty well knows what they want. It's our job to implement the brief'. The project manager also gave his view of what a construction project manager does : 'It's our job to see that other professionals and contractors do their jobs'.

General discussion with KJC, RP and GG followed.

The meeting ended at 13h45.

# CASE STUDY B – CODES & UNDERLINING – HARD COPIES OF DOCUMENTS AND INTERVIEWS

## Data collection instrument for Case Study B

Extracts from documents relating to feasibility assessment of Project B

Sources of views collected in data collection instrument (these correspond to the 'subjects examined' in Case Study A)

| Date | Subject | Source |
|---|---|---|
| October 2011 | On the overview after completion | Extracted from Jensen (2011) |
| 19/08/2013 | On the assessment process | Extracted from Jensen (2011) |
| 19/08/2013 | On what constitutes feasibility | Extracted from Jensen (2011) |
| 19/08/2013 | On economic feasibility | Extracted from Gautrain Feasibility Report, Studies and documents, Gautrain |
| 19/08/2013 | On feasibility requirements from Government's perspective | Extracted from Gautrain Feasibility Report, Studies and documents, Gautrain |
| 19/08/2013 | On feasibility requirements from the perspective of the private sector | Extracted from Gautrain Feasibility Report, Studies and documents, Gautrain |
| 19/08/2013 | On feasibility requirements of the PPP-unit of National Treasury | Extracted from 'Studies and documents, Gautrain' |
| 19/08/2013 | On optimising the system design | Extracted from 'Studies and documents, Gautrain' |
| October 2011 | On programme milestones | Extracted from Jensen (2011) |
| 13/05/2015 | Overview on the feasibility assessment of Gautrain | Interview with the Gautrain lead project manager (Telephone interview by R. Smith) |

**The feasibility assessment process of Case Study Project B (Gautrain)**

*Confidentially concerns by Gautrain management precluded this researcher from obtaining raw data on the feasibility assessment process used by case study B. the Executive Manager : Operations and Maintenance deemed the information as rated confidential and could not be made available for research purposes. (Van der Westhuizen, M, 4 November 2013 – Personal communication with the researcher). However, the approach to the feasibility study is in the public domain. The approach is given below, drawn from Gautrain's own publications.*

## On the overview after completion- Jensen

*(This text is drawn from Jensen, Ingrid 2011 'Gautrain : for people on the move' – Gautrain Management Agency – Johannesburg : -*

'It was because of the foresight, steadfastness and commitment of government, particularly the Gautrain Provincial Government, which made the project – initially scorned by some – a reality. It took years of hard work and tough negotiations. The project faced criticism, some came from politicians and some from academics. There was also some criticism from the media and affected residents. It took the project team many thousands of hours of tough negotiations with residents, bidders and bidding companies. (Jensen 2011 p.2).

Financial analysis

For the project to succeed, it had to be financially viable. Potential investors required a comprehensive feasibility report stating clearly government's viewpoint of the project and indicating project viability with sufficient information to judge for themselves the feasibility of the project. This was judged in terms of financial and technical feasibility.

Financial feasibility meant that the benefits accruing to the broad community, usually measured in monetary terms, had to be higher than the cost of undertaking this project. For this purpose, the benefits, even the value and quality of life and travel time saving, had to be quantified and put into monetary terms to compare these with the project costs.[01] In addition, the future value of money had to be determined to compare the future benefits with current construction costs (Jensen 2011 p.24).

The financial analysis concerned the potential "Build, Operate and Transfer" concessionaire who would invest in, construct, operate and maintain the rail transport system. This analysis was largely related to the bankability of the project that was very important to ensure private sector interest and competition in the tender process.

The studies that had to be done were about :

- Acceptable travel fares,[04]
- What constituted a sufficient number of passengers,[04]
- Acceptable profit and risk levels for the investors and operation,
- Acceptable investment levels, and an
- Acceptable and affordable government subsidy level.

It was also important to identify the risk that could impact on the project.[01] This was firstly important with regard to the feasibility and to enable the project planning and design tasks to address these risks.

Other financial risks were :

- Inflation rate,
- The exchange rates,
- Country taxes,
- Interest rates,
- Changes in the unemployment rate, and
- Fares charges by parallel public transport; the cost of fuel versus the cost of electricity, toll charges[01]and accuracy of cost estimates.[05]

Cost analysis

The approach was to reduce life cycle costs to government, attract private sector interest, create a bankable development, satisfy public transport needs, enhance economic development and transfer the risk to the party who could best control it.[01]

Cost were determined based on information obtained from manufacturers and suppliers, as well as benchmarking against international examples. Information was obtained from international examples by means of a literature survey, in-depth discussions with main total rail system suppliers, and by visiting a number of systems in Europe, Britain, South East Asia and the United States. Local rates were used for civil construction work and the cost analysis was done on the planned system and included all components.

Most risks were contained and the fact that Government subsidised its share of the capital cost up front, instead of spreading it over the life of the project, meant that future generations will have no or very limited liability towards the operations. The greatest

risk remained potential ridership, but the evidence in favour of compelling pressures to induce passengers to use the Gautrain was substantial.[04] (Jensen 2011 p.25).

Gautrain was found to be feasible

The professionalism exhibited in project preparation gave no cause for concern. However, it was important to ensure that key performance indicators were established and monitored regularly by the provincial authorities in consolation with appropriate stakeholders (e.g through third party agreements with local authorities). A further mitigation measure suggested was to develop a transport strategy linking travel demand management of the road system,[01] the efficiency of the Gautrain feeder and distribution system and the level of ridership of the Gautrain itself (as required by the National Land Transport Transition Act, No. 22 of 2000). (Jensen 2011 p.26).

**End of 'On the overview after completion- Jensen'**

## On the assessment process- Gautrain management

*The following information was dated 19 August 2013 and drawn from 'Studies and Documents, Gautrain - The Gautrain Project' http://www.gautrain.co.za. The text has been shortened.*

A detailed description of the assessment process used by the project team to determine the feasibility of the project - Approach to feasibility analysis

1. Introduction

This section describes the criteria and the approach used by the Project Team to assess feasibility, and the requirements that have to be met before the project can be implemented successfully. After the feasibility criteria and requirements have been described, a short description of the feasibility approach is given. The Project Team used the feasibility criteria and requirements both in planning the project and as part of this Feasibility Analysis.

The following questions are typically asked when considering whether or not a project is feasible :

- Is the project possible?[04]
- Is it affordable?
- Is it needed?[02]
- Will it be acceptable?[04]
- Is it beneficial?[07]
- Will it be worthwhile considering the input needed to implement it?
- Is this project appropriate for funding from Government investment funds?[01]
- What is the best way to implement the project?

As many role-players will be involved in this project and many stake holders will be affected, the Feasibility Analysis had to be considered from a number of perspectives,[01] namely :

- The users (passengers on this system once commissioned)
- Other passengers travelling in the corridor
- The broad community, i.e. residents of the Province of Gauteng (South Africa)
- Government (all three spheres, but more specifically the Gauteng Provincial Government)
- The private sector, and more specifically, the successful bidding company or consortium (including construction, financing, suppliers and the operating company responsible for operations and maintenance).

In the final instance, the project must be acceptable to the Gauteng Provincial Cabinet in its capacity as owner of the project.[07]

Feasibility (and more specifically, financial viability and bankability) was a goal both in the Feasibility Analysis, as well as the planning of the project.

This is important for the following reasons :

- To ensure the interests of the private sector, business entrepreneurs, funding institutions, financiers and bankers.
- To ensure that competitive tenders, and hence financial implications acceptable to government, are achieved, with the role-players being well informed[04] about the potential benefits, costs and risks involved.
- To ensure that the project does not fail after construction has commenced[07] and especially after operations have commenced (the implications will be difficult to handle).

To summarise, the main aim is to determine what conditions should be met :

- For Government and private sector companies to support and implement the project
- To avoid implementing a project that is not feasible or viable,[06] with major consequences in the long term
- To avoid incorrect decisions,[06] which could result in major problems
- To cover all crucial aspects and undertake an in-depth study to minimise the probability of default in the project[06]

The criteria had to take into account the main goals of the project. These goals include :

- Stimulating development, growing the economy and creating job opportunities
- Changing the urban structure
- Bringing about socio-economic improvements for the population of the Province

- Changing the economic base of Gauteng
- Focusing on public rather than private transport[04]
- Stimulating tourism development and assisting the promotion of tourism
- Assisting the development of Small and Medium Enterprises (SMEs)
- Contributing towards Black Economic Empowerment

In addition, the guidelines and requirements of the PPP-Unit of the National Treasury[04] for the acceptance and implementation of Public Private Partnerships (PPP's) are important goals, particularly where private sectors and international funding is involved.

**End of 'on the assessment process- Gautrain management'**

## On what constitutes feasibility- Gautrain Management

Feasibility can be considered firstly as the general factors that should be present to make the project possible (in terms of the broad description of feasibility) and, secondly, as those criteria that have to be met for Government to accept the project as feasible.[01] For a PPP-type project of this nature, it also includes those pre-conditions that should apply in order to interest the private sector in investing in this project,[01] as well as those which the PPP-Unit of the National Treasury may lay down.

From an analysis of the input and the characteristics of this particular project, it is considered that the requirements of feasibility are :

- Technically possible
- Political will to undertake the project exists
- Environmentally feasible
- Socio-politically acceptable (including acceptable to the community)
- Legal and institutional powers exist
- Affordable to Government, users and investors (financial feasibility)
- Will involve the private sector, with acceptable risks in relation to profits

A number of additional aspects are covered in the Feasibility Analysis. These are mainly those determining whether it is worthwhile to undertake the project[07] or the best solution for the problem,[07] rather than determining whether it is possible, although the latter are usually also included in the Feasibility Analysis. This is measured as the relationship between the benefits and costs of the project for the community affected.

Broad description of feasibility

Feasibility implies that the project can be done. This is judged in terms of :

Technical Feasibility

Technical Feasibility means that all the criteria are met which will indicate that it is technically possible to implement the project.[04] These are mainly the physical elements, but also include the use of appropriate technology, acceptable reliability and technical risks, the possibility of maintaining or replacing parts and components, etc. Some practitioners even include an assessment of whether it is technically possible within the stated budget constraints.

**End of 'On what constitutes feasibility- Gautrain Management'**

## On economic feasibility- Gautrain Management

Economic Feasibility

A project is considered economically feasible when the benefits that will accrue to the broad community[04] (often measured in monetary terms) are greater than the cost of undertaking the project. This, in other words, implies that consideration be given to whether "it is worth it".

The benefits concern the welfare of a defined group of people, in this case the residents of the Province of Gauteng. A macro-economic perspective is therefore used. For this case, market prices are often adjusted by means of shadow pricing techniques. This is because market prices are often distorted for political reasons.[03] Taxes and subsidies are ignored[03] (as these entail considering cross-allocations within the community which are not applicable to economic feasibility assessments).

For this purpose, the benefits (even the value of life and savings in travel time) can be quantified and put into monetary terms in order to compare them with the project costs.

Financial Viability

Financial analysis concerns the financial position of a person, firm or organisation, so that both costs and benefits are measured in terms of money spent or received by that party, regardless of whether the prices are a good reflection of true value. This kind of analysis includes taxes and subsidies.

As financial analysis needs to be done from a single perspective only, it usually has to be done for more than one organisation. For a project of this nature, such an analysis had to be done for :

- The Operating Company / BOT Concessionaire, who will invest, maintain, operate and manage the rail transport system

- Government (Gauteng Provincial Government and the relevant local municipalities), who has to contribute financially to establish the system
- The potential passengers, who will decide whether or not to use the proposed system; this was addressed in the Modal Choice and the Demand Forecast Models[04]

Socio-political Acceptability

This measure of feasibility considers the acceptability of whatever the project entails to the communities affected by the project. it also includes aspects such as whether or not the project meets Government objectives and goals, such as job creation, transformation and creating opportunities for SMEs. (This should not be confused with political decision-making as to whether or not to continue with the project).

Environmental Impact

One of the interesting challenges for the Project Team was to handle environmental feasibility. International research found rapid rail systems to be a superior form of transportation from an environmental impact perspective.[06] In terms of current environmental legislation, a project of this nature requires a comprehensive Environmental Impact Analysis (EIA) undertaken by independent consultants. Despite the official appointment of such consultants, the Planning Team could not ignore this issue and undertook an Environmental Feasibility Analysis.[04] The aims were to identify sensitive areas and to investigate possible fatal flaws. No evidence of fatal flaws was found. However, this project will be subjected to a full EIA during the coming year.

**End of 'On economic feasibility- Gautrain Management'**

## On feasibility requirements from Government's perspective

Feasibility requirements from Government's perspective

As previously mentioned, the Gauteng Cabinet accepted the Gautrain Rapid Rail Link (Gautrain) as one of the ten SDI (provincial Spatial Development Initiative) projects to be implemented. The political will to implement this project has thus been illustrated.[07] This is the reason why the current study is not only a feasibility study, but a planning and implementation study leading to a tender process.

However, it is important that, firstly, the project should have the support of the government and community representatives in Gauteng and, secondly, that the project does not fail, as this may have a major negative impact on the province and on Government.

Feasibility from Government's perspective can therefore be described as ensuring that the following criteria are met :

- Technical feasibility (the project should not fail technically)[04]
- Social acceptability (the community should provide broad support for the project)[07]
- Financial affordability (this includes the ability of Government to afford its financial contributions to the project.[04] Government is also interested in bankability insofar as there may be a risk that the operator / successful concession company may suffer financial problems, with a negative impact on the project itself)
- Environmental feasibility (the project should be environmentally sustainable and should not have any fatal flaws)[04]
- Economic feasibility (the project must be worthwhile and this should be known to the public)[04]

**End of ‘On feasibility requirements from Government’s perspective’**

## On feasibility requirements from the perspective of the private sector

Feasibility requirements from the perspective of the private sector

The interviews with the potential bidding companies gave a wide range of information requirements prior to deciding whether or not to invest in this project. These requirements differ from institution to institution and from person to person. However, some common requirements have been identified. From this information, it was found that potential investors would want to know that a comprehensive feasibility study had been undertaken and what Government's official point of view of the feasibility of the project was. They would also require sufficient information to determine and judge for themselves the feasibility and, more specifically, the bankability of the project.

The private sector would therefore like to know the following about the project :

- Bankability and financial viability (potential profits vs risks)[04]
- Technical feasibility[04]
- Political will[07]
- Environmental viability[07]
- Social acceptance[07]
- Risks[04]

Summary

The feasibility information required by the public and private sectors is as indicated in Table 3.1 (on the understanding that all parties need to be satisfied that the needs of the other role-players have been met before they can enter into a public-private partnership) :

Table 3-1 : Feasibility information required by the public and private sectors

| Feasibility Element | Private Sector | Public Sector |
|---|---|---|
| Bankability | X | X |
| Financial viability | X | X |
| Technical feasibility | X | X |
| Political will | X | X |
| Environmental feasibility | X | X |
| Social acceptance (project will not be opposed) | X | X |
| Commercial risks | X | X |
| Socio-political acceptance | X | X |
| Economic feasibility (cost vs benefits) | X | X |

**End of 'On feasibility requirements from the perspective of the private sector'**

## On feasibility requirements of National Treasury

Requirements of the PPP-unit of National Treasury

The Cabinet endorsed the Strategic Framework for Public-Private Partnerships in December 1999. Treasury Regulations were published in April 2000 in terms of the Public Finance Management Act (Act No. 1 of 1999) to govern their implementation. The South African Treasury criteria that Public-Private Partnership (PPP) arrangements must, among others :

- Demonstrate value for money,[04] for example by enabling departments to achieve more with the same resources or as much with fewer resources
- Be affordable, i.e. fit within a department's budgetary parameters[01]
- Be procured using transparent and competitive processes[07]
- Show evidence of substantial risk transfer from the department to the private sector[07]
- Be implemented within a sound suitable project management and administrative structure[01]

The Treasury Regulations require accounting officers to ensure that a feasibility analysis is conducted to assess whether a proposed PPP agreement will be in the best interest of both the government and the public.

Treasury approval is only required in those stages that affect expenditure control and the prudent use of state resources.

- Treasury authorisation I – Demonstrating "Affordability"

  The first Treasury authorisation entails the submission to Treasury by the sponsoring department of a feasibility study, which must demonstrate "affordability", as well as provide an initial indication of how "value for money" will be achieved, through appropriate risk transfer. Approval by Treasury allows

the sponsoring department to proceed with the drafting of the necessary tender documents and draft contracts.

- Treasury Authorisation II – Demonstrating “Value for money”

  The second Treasury authorisation entails the submission to Treasury by the sponsoring department of the draft request for proposal (RFP) and draft contract documents, their distribution, the conduct of the “value-for-money” test, and the selection of a preferred bidder. Approval by Treasury allows for the appointment of the preferred bidder and the negotiation of the PPP contract, leading to financial closure.
- Treasury Authorisation III – Financial Closure

  The third Treasury authorisation entails the submission to Treasury by the sponsoring department of the proposed final contract for the approval of all budgetary commitments attendant to the agreement. Approval by Treasury allows this to be signed by the parties. The documents contain a comprehensive description of the PPP guidelines and requirements.

**Summary**

By considering the following facets of feasibility, this project was assessed to be feasible :

- Technical feasibility
- Economic feasibility
- Socio-political feasibility (public acceptability and legal / institutional ability)
- Financial feasibility and bankability
- Environmental feasibility
- Compliance with the specific requirements for a PPP
- The Gauteng Provincial Cabinet’s decision to continue with the development of the project

## On optimising the system design- Gautrain Management

One of the difficulties encountered by the Project Management Team was the large number of inter-dependent project elements that had to be addressed simultaneously. International indications are that a typical modern airport link or rapid rail system takes, on average, 14 years to plan and construct, but this was beyond the acceptable time-frames allowed for the project. It as therefore necessary to fast-track the project process, which required simultaneous planning for the various multi-disciplinary elements. This, in turn, made project communication even more important than in other, more conventional projects.

The stations were used as a convenient starting place for most elements, as it was here that there was most interaction since almost all the elements had some factors in common at the stations. Another challenge was to optimise the system design. The optimisation process could only be achieved using an iteration approach.[04]

During the first phase of the project, a number of adjustments were made to move towards optimisation of the design, but the final optimisation will be the responsibility of the successful bidding consortium which will do the detailed design. The opinion of the Project Team is that there is sufficient evidence to move towards implementation. The next step would be to optimise the life-cycle cost of the project. The challenge will be to optimise the initial construction costs against the ongoing operational and maintenance costs.[04]

**End of Document**

Date : 19.08.2013

Subject : **On optimising the system design**

**End of ‘On optimising the system design- Gautrain Management’**

## On programme milestones

Programme milestones

*(From Jensen 2011, as an insert between p.3-7):*

'The Gautrain pre-feasibility study was initiated in 1998 and completed in 1999

- In February 2000, the Gauteng Province Government announced the Gautrain, a new rapid rail system
- In April 2000, a team of three technical consultants was appointed
- Later during 2000 the other transaction advisors were appointed
- In June 2000 the conceptualisation report for Gautrain was completed and submitted to the Gauteng cabinet
- February 2000, the project leader was appointed. The project leader right from the onset was Jack van der Merwe who initially was also the head of the Gauteng Provincial Department of Public Transport, Roads and Works
- One of the most important initial decisions in the project was to make it a Public Private Partnership[01] (PPP) in terms of the Public Finance Management Act. That determined the studies that had to be done, the approval process, the procurement process and most important, the nature of the Concession Agreement that would make it fundamentally different to a large traditional construction project. Because of the decision to make it a PPP project, the PPP Unit of National Treasury commenced to play a very important part in the project. Especially for the assessment of the feasibility study, they brought the assist of the PUK in – the PPP unit of the British Government who had experience of similar type projects[02]
- A comprehensive feasibility study had to be done which had to be revised every time there were fundamental changes to the project. This happened twice. These studies had to look at value for money, a public sector comparator and also affordability which, inter alia, caused an investigation into the constitutional responsibilities of Provincial Government and the finances required for that.[04] Especially that of its social responsibilities. In these studies a number of benefit-cost studies were done. In PPP projects risk transfer is a very important aspect. Risk must be identified, quantified and allocated to a body best equipped to mitigate it
- After the Conceptualisation Report, the next important task was to determine the location of the route and the stations
- A number of key nodes in Gauteng were also identified for the location of stations. However, only those nodes that fell within the core demand area were considered for the first phase of the development of the Gautrain

- The Gautrain Special Development Framework (GSDF) was analysed for compatibility with the proposed rapid rail link.[04] It was concluded that the Gautrain project would complement the GSDF in terms of the latter's fundamental principles, such as enhancing mobility and accessibility, retaining and strengthening Gauteng's economic base, containing urban sprawl and re-directing urban growth to address distorted settlement patterns
- One of the important parts of the feasibility study was the demand determination to predict the number of passengers and thus also the possible annual revenue.[04] Several traffic surveys were done in this study and local and international experts were obtained to review the study
- July 2000 the first Consultative Conference, especially with Local Government was held
- At the same time, consultation started with a whole range of stakeholders
- The Project Management Structure initially included
  - Consultants' Committee
  - Provincial Project Committee
  - Project Review Committee and
  - Provincial Steering Committee
- July 2000 a feasibility report on the proposed project was completed
- Several Local Government Summits were held
- In August 2001 political visit to Germany, France, Luxembourg and the United Kingdom to hold discussions with development agencies and possible investor
- September 2001 International Investors Conference was held
- In January 2002 the Environmental Impact Assessment commenced
- In February 2002 the first Public Private Partnership Treasury Authorisation of feasibility was received as well as permission to issue the Request for Pre-qualification (RQF)
- During April 2002 ten RFQ submissions by prospective bidders were received
- Two pre-qualified bidders were announced in May 2002
- The Request for Proposals (RFP) Phase I documents were issued to the pre-qualified bidders during June
- During October 2002 the Draft Environmental Impact Assessment Report was published for comment
- In September 2002 the second PPP Authorisation to issue the final RFP Phase 2 documents received
- The RFP II documents were issued to bidders soon thereafter
- In December 2002 comments closed on the Draft Environmental Impact Assessment Report
- In April 2003, the final EIA Report was submitted to the Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACEL)
- In September 2003 the GDACEL issued their Record of Decision (RoD) on the EIA. This RoD basically approved, from an environmental perspective, the Gautrain Project and the proposed route based on certain conditions
- September 2003 bid submissions by pre-qualified bidders were also received and the evaluation of the submissions commenced
- In 2004 an analysis of the RFP II submissions indicated that the proposals exceeded the affordability limit of the project as determined in Treasury Authorisation I
- On 26 April 2004, the Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACEL) released an amended Record of Decision (RoD) on the Environmental Impact Assessment (EIA) after the consideration of comments and input from the public
- The feasibility of the project, including several cost-benefit studies was reviewed

- In October 2004, National Cabinet gave its financial support for the project and agreed that National Government would carry joint financial responsibility for the contract price with the Provincial Government. One of the conditions was that the project had to be properly integrated with other public transport in the area
- In November 2004, approval was received to issue RFP III which was also called a Best and Final Offer
- In January 2005, the Best and Final Offer (BAFO) documents received from bidders with final documents (FBAFO) received in March
- A very comprehensive evaluation of the bid submissions according to a previously approved procedure followed
- On 15 April 2005 the Gauteng Department of Public Transport, Roads and Works published a notice for the route determination of the Gautrain in terms of the Gauteng Transport Infrastructure Act (GTIA) in the Gauteng Provincial Gazette
- July 2002 the preferred bidder, the Bombela Consortium, was announced by the Premier after the whole Provincial Cabinet considered the outcome of the evaluation
- On 15 February 2006, an Early Works Contract was signed between the Gauteng Provincial Government and Bombela Consortium. This allowed for important preliminary work on the relocation of utility services to commence
- On 9 March 2006, the preliminary design for Gautrain in terms of the GTIA along all sections of the route that have not been subject to variant alignments proposed by the preferred bidder was agreed to by the MEC for Public Transport, Roads and Works in Gauteng
- On 18 August 2006, the Draft Final Environmental Management Plan for Gautrain was conditionally approved by GDACE
- On 28 September 2006 the Premier announced that the negotiations with Bombela had been finalised and that the Concession Agreement had been signed. The preferred bidder since 2 July 2005 thereby became the official Concession Company for Gautrain
  - Official commencement of construction
  - New Gautrain brand is launched[07]
  - *(This is the decision to proceed)*[07]
- Financial Close was reached in 25 January 2007 – negotiations with lenders to fund its R3.1 billion commitment to Gautrain were finalised with Bombela
- On 4 February 2007 the implosion of four buildings which made way for the Gautrain took place
- On 13 December 2007 launch of Tunnel Boring Machine (TBM) at Rosebank station
- On 8 July 2008 custom branded in Gautrain's distinctive golden colour, the first four-car train set was proudly handed over to the Gauteng Provincial Government at Bombardier's Derby assembly plant in the United Kingdom
- On 28 September 2008 first tunnel break through
- October 2008 first fully assembled train car left Derby in the United Kingdom
- On 1 December 2008 the first shipment of two completed rail cars arrived in Durban
- On 30 January 2009 Gautrain's Tunnel Boring Machine, Imbokado, completed its last metre for the project before being powered down
- On 3 February 2009 guests gathered at the Gautrain depot in Midrand for the official welcome ceremony celebrating the first completed train set to its operational home
- On 31 March 2010, first train car assembled in South Africa arrived in Midrand
- On 29 May 2010, all trains to be ready for Operation Commencement Date 1 are in Midrand

- On 11 September 2010 excavation of Gautrain's 15 km tunnel is complete
- On 5 June 2010 the Gautrain celebrated its commencement of operations
- On 8 June 2010 during the first hour that Gautrain commence operations, nearly 1000 passengers used the service between Sandton and the OR Thambo International Airport

- 2 August 2011 the first commercial rides between Johannesburg and Pretoria

*(Effective completion of project)'*

**End of 'On programme milestones-Jensen'**

**Interview with the Executive Manager,Gautrain**

**Interview transcript**

Date : 13.05.2015

Subject : **Overview on the feasibility assessment of Gautrain**

Source : Interview with the Gautrain lead project manager (Telephone interview by R. Smith)

## Purposive interview with the executive manager responsible for putting together a feasibility report - Gautrain project

(Participant was approached as the executive lead project manager who put together in the feasibility study of the Gautrain transport project for Gauteng)

Date : 13.5.2015, Wednesday

Time : 07:35 – 08:10am

Duration : 35min

Subject : Factors that influence putting together the feasibility report

Field of expertise of participant : Project Management

Location : Telephone to Gautrain Management Agency, Midrand, from Booysens, Johannesburg

Participant had earlier been willing to undertake a face-to-face interview, but had been off ill, and so agreed to a telephone interview as he was trying to catch up with his work.

Interviewer : R. Smith

Interview taped initially on an Olympus Pearlcorder S930, then hand-transcribed by the interviewer, then typed by ZG.

## Interview with the Executive Manager Gautrain (GLP)

Purpose of interview :

This will be a purposive interview intended to obtain the perspective of the person responsible to the project promoter for establishing the feasibility of the project. To probe the GLP's views on what factors influence the constraints and viability of a project from the perspective of the lead project manager charged with putting together the feasibility study report.

**Transcript**

13.5.2015 Starting at 7:35 am

(Interviewer greets and explains generally what he is trying to find out about how the constraints and viability of a project is reviewed and resolved)

I: When you looked at the Gautrain project, what did you look for? What do you personally understand as being the meaning of the word 'feasibility' of a project'?

GLP: I'm writing something to you on this. I just haven't had a chance. As you know, I've been off ill.

(Some discussion ensues about the GLP's illness)

I: But how do you yourself understand 'feasibility'?

GLP: I see 'feasibility' as 'can a project pay'.[04] Is it worth doing or not?

I: Would you call what's wrong with a project 'flaws'?

GLP: Flaws are risks to a project. There has to be a model of everything the project is. We have to create (? This word is not clear : I) a model.

Is it technically possible?

Is there political will?

Is it environmentally feasible?

Is it acceptable to the community?

Do legal powers exist?

Is it affordable?

Does it involve the private sector?

Would it be worthwhile doing the project?[04]

(GLP appeared to be reading off a document : I)

I: What else would you look for?

GLP: I would also look at : are there risks and weaknesses in the project?[04] There might also be opportunities.

I: What strengths and weaknesses would you look for?

GLP: Technical feasibility is one. Technical feasibility means that it is technically possible to implement the project. These are mainly the physical elements, but also include the using appropriate technology, acceptable reliability and technical risks, maintaining and replacing parts.

A project is economically feasible when benefits to the community are greater than the cost of undertaking the project. "Is it worth it". What problems come up once the project is working.

I: What projects are not worth it?

GLP: Projects are worth it when the benefit to the community outweighs the cost. Projects often don't work the way they were intended to work.

I: Would there be any way that one could tell up front that a project would work before we start spending massive amounts of money on it?

GLP: You have to look at the project's risks. Can the project pay?

I: How do you personally interpret the word 'feasibility'?

GLP: Feasible is if something pays.

I: Do you think there is a way of spotting problems ('flaws') in the project concept up front?

GLP: Treasury requires a very thorough analysis of the feasibility.[04] They have to be done by expert practitioners who have knowledge of particular (technical) aspects.

I: Might the outside people (experts) be biased in their views?

GLP: It depends how professional they are.

(Some discussion was lost again : I)

I: Is there any way of ensuring that they are not biased and their opinions are valid?

GLP: There have to be separate opinions and different viewoints.[04]

I: How would you go about it, if you were doing it? (ie : assessing a project for viability).

GLP: Use the Treasury regulations on how to do feasibility studies.

I: What would you do if you did spot a flaw in the project concept?

GLP: That could affect the whole project report.

I: How do you think detected flaws affect planning?

GLP: If you follow up doing a feasibility study.

I: Thank you. Is there anything you would like to add about how you would go about finding the viability and constraints of a project concept?

GLP: Is the project needed? Is it technically implementable and sustainable? Is it politically and socially acceptable? What are the environmental impacts? Does it benefit the community? Is it affordable?[04]

I: Do you mean owners of the project, or users of the project?

GLP: All stakeholders have to be considered.[01]

I: Thank you for your time. I really appreciate it.

(Interview ends at 08:10 after 35mins)

**End of Interview transcript**

Date : 13.05.2015

Subject : **Overview on the feasibility assessment of Gautrain**

**End of 'Interview with the Executive Manager Gautrain'**

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