



**Decision Making in Darkness: an Analysis
of Initial Decision Making Prerequisites in
Public Projects in Iceland**

by

Andri Már Reynisson

Thesis

Master of Science in Construction Management

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Thesis submitted to the School of Science and Engineering
at Reykjavík University in partial fulfillment
of the requirements for the degree of
Master of Science in Construction Management

January 2012

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Abstract

Large public projects in Iceland suffer from frequent cost overruns. No indications of increased accuracy in estimations over time and with increased experience are visible. These estimations are amongst the foundations or prerequisites of initial decisions of undertaking large public projects, using public funds.

Prerequisites for decisions should be reflected in the outcome of the decision, along with other environmental factors that are beyond the control of management. Two of the prerequisites for initial decision making and selection of public projects in Iceland are the knowledge of decision makers in Parliamentary committees and the guidance for decisions that is provided in guidelines for decision making and project selection.

In this dissertation, the consistency of these decision making and selection prerequisites to best practices is benchmarked. Best practices are divided into four fields of practices from project management and decision analysis.

The findings indicate significant gaps between best practices and the analysed prerequisites of decision making and selection of large public projects. Among further findings presented, the presence of cognitive bias was confirmed amongst decision makers and the majority of Members of Parliament consider it important to issue a benchmark of recognized and defined methods that committee members could use to assist them in decision making about important issues.

Issuing of formal benchmarks in consistency with best practices for initial decision making and selection of public projects in Iceland is suggested as a long term solution. For short term improvements, implementation of methods from the Green Book, the UK guideline for public project decision making and project selection, is suggested.

Keywords: Decision analysis, project management, risk management, public projects, cost overruns.



Útdráttur

Stór opinber verkefni á Íslandi fara oft fram úr kostnaðaráætlunum. Engin sjáanleg merki eru um aukna nákvæmni í áætlunum með aukinni reynslu. Þessar áætlanir eru meðal forsendna þess að ráðist er í opinber verkefni, fyrir skattfé.

Forsendur ákvarðanatöku ættu að endurspegla þá niðurstöðu sem ákvörðunin leiðir af sér, ásamt öðrum þáttum í umhverfinu sem ná út fyrir áhrifasvið stjórnenda. Tvær af forsendum fyrir upphaflegri ákvarðanatöku og vali á verkefnum eru þekking ákvarðanataka í þingnefndum sem fjalla um opinber verkefni og þær leiðbeiningar sem eru til staðar fyrir slíka ákvarðanatöku.

Í þessari ritgerð eru þessar forsendur ákvarðanatöku og vals á opinberum verkefnum bornar saman við bestu aðferðir (best practices) í ákvarðanatöku frá verkefnastjórnun og ákvarðanagreiningu, sem skipt er niður í fjögur svið.

Niðurstöður benda til töluverðs bils milli bestu aðferða og forsendna fyrir ákvarðanatöku og vali á stórum opinberum verkefnum. Meðal annarra niðurstaðna verkefnisins eru staðfesting á huglægri bjögun ákvarðanataka í þingnefndum og að meðlimir þingnefnda telja það mikilvægt að gefin verði út viðmið um viðurkenndar og skilgreindar aðferðir í ákvarðanatökuaðferðum sem nefndarmenn myndu nota sér til aðstoðar við ákvarðanatöku um mikilvæg málefni.

Útgáfa slíkra viðmiða, sem eru í samræmi við bestu aðferðir í ákvarðanatöku og vali á opinberum verkefnum á Íslandi, er lögð til sem langtíma lausn á vandamálinu. Úrbótum til skamms tíma mætti koma fram með upptöku leiðbeininga frá Green Book, leiðbeiningar frá Bretlandi um ákvarðanatöku og vali á opinberum verkefnum.

Lykilhugtök: Ákvarðanagreining, verkefnastjórnun, áhættustjórnun, opinber verkefni, kostnaðar framúrkeyrslur.



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1. Introduction

1.1 Background of the research

In the year 2009 an agreement was made between the Icelandic Ministry of Finance and the School of Science and Engineering at Reykjavik University. This agreement stated the Ministry's will to support a program entitled *Improvement of the Public Project Lifecycle* (IPPL). The program is intended to explore project management practices, in accordance with its current definition as a general management tool (Kerzner 2007), incorporating elements from Prospect Theory (Tversky & Kahneman 1974) and Decision Analysis (Goodwin and Wright 2010). The public project was defined in sixteen chronological segments and four decision points called the *Optimal Public Project Lifecycle* (OPPL), partly inspired by the OGC GatewayTM Process. Each segment can therefore be studied separately and from various academic and theoretical viewpoints. Three of the segments are excluded from the IPPL program, either because they fall outside the public domain, or because they are not a part of the engineering practices under scrutiny. For example, the segment "Design" is normally outsourced and not a part of public operations and the segment "Contracting" is a legal matter. OPPL serves the purpose of providing the structure for this research.

During the IPPL program a number of benchmark studies are conducted on topics such as strategic management, decision analysis and project management.

The program addresses most levels of the public hierarchy involved in project management, from the Parliamentary committees involved in the initial decision making to the ministries responsible for preparing the project and the institutes and public companies responsible for executing the project. The program also investigates specific large projects.

The objective of this research is to gain understanding of current applied practices and benchmark them against best practices as they are defined in literature about project management and decision analysis.

If a gap between the "as is" situation and best practices is confirmed the results will help us to understand why public projects constantly suffer from cost overruns, late schedules and hefty debates. Furthermore, as this research focuses specifically on engineering practices, the results will provide guidelines on how to improve management procedures and processes on the tactical level.

1.2 Statement of the problem

The decision of whether or not to undertake a public project involves the processing of multiple interrelated decisions that eventually affect the project outcome. Thus, it is essential that the decision is based on solid foundations of data and information. These foundations are extremely important, as they control the effectiveness of the decision-making process, namely that the "right" project option is chosen.

According to Flyvbjerg et al. (2002), who studied public transportation infrastructure projects, costs are underestimated in almost nine out of ten projects. Their study involved 258 projects



where the average cost was 28% higher than estimated. Furthermore, the findings suggest that systematic underestimation of costs in public projects is not a random phenomenon, but rather the result of project promoters using intentional deception.

Regarding public projects in Iceland, Fridgeirsson (2011) supports this statement, claiming that in multiple high profile projects in Iceland, individual interests of politicians and other project stakeholders have been prioritised over public interest. According to Fridgeirsson (2011), one of the reasons for underestimation of project cost, is the overestimation of one's own abilities, which is also called *optimism bias*.

It has been confirmed that optimism bias affects forecasts and estimations among executives (Kahneman & Lovallo 1993). The effects of this cognitive bias can be seen in overoptimistic estimations, for example of costs and schedules, which then could result in biased decisions to undertake a project. Hence, unfeasible projects could be deemed feasible because of biased estimates.

Fridgeirsson (2011) mentions that in Iceland, the decisions of undertaking/funding projects are at least partly made by the Icelandic Parliament at the suggestion of ministries and / or other stakeholders, citing examples such as Hédinsfjardargöng, Harpa, and Landeyjahöfn. Ministries are subject to certain regulations and guidelines that are among the main prerequisites of public projects, along with the knowledge and judgement of the decision maker.

Cost overrun in large public projects has been the subject of recent debates, as many high profile projects have encountered the problem. Fridgeirsson (2009) studied 70 Icelandic projects in regards to planned cost and actual cost. He found that there was cost overrun in more than two-thirds of the projects.

The Icelandic National Audit Office (INAO) has officially stated that unprofessional decision making is the weakest link in public financial management.

According to the majority of project management and decision analysis literature, project cost is one of the criteria used to determine the success or failure of a project (subchapter 2.2). It is important to estimate project cost carefully and thoroughly, as decisions of undertaking projects are based on estimations of cost and evaluations of other factors. The consequences of biased prerequisites influencing project decisions can eventually affect the outcome of the projects.

1.3 Research aim

The aim of this research is to contribute to the improvement of the public project lifecycle in Iceland, by analysing prerequisites of initial decision making and selection in public projects. The analysis will then be used to identify fields of improvement for the benefit of public project stakeholders.



1.4 Research objectives

The objectives of this research are:

1. To identify best practices for initial decision making and selection in public projects in the literature and to select representatives of the best practices from tactical methods in management literature.
2. To provide measurable comparison between initial decision making and selection in public projects in Iceland and best practices and prerequisites for public project decision-making in comparable countries.
3. To provide a GAP¹ analysis between best practices and applied methods in Iceland.
4. To suggest improvements to the process of initial decision making and selection of public projects.

The two parts of the decision making process that will be analysed are:

1. The purpose intent guidelines for initial decision making and selection in public projects in Iceland and the United Kingdom.
2. The knowledge and understanding of decision-making methods among members of three Parliamentary committees that contribute to decisions of whether or not to undertake large public projects in Iceland.

1.5 Research questions and hypotheses

1.5.1 Research questions

- a) Is there a gap between the prerequisites of initial decision making and selection in public projects in Iceland and the United Kingdom, regarding purpose intent guidelines?
- b) Is there a gap between the prerequisites of initial decision making and selection in public projects in Iceland and the field's best practices described in the literature?
- c) Are there specific fields of the decision-making process that need more improvement than others?
- d) What short-term and long-term improvements can be made to the decision-making process?

1.5.2 Hypotheses

1. The Icelandic purpose intent guidelines for initial decision making and selection of public projects do not measure up to the requirements of best practices in decision making.

¹ A technique for determining the steps to be taken in moving from the current state to a desired future-state. Also called need-gap analysis, needs analysis, and needs assessment. Gap analysis consists of (1) listing of characteristic factors (such as attributes, competencies, performance levels) of the present situation ("what is"), (2) cross listing factors required to achieve the future objectives ("what should be"), and then (3) highlighting the gaps that exist and need to be filled. (www.businessdictionary.com).



2. There is a significant gap between the Icelandic purpose intent guidelines for the decision-making process of public projects and their counterpart in the United Kingdom.
3. The members of the Parliamentary committees, who make decisions regarding large public projects and evaluate them, generally have little knowledge of best practices in decision making and project selection.
4. The prerequisites of decision making for large public projects in Iceland do not meet the requirements of best practices for decision making and selection of projects.

1.6 Research methodology

The research presented in this dissertation was conducted in two parts.

Firstly, the contents of purpose intent guidelines for initial decision making for projects in Iceland (PP) and the United Kingdom (Green Book) were benchmarked against best practices in decision making and selection of public projects. The results of a qualitative analysis of the contents of these guidelines were then converted into a scoring model, to indicate the consistency of the given guideline with the field's best practices. Recognised and defined methods from management literature were selected to represent best practices for the benchmarking activity.

This analysis also provides a comparison between the consistency of best practices within the guidelines of Iceland and the United Kingdom.

Secondly, the author conducted questionnaire-interviews with Members of Parliament who form three Parliamentary committees; the Budget-, Environment and Transport-, and the Industries committee. These committees were selected because they are relevant to the subject of this study, as they generally discuss large public projects. The questionnaire focused on the application and knowledge of best practices for decision making among the members of the Parliamentary committees.

1.7 Position of the dissertation

This dissertation covers the initial phases of a project, from the realisation of a need or problem until the decision is made to implement a specific solution or option.

The process diagram (figure 1.1) shows the process that leads to the decision making at the end of the feasibility study (decision 2), where the decision is made to implement a specific solution.

The white boxes represent the series of activities that occur during the project lifecycle. The ones identified here are the same as the ones used to define the IPPL project lifecycle. Figure 1.2 demonstrates a hierarchical view of these activities.

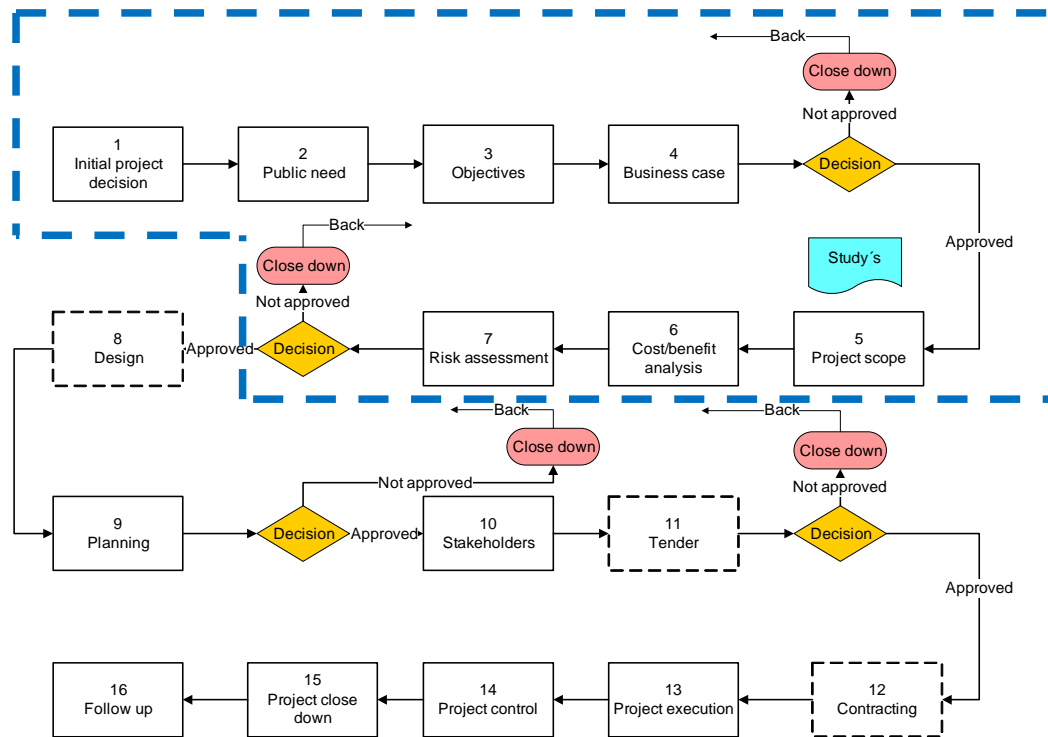


Figure 1.1: The Project Lifecycle Process. Activities 1-4 represent the conceptualisation phase, whereas activities 5-7 represent the feasibility study phase as it is described in this dissertation. The dissertation covers the activities from 1-7 and the decision making included in the process.

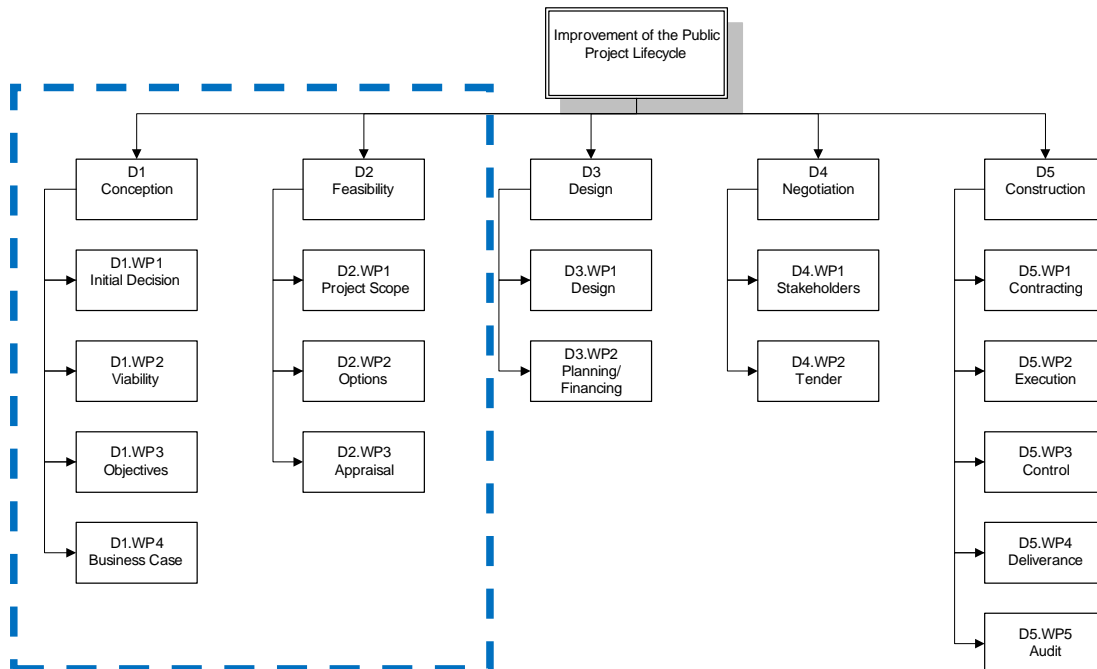


Figure 1.2: This dissertation discusses the initial part of the Public Project Lifecycle, from need conception or problem realisation until the decision is made to implement a certain solution. These phases are illustrated here in sections D1 and D2, framed with a dotted blue line.



1.8 Limitations

The research presented in this dissertation is limited to the process of decision making in public projects; from the initial project conception until a decision is made to select and undertake a specific project. The limitations of each research task are explained below. The research is limited to two prerequisites of decision making, as explained below.

1.8.1 Guidelines analysis

This analysis focuses on the purpose fit guidelines for initial decision making and selection of public projects (PP and Green Book), focusing on the consistency of best practices in project management, decision analysis and other management literature. The analysis is limited to the subjects selected to represent best practices. The selection is presented after the literature review and framed in chapter 3: Framing of best practices.

The evaluation relies on the author's qualitative analysis, making use of a scoring model. Scores should be interpreted as indications of the true values or levels of consistency with best practices. The analysed guidelines are intended for use in initial decision making and project selection in Iceland and the United Kingdom.

1.8.2 Questionnaire surveys

The questionnaire survey is limited by the aforementioned knowledge of the responding Members of Parliament regarding best practices in the specific field of decision making. Considering the limitations of this part of the research, the question arose if the questionnaire survey should be directed towards the ministries' staff instead of Members of Parliament, as project conception is frequently an affair of the appropriate ministries.

However, the objectives of this study were to gain an overview of the process that commences with the conception of an idea and ends with the decision to undertake a specific project. As the final approval of large scale public projects generally depends on the Parliament, this part of the "decision chain" could not be left out of the study. Hence, the outcome of the questionnaire survey is limited to the roles of Members of Parliament and Parliamentary committees.

The results of the questionnaires are limited to the subjects that were selected to represent best practices for certain aspects of decision making. When selecting the subjects for the survey, the author emphasized subjects that project management- and other management literature identify as key factors for best practice decision making and project success, in order to produce integral and systematic survey results.

1.9 Structure of the dissertation

This marks the conclusion of the dissertation's introduction. Chapter 2 presents a literature review, where state of the art literature is explored to build the foundations of this research project. After the literature review, chapter 3 proceeds to frame best practices in initial decision making and selection in public projects. In chapter 4 the research methods are introduced. The findings from the study's field research are introduced in chapter 5, with the



following chapter containing a discussion of the meaning of these findings, compared to what is already known in this field of research. Chapter 7 presents the conclusions drawn from the findings, with an overview of the contribution this dissertation makes to the literature. Points of further research in the field are then discussed. Lastly, the dissertation ends with a list of references and appendices.



2. Literature review

In this chapter, project management-, strategic management- and decision analysis literature is reviewed to lay the foundation for the research. The chapter begins with an introduction and a short overview of project management, discussing success in projects and how the concept of success is interpreted in the literature. Following this is an overview of how the literature portrays the strategic purpose of projects, the importance of the consistency of projects, and overall strategy and vision. Next, the two phases of project decision-making that are the focal points of this dissertation are approached: the conceptualisation phase and the feasibility study phase. The important fields of risk management and general decision-making methods are approached, along with concepts and techniques adopted from project management. The literature review showed that these fields are fundamental to conceptualisation and feasibility studies, when preparing for public project selection.

2.1 Introduction to Project Management

2.1.1 *Project distinctions and the origins of project management*

The main distinctions of projects are that they are multifunctional, time bound and budgeted series of combined work tasks, to be delivered according to specific demands regarding quality and performance. Furthermore, projects are undertaken to reach certain objectives, utilise certain strategies, or fulfil certain needs. This is done by consuming resources (input) and turning them into the desired output.

Modern day project management is usually considered to have begun with the Manhattan Project, the making of the first atomic bomb. It was initially used for very large research and development projects or large construction projects. The techniques used in project management developed mostly in the military, and then spread to private construction firms, the automobile industry etc. In recent times, project management has been adopted by computer software companies, service companies and advertising campaigns, to name a few examples (Meredith & Mantel 2010, p. 9).

Project management is a relatively young discipline. It consists of a variety of techniques that are used to achieve better utilisation of resources with planning and increased control of work tasks, ultimately providing more satisfying results.

Underneath is a useful definition of project management (Kerzner 2009, p. 2).

Project management is the planning, organizing, directing and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. Furthermore, project management utilizes the systems approach to management by having functional personnel (the vertical hierarchy) assigned to a specific project (the horizontal hierarchy).

Projects are undertaken for a reason, namely to deliver benefits (output) according to given objectives or prescriptions to project owners and/or stakeholders. The benefits can be



financial, environmental or of another kind. The function of project management, according to Munns & Bjeirmi (1996), is to achieve the specific and short-term targets set up for the given project.

However, Munns & Bjeirmi (1996) also conclude that the responsibility of reaching these goals for a successful project outcome should not be placed entirely on the project management team, as they would only be able to enhance project success. They state that it would be inappropriate to expect good project management to prevent failure in cases where the project has inadequate prerequisites. Munns & Bjeirmi (1996) close their paper with the following statement:

The right project will succeed almost without the success of project management, but successful project management could enhance its success. Selecting the right project at the outset and screening out potentially unsuccessful projects, will be more important to ensuring total project success.

The latter sentence of this statement is central to this dissertation, as it states the importance of the aforementioned scope of this study: public project decision-making and the selection of the right project out of a pool of options or solutions to the problem or the need.

When the decision has been made to undertake a certain project, the execution or implementation of the project begins. Every project stakeholder wishes for a successful project outcome for their own benefit, but the concept of success can be seen from multiple perspectives. A successful outcome could be interpreted as an optimal outcome of the project. However, project management literature does not provide a clear explanation of the meaning of *success* in this context. The success phenomenon is discussed further in the next subchapter.

2.2 The success phenomenon

Many authors have discussed the success phenomenon. Up until contemporary project management, three criteria have been especially dominant: time, cost and performance (scope, quality or even technology have also been used to describe the third criterion). The focus on each criterion varies according to its importance to project success. Throughout the years, these main success criteria have been challenged and supplemented by researchers.

Atkinson (1999) asked an interesting question: if the important criteria for project success are known (time, cost and performance), then why do projects continue to fail? He even considers the possibility of projects being labelled as failures simply because the three criteria are wrong or not comprehensive enough to cover the real project outcome.

It should also be considered that projects measured against the three basic criteria could have failed because they were not being measured against the right criteria. Thereby, the focus of what is important can potentially slip away from project management.



Before the other success criteria from project management literature are introduced, a distinction has to be made between *project management success* and *project success*. The fact is that the success criteria for both the project and the project management would only be the same in the case where the objectives for the two are identical. However, it is unlikely that this will happen in an established organisation that has many ongoing, past and future projects.

2.2.1 *Project management success or failure*

De Wit (1988) argues that project management success is the performance of a project according to the three main criteria: cost, time and performance. Kerzner (2009, p. 3) supports this definition, but adds efficient and effective utilisation of resources and the client acceptance factor, which states the client's acceptance of a project's performance.

The importance of this last factor is reinforced by Wateridge (1998). His findings from studying IT projects suggest that meeting user requirements, which can be linked very closely to client acceptance, is the most important success criterion for project management, more important than the commercial success of the project and the cost, time and performance criteria.

Cooke-Davies (2002) adds other factors that project management success depends on, stating the importance of risk management abilities and project responsibilities. His study also mentions time limitations, management of project scope and measuring of project performance among the important factors that lead to project management success, indicating that the absence of these could lead to project management failure. Other factors that cause project management failure are for example (Munns & Bjeirmi 1996):

- Inadequate basis for a project
- The wrong person selected as project manager
- Unsupportive top management
- Lack of project management techniques
- Misuse of management techniques
- Lack of commitment to project

2.2.2 *Project success or failure*

De Wit (1988) states that the most appropriate criteria for project success are the project objectives, i.e. to what degree the objectives have been met in the project.

Furthermore, De Wit (1988) states that cost and time are not necessarily important to project success. Other factors, such as satisfaction of key stakeholders and technical scope delivery should be considered more important. For example, the North Sea oil projects that suffered from severe cost and time overruns were nonetheless extremely profitable.



Cooke-Davies (2002) supports this, as he maintains that project success is very dependent on the delivery of key “benefits” as perceived by the client or project owner, i.e. project purpose or project goals.

Pinto & Mantel (1990) point out that it is important to know more about how project managers and stakeholders define project success or failure to be better able to determine the success or failure of a given project. They identify the mission, which was defined in the strategic stage to be a critical factor in project success and/or failure. Pinto & Slevin (1988) also state the importance of the project mission, arguing that a clearly defined project mission with general directions is one of the keys to project success.

In a study performed by Chua, Kog, & Loh (1999) they conclude that different factors affect project success depending on the various project objectives. The contractual arrangements of the project along with project characteristics such as size, public impact and constructability are important to any type of project. They also state that project success cannot be secured by good project management practices such as control and monitoring techniques.

Taking us back to the three classic and dominant success criteria in project management literature Kerzner (2009, p. 7) states that project success is achieved by finalising the project within the appropriate time-, budget-, and performance frame and with customer/user acceptance. He also maintains that success is gained by finalising the project with minimal changes to the scope and without changing the company’s culture or workflow.

Additionally, these factors can be important to project success (Morris 1986):

- A realistic goal
- A definite goal
- Third parties impact
- The perceived value of the project

2.2.3 Conclusions on success

From this literature review of the success phenomenon, it has to be concluded that the concept of success in projects and project management is somewhat obscure. The concept is very dependent on individual perception, as stakeholders can have different views and expectations regarding the project.

However, authors widely agree on certain points that can contribute to both project and project management success. Thus, it can be determined that the frequently mentioned factors from the literature should all contribute to success, but their contributions vary according to the projects, project managers and project objectives. This is especially the case with public projects. Unlike the private sector, they are less likely to be conceived for financial gain. Distinctions of public projects are explained further in subchapter 2.6.

Despite the vague, general definition of project success, it is very important to apply the success criteria to projects, especially if the project is funded and supported by public capital.



Otherwise, project promoters could claim that projects were successful, regardless of their actual outcomes, as success could be determined by their own subjective estimates.

If project objectives and success criteria were maintained from the beginning, the success would be objective and measurable, which would decrease the possibility of subjectivity in success evaluation, and lead to the coordination of the different perspectives on the matter. Furthermore, the project could focus on reaching the project objectives and intended values. This consists with the theory of Pinto & Slevin (1988), about the project mission being the most important criterion for success in projects.

2.3 Project relation to vision, strategy, tactics and organisational objectives

The project plays an important role in reaching the objectives and following the strategies that consist in the vision of a company, organisation or society. This subchapter discusses the relation between these elements, as they are important to the strategic consistency of projects that a project owner chooses to implement.

2.3.1 Vision

The vision should always precede goal setting. This is the foundation, where it is determined who we are, what we do, where we are now and last but not least, where we are going. A vision can be determined by organisational or public leaders, who then try to move their organisation or society towards the vision. They use the strategy, tactics and operations, and set long-term goals or objectives that are to be reached in the process of achieving the vision. Below is a brief overview of the three main tasks necessary to establish the vision, adapted from (Thompson & Strickland 2003, pp. 32–41):

- Create a mission statement – who are we, what we do and where we are now?
- Decide a long term course using the mission statement – where are we going?
- Communicate the strategic vision of the organisation in a clear manner to encourage employees and other stakeholders.

Although the creation of the vision would not be considered a task for a project management team, it is important that they have some understanding of what a strategic vision consists of. This can help them understand the project's purpose and desired outcome for the organisation and therefore they become better equipped to deliver the project's intended value. The vision enables the organisation to create long-term goals or objectives, which it then strives to reach using the appropriate strategy.

2.3.2 Strategy

The strategy is the definition of how long-term goals are to be reached, i.e. it determines in what direction the organisation/society go. Thus, the strategy is the foundation of the projects that are undertaken. Projects must always be consistent with the overall strategy. If they are not, the strategy is either inadequately defined or the project will not contribute to the organisation or society reaching its long-term goals.



The use of models, where criteria can be weighted according to importance, is suggested to identify projects that consist with the organisational strategy. Models are addressed further in subchapter 2.4.8.

2.3.3 Tactics

Tactics are the methods used to deliver the strategy, i.e. the means used to progress and reach the goals or objectives. Tactics can for example consist of specific methodology intended to achieve optimal and intended results.

The next subchapter introduces a methodology, or mnemonic device, that helps to establish or verify the methods used to reach objectives: the SMART method.

2.3.4 Objectives

Organisations strive to reach certain objectives and goals in the process of accomplishing their vision. An objective can be comprehensive, requiring the manpower of the entire organisation, or it can be the temporary objective of a small working group. However, it is important that the objectives are well thought out, as they are the steps to accomplish the long-term goals.

SMART is a mnemonic tool used for the process of assessing and developing objectives. It is important that the objectives undergo an analysis such as this one, to avoid the project objectives turning into a “wish list” with ill-defined objectives that are difficult to measure.

- S Specific
- M Measurable
- A Attainable
- R Realistic
- T Time-bound

Large public projects should have objectives that are set or reviewed using a clearly defined methodology. Since objectives can be described as the overall mission of the project, this can be essential for project success.

Klakegg (2010, p. 162) studied public projects in Norway. His findings provide a good overview of the problems with setting objectives in such projects. He presented that 47% of the projects experienced problems caused by unverifiable objectives from strategic levels. Furthermore, 20% of the projects did not have strategic or tactical objectives. In 27% of the cases, objectives from strategic level were found to be overly ambitious.

According to Pinto & Slevin (1988), clearly defined goals and project missions are the most important criteria for project success. An overview of their criteria is given next, in order of importance to project success.



Pinto & Slevin (1988) Success Criteria

1. Project Mission
2. Top Management Support
3. Project Schedule / Plan
4. Client Consultation
5. Personnel
6. Technical Tasks
7. Client Acceptance
8. Monitoring and Feedback
9. Communication
10. Trouble-Shooting

Hence, it is essential to project success that the objectives are well-defined and established according to best practices.

The nature of objectives can vary depending on the organisation or project owner. Under many circumstances, the objectives of a privately owned company would be financial, whereas public organizations would mainly focus on improving service (Fewings 2005, p. 27).

2.3.5 Projects to deliver objectives

It is vital that projects undertaken by organisations and institutions are consistent with the strategy of the organisation. Thus, project objectives must also be consistent with the overall strategy. The question of how to improve the success rate of projects is described in Meredith & Mantel (2010, p. 38) as one of the challenges facing organisations today, along with how to handle growing numbers of ongoing projects.

This study is limited to public projects, where the parent organisation is a public body. Chapter 2.6 will discuss the main elements that distinguish public projects from projects within private and commercial organisations.

When the objectives have been set, it is the project (in a project oriented organisation) that delivers the objectives. Here is a fictional example for the City Library in Helsinki, demonstrating how we go from the vision to the project that will deliver a part of the objectives.

- **Vision** – The City Library in Helsinki has the vision that every individual, regardless of age or condition, can find the knowledge they need in the library and that literature in general should be a cornerstone of the Finnish culture.
- **Strategy** – To ensure that the premises are accessible; that everyone is able to enter by their own effort.
- **Tactics** – By the year 2013, four elevators will have been installed in the northern section of the main building, each of which can carry 200 people pr. hour.



- **Objectives** – To ensure transportation options for disabled people to all floors of the building by the year 2013.
- **Project to deliver objectives** – The installation of the elevators in a series of time-bound, budgeted work tasks that have specific requirements regarding the quality of the outcome.

Notice that the project objectives were not to install elevators, but to ensure good transportation. This is a key aspect as the objectives must avoid excluding radical options by focusing on only one solution to the problem. For example, another possible solution would have been to install escalators, which could have been the best option under other circumstances. However, after appraising the available options in this example, the tactic deemed most suitable was the installation of the elevators. The requirements projects must fulfil in order to gain the intended benefits can be summarised in the *project scope*, which has to be clarified before the project is undertaken.

2.3.6 About project scope

The project scope, according to Kerzner (2009, p. 426): “. . . is the work that must be completed to achieve the final scope of the project, namely the products, services and end results.” This is closely related to the strategy, tactics and objectives of projects as the definition names the purpose of the project, including all objectives.

To offer a simplified explanation, the project scope clarifies the needed accomplishments for the desired outcome of the project. After the project scope has been defined, it is agreed upon with a *scope statement*, which is a written document intended to ensure that stakeholders have basic knowledge of the project scope. Kerzner (2009, p. 426) suggests that this document should consist of the project objectives, a description of the deliverables, a description of the desired end result of the project, and justification for undertaking the project. This is necessary to ensure that all involved parties focus on the fundamental need that instigated the conception of the project.

A tool that is frequently used to provide an overview and assist to determine the project scope is the *Work Breakdown Structure* (WBS). The WBS divides the project (top-down) into smaller units at different hierarchical levels, where the units at the lowest level are the work tasks, or the actual activities that are performed over the course of the project. The WBS gives a comprehensive overview of the project with nothing left out of the reach of planning.

The project scope statement can also be used to prevent unnecessary or unwanted changes to the project. In most cases, some changes will be required or wished for along the way, but changes can also result in cost overrun, especially if they are introduced late in the project lifecycle (Flyvbjerg, Holm, & Buhl 2002). Thus, it is important that changes to the project scope are made by mutual agreement of all parties. Furthermore, they should always be well justified, to minimise risk.



Comprehensive knowledge of WBS should not be considered as essential knowledge for the general decision-maker on a given project. However, basic knowledge of the project scope concept, and how project scopes are conceived, could help the decision maker to visualise the project and determine the specifics of a project estimate. Moreover and perhaps more importantly, it could help them to notice if certain elements have not been taken into account, for example when estimating cost or time.

2.4 Project decision making

2.4.1 The importance of the decision-making process

As it was stated in the opening of the literature review, every project has a defined beginning and ending. The process from the initial identification of the need/problem until the completion and review of the project is called the project lifecycle. In this lifecycle, different decisions have to be made regarding the project, ranging from the decision to undertake the entire project to deciding the types of doorknobs to be used in a potential hospital project. In both cases, options need to be appraised and decisions need to be made. The appraisal is certainly not as critical in both cases, however, options and factors need to be evaluated and subjects of decision making for the optimal solution.

So far it has been established that to achieve project success, projects need to be consistent with the organisational strategy. It is also necessary that decision-makers know how to determine objectives, set strategies and maintain the project scope. The next step is to examine the decision-making process to determine why it is important for project outcome and how the literature suggests that the decision-making phases of projects should be executed.

This study focuses on the initial decision of choosing a project for implementation, after all options have been evaluated. This is done during the conceptualisation- and feasibility study phases of the project lifecycle.

Before these phases are discussed further, it should be verified whether or not the effort required for structured and strategic project selection is valuable to the ultimate outcome of a project.

The question is:

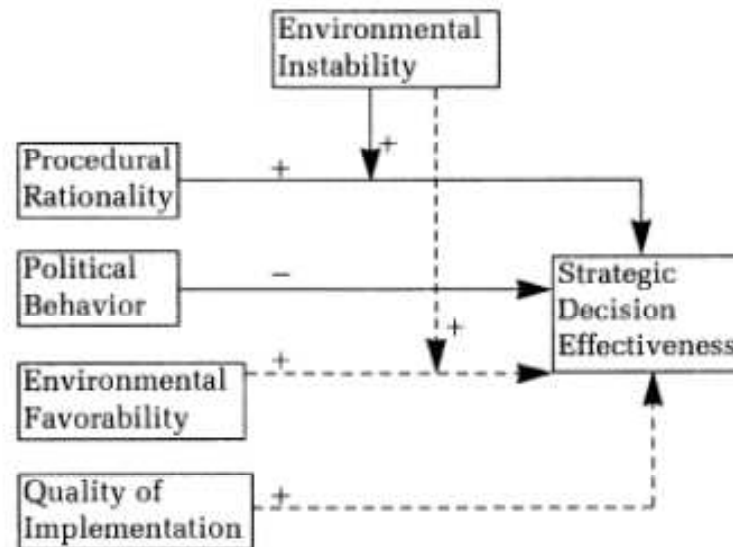
Does strategic decision making have a positive effect on project outcome?

According to Dean & Sharfman (1996), strategic decision making (SDM) does shape the effectiveness of decisions, along with environmental forces. However, the estimated influence of the two factors in relation to each other has not been determined.

This is reminiscent of what was stated in subchapter 2.2; namely that good project management can only improve already successful projects, but cannot be expected to prevent project failure.



Other factors, such as the environment, i.e. organisational circumstances, changes in regulations, competition and even natural forces can also affect the project outcome. Below is a model that shows the effect these factors can have on the strategy and effectiveness of the decision-making.



* Dotted lines indicate control variables.

Figure 2.2: Strategic and effective decision-making from Dean & Sharfman (1996). The figure is consistent with the statements of Flyvbjerg et al. (2002) who found that project prerequisites were often biased by project promoters, for example political figures.

Dean & Sharfman (1996) state that *policy rationality* has a positive effect on strategic decision making, whereas *political behaviour* will have a negative effect. Policy rationality is simply a matter of collecting valid and relevant information, analysing it in regards to the objectives and using this analysis as a foundation for your decision. Political behaviour in decision making is when the parties of interest make decisions to enhance their own or their group's interests, not necessarily considering the interests of others even though their decisions are made on behalf of the whole. This behaviour has been called *moral hazard*. In these situations, the decision-makers decide how much risk will be taken. However, if they are wrong, they will not have to suffer the consequences themselves (Hölmstrom, 1979).

Effective decisions have to be based on either organisational or social goals. As Pettigrew (1973) and Pfeffer (1981), referenced in Dean & Sharfman (1996) state, political decisions are based on the self-interests of individuals or groups. If there is no overall consistency between the interests of influential groups and the organisation, it is less likely that organisational goals will be served, since general interest of the organisation is not in focus in both cases. Hence, SDM will have a similar effect on project delivery as project management and should not be considered as a guarantee of decision effectiveness. Factors such as market evolution and technological change along with countless others will also affect the outcome. SDM can nonetheless enhance the probability of making optimal decisions.



It has previously been stated that the project selection and the screening of potential unsuccessful projects is very important to project success (Munns & Bjeirmi 1996). Other authors have also stressed the importance of these factors (Kerzner 2009, pp. 419–420), (Meredith & Mantel 2010 chap. 2). Thus, the use of strategic decision making (SDM) to select projects enhances the probability of finding the right solution to a problem.

In a study of public projects in Norway, Klakegg (2010, p. 155) discussed the most important functions of governing the front-end of public projects, from an owner's perspective. He concluded that it was imperative to have a well-defined decision-making process, as well as control of the quality of documents used as a basis for decision making.

It has now been established that strategic decision making and thorough project selection are important to project outcome. Now I will discuss the first two phases of a project, the conceptualisation phase and the feasibility phase, in terms of how to optimise the likelihood of project success, according to the literature.

2.4.2 Phase 1: Conceptualisation

The project lifecycle starts with the identification and definition of a need, potentially caused by a problem. This is the first step of the conceptualisation phase. When the need or problem has been identified and defined, the next step is to identify possible solutions (Kerzner 2009, p. 419). It is important to consider a wide variety of options, including radical ones, so that the project can be viewed from different perspectives. This can be achieved by brainstorming about options, a method that is also suggested by Kerzner. The creation of options is an important phase of the project, and just as the other phases it requires management.

Methods for creative problem solving, for example the Creative Problem Solving Process (CPSP) (Basadur 2004), can be used to structure work in the creative process. As Basadur's work demonstrates, a large part of creative work focuses on defining the actual problem or need. The problem needs to be well-defined, so the full potential of options can be explored and later evaluated. Below is an example of valuable conceptualisation from the commercial world (Basadur 2004):

...I was approached to help a Procter & Gamble product development team formed at short notice to respond to Colgate's new green-striped soap bar. Early on, I realized that the team had chosen to define its problem as follows: How might we make a green-striped bar that consumers will prefer over Irish Spring? Posing the question from a consumer's point of view, we came up with a new challenge: How might we better connote refreshment in a soap bar? Without any mention of green stripes, this less restrictive conceptualization allowed more room for creative solutions. The result was a blue-and-white swirled bar with a unique odour and shape, which eventually achieved market success as Coast. By leaping prematurely into solutions, the team had wasted almost 6 months before coming up with a superior conceptualization.



As the understanding of the problem increases, the ideas for possible solutions become more valuable. It is also important to emphasize the *end user involvement*, also called stakeholder involvement in the literature review chapter, which can prove very valuable during the early stages of projects (Kerzner 2009, p. 419).

Following the definition of potential options, it is important to document the assumptions that they are built on, so that possible changes in the project environment can be evaluated in regard to each option. No conceivable solutions should be left out at this stage. A technical evaluation of the potential options should also be included, to shed light on problems that might arise, and thereby mitigate the uncertainty surrounding the options. Multiple studies have shown that ineffective execution of the early project phases can lead to conceptual changes later on in the projects (Kolltveit & Grønhaug 2004). Flyvbjerg et al. (2002), Flyvbjerg, Skamris Holm, & Buhl (2003) and other authors have emphasized the how risky this can be, as changes to projects late in the process very often lead to cost overruns.

When a list of options has been produced, the next step is for the options to undergo an appraisal, where their merits and shortcomings are evaluated to find the optimal solution to the defined problem.

Subchapter 3.2 presents an overview of best practices in the conceptualisation phase. This overview is built on the information and methods that were explained in this subchapter.

2.4.3 Phase 2: Feasibility study

The appraisal of options generated in the conceptualisation phase is carried out in the feasibility study phase. Kerzner (2009, p. 419) provides a useful explanation of the feasibility study phase: *“The feasibility study phase considers the technical aspects of the conceptual alternatives and provides a firmer basis on which to decide whether to undertake the project”*. According to Kerzner, the purpose of the feasibility study is to:

- Plan the project development and implementation activities
- Estimate the probable time, staffing and equipment requirements
- Identify the probable costs and consequences of investing in the new project

During the feasibility study phase, attributes of potential options are compared to find the best solution to the problem or need being addressed.

At this stage it is important to re-emphasize the difference between private and public projects when it comes to studying project feasibility. In private organisations, project conceptualisation will often derive from a need to make profit, whereas public projects address the needs of the society, for example by building new hospital wings for better patient service and improved public health. Sometimes public projects are not financially feasible; however, the need and the nature of the subject at hand can make public decision-makers look beyond the financial criteria.



In many cases and especially in large non-profit projects, many evaluations need to be performed to find the best solution. In this subchapter I will provide an overview of the evaluations or appraisals that apply to a large public project, adapted from (Dey 2001), (Kerzner 2009), (Kolltveit & Grønhaug 2004) and (Meredith & Mantel 2010).

The feasibility phase of a project is closely connected to the *project implementation strategy*. Project viability depends largely on the selected implementation strategy (Fewings 2005, p. 9). For example, the cash flow of a large public construction project can be closely tied to the project's timeframe. In this case the strategic management must determine if they want to finish the project quickly, with a relatively short time for the outflow of cash or opt for a slower progress, for example to utilise a lack of ongoing projects in a specific industry. The role of project cost in the economic appraisal of a project will be discussed further in the following subchapter.

2.4.4 Economic appraisal

Flyvbjerg et al. (2002) state that important figures or parts of projects are too frequently omitted from cost planning in public infrastructure projects, in order to lower the perceived cost of the project. This could for example apply to factors that are unpredictable, such as preparation or geologic work, which is often bound to a high degree of uncertainty. In this context it must be emphasized how important the use of historical data can be, as well as the including of a contingency plan in the project cost estimate. No part of the project should intentionally be left out of a project's cost estimations as decision making can be biased by underestimations. It is also essential to avoid overestimating one's own ability to execute a project that has a low cost estimate. As stated earlier, the importance of accurate cost estimation is crucial to the decision of whether or not to undertake a certain project.

The lifetime of large projects can often span years, which makes it difficult to maintain an overview of costs. Furthermore, inflation and interest rates are often a larger factor in the financial overview and planning in larger projects than in shorter projects. This has been called the time-value of money, as described by (Meredith & Mantel 2010, chap. 2.4). The application of methods such as cash discounting with Net Present Value (NPV) is important to observe costs and collect comparable project data.

When the project is completed, funds need to be allocated to the running and maintenance of buildings. The costs of running and maintenance should be evaluated as well as the capital costs. By adding them to the financial appraisal, the appraisal is brought closer to *whole-life cost* estimates. It is only when the whole-life cost has been estimated that the evaluator has a realistic view of the project's cost-effectiveness and is better able to evaluate and compare project costs and benefits.

Economic appraisals are not only based on financial subjects. Other economic factors need to be addressed, as discussed earlier in this chapter. In public projects, the intended benefits of projects can be social or socio-economic, for example to provide improved health care for senior citizens. The financial and social benefits should be compared in a cost-benefit analysis



to discover the optimal cost-effectiveness of the projects. The cost-effectiveness appraisal is the true economic appraisal of the project, as it identifies the actual return on the proposed investment intended to solve the problem.

2.4.5 Technical appraisals

The technical basis of projects must be evaluated as a part of the main feasibility study. Technical appraisals are important to quantify project risks, costs, time limit, manpower and other significant information that contributes to making enlightened decisions about project options.

The analysis included in this appraisal can for example be about the development of conceptual solutions to reach a practical and viable decision. If the technical appraisal is not executed in a proper manner, it can lead to economically or technically unfeasible decisions to be made, or even the termination of feasible projects (Kerzner 2009 p. 419). A technical appraisal can also consider the available skills, manpower and technology. Tasks that require special skills can potentially need outsourcing, which brings new dimensions to the financial appraisal of the project. It is apparent how strongly the technical appraisal is linked to other aspects of the project.

Although the future is impossible to predict with certainty, technical appraisals are extremely important. The compilation of the technical aspects of a project, to our best knowledge, helps us form the best possible basis for decisions.

2.4.6 Other appraisals

The following are given as examples of appraisals to be included in feasibility studies of projects in (Kerzner 2009), (Meredith & Mantel 2010), (Kolltveit & Grønhaug 2004) and (Dey 2001).

- Market appraisal
- Strategic appraisal
- Trade-off analysis
- Legal appraisal
- Environmental appraisal
- Operational appraisal

2.4.7 User involvement and stakeholder management in early stages

Research has shown that user involvement in the early stages of the project lifecycle regarding ideas, practical information, information gathering etc., is crucial to project success (Kerzner 2009, p. 419). Authors have stated the importance of this before, but named the activity *client consultation* (Pinto & Slevin 1988). The importance of consulting users and clients is undisputed. However it is important to use the term “client consultation” carefully, since the clients who potentially pay for the project are not necessarily the end users. This applies especially to large public projects that have many end users, and therefore incorporate many stakeholder perspectives that need to be considered.



Newcombe (2003) stated:

Project stakeholders are groups or individuals who have a stake in, or expectation of, the project's performance and include clients, project managers, designers, subcontractors, suppliers, funding bodies, users and the community at large.

One of the problems of having multiple stakeholders on projects can be that the stakeholders will very likely have different expectations. Problems can arise, especially if the expectations are in conflict. Examples of expectation conflicts are short-term interests vs. long-term objectives, derived jobs vs. cost-efficiency of projects and project quality vs. project quantity.

Therefore it is suggested that stakeholders are mapped by making evaluations of three issues (Newcombe 2003): the power of the stakeholder, the level of interest they are likely to have in the project and the predictability of the given stakeholder. With the examples given in the last paragraph, it is foreseen that stakeholders will have interest in large public projects and due to the stated importance of user involvement or stakeholder involvement, it is hence considered important to map these in the early stages of large public projects.

Although it is early in the project lifecycle at this stage, it is important that potential changes are considered, as cost overruns are often caused by late changes (Flyvbjerg et al. 2002) (Kolltveit & Grønhaug 2004). Figure 2.3 shows examples of the mapping of stakeholders in these dimensions, with power and predictability and power and level of interest.

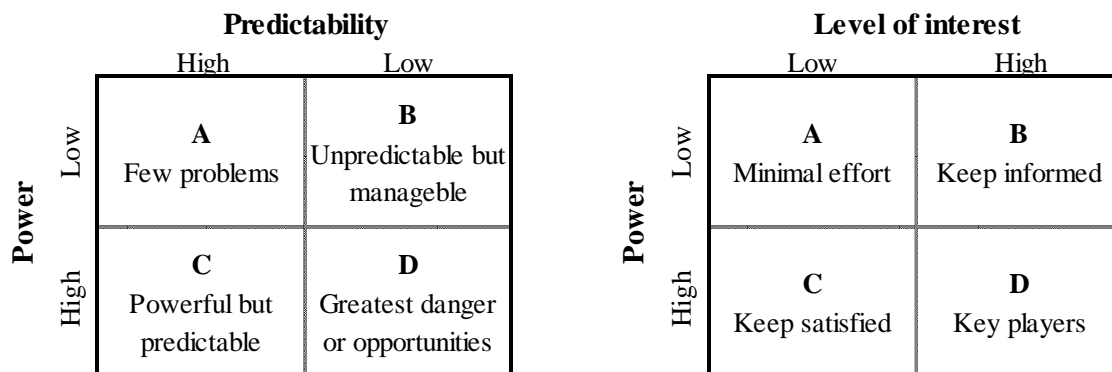


Figure 2.3: The stakeholder mapping approach from (Newcombe 2003). When the initial decision of whether or not to undertake a project is being made, focus should be kept on the most important stakeholders and the ones who pose the greatest risk for the project. They are marked with the letter D in the mapping systems.

Stakeholder mapping should be used early in the process, as a tool to define the stakeholders that will be consulted for potential input. Stakeholder consulting and mapping should enhance the probability of project success and decrease uncertainties and risks. Stakeholder input will benefit the project most if it is sought in the beginning, as the cost of late changes in projects is higher than the cost of early changes.



2.4.8 The use of decision aiding models

The decision to select a certain project from a variety of project options can involve multiple factors. It can be difficult for a decision-maker to keep track of all the factors and view them with the appropriate and desired perspective without the support of management methods. In such cases, the use of decision-aiding models is suggested.

Models imitate reality; however, they are simpler than the real world, which makes it easier for the decision-maker to discern the factors that are most important for the project owner and make a decision based on these criteria. It is frequently stated in project management literature that reality is far too complex to deal with in its entirety. Thus, models are used to help with making decisions about project selection. By using models, aspects of situations can be isolated or manipulated to simplify the decisions (Meredith & Mantel 2010, p. 40). This can draw attention to the important criteria that need to be analysed carefully in order to achieve project success. It must be emphasized that the role of models in decision making is to aid the decision-maker and make the decisions easier.

Models can be numeric and non-numeric, depending on their input. The input of numeric models can be based on subjective or objective evaluations, but as stated in Meredith & Mantel (2010, p. 43), subjective input of models is not necessarily worse than objective or objectively evaluated input.

2.4.9 Summary of the early project phases

In subchapter 2.4, the focus has been on the two earliest phases of the project lifecycle, the conceptualisation phase and the feasibility study phase. Best practices have been introduced, i.e. methods that optimise the output of these phases according to the literature reviewed. These first two phases require the assistance of two other fields of knowledge: general decision-making practice and risk management. The literature identified these fields as necessary for project success. General decision making methods consist of fields that were discussed early in chapter 2, concerning management methods. Risk management is, however, the subject of the next subchapter.

2.5 Decision making under risk and uncertainty

In reality, project decisions often require the involved parties to make assumptions and estimates regarding the project's prerequisites, as the environment circumstances cannot always be controlled. When decisions are made in an unstable environment, the decision-makers are bound to discover previously unknown factors that can later affect project outcomes. Thus, they must base their decisions on uncertainty, and the future will ultimately show whether or not the decisions were favourable. For example, when a person is interested in buying a new flat, he or she cannot know with absolute certainty if the windows will leak in the coming years. However, the buyer can collect data and perform inspections to eliminate as much of the uncertainty as possible and make an informed decision.

Ultimately, the decision of whether or not to buy the flat will always be made with a certain degree of uncertainty. The collection of information and the elimination of uncertainty to map and control project risk is called risk management.



Individuals and organisations have different attitudes towards risk, and they can be categorized into risk averse, risk neutral or risk seeking. For example, property developers and contractors have been found to be more risk seeking than architects and engineers (Uher & Toakley 1999). Public bodies are generally considered to be risk averse (Drewry, Greve, & Tanquerel 2005, p. 70).

As Flyvbjerg et al. (2002) pointed out it is common that geological activities are left out of public project cost estimates, as they are known for high uncertainty. Hence, this perception of risk aversion might be true to a certain degree. However, if important and risky project tasks are left out of projects, their exclusion can appear to contradict the perceived risk aversion. Exclusion of large parts of projects has also been interpreted as intentional deception (Flyvbjerg et al. 2002).

Klakegg (2010, p. 163) found that in 90% of the Norwegian public projects he studied, all uncertainties were not included in the analysis used to make decisions about whether or not to accept and finance projects.

A decision-maker often has multiple objectives that affect the decision. In the flat scenario described above, criteria such as space, floor materials, location, and elevator access must be fulfilled. The fulfilment of all criteria is not always possible. To further complicate the matter, the project only has access to limited resources such as time and funds. Some find that heuristics are helpful decision-making aiding tools that can be described as “rules of thumb” in decision making. Some heuristics can have a positive effect on decision making while others tend to bias the selection. Goodwin & Wright (2009, chap. 2) describe multiple heuristics that have been the subjects of research. They are for example:

- The recognition heuristic: people recognise certain brands when making decisions and would rather be inclined to buy a high quality brand than an unknown one.
- Attribute comparison heuristic: project or product attributes are compared using different techniques by weight or not, until a decision is reached.

These heuristics can aid with decision making; however, they can also bias decisions. The effects of irrational decision-making due to cognitive bias can be exemplified with the following examples from (Tversky & Kahneman 1974).

2.5.1 The representativeness heuristic

Consider the following scenario that is linked to one example of the representativeness heuristic (Tversky & Kahneman 1974):

Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.



If people were asked to guess Steve's occupation from a list that included a farmer, a salesman, a pilot, a librarian and a physician, research has shown that they would connect the information about Steve directly to the perceived stereotype of the given profession. In this case they would consider it to be most likely that the shy and withdrawn Steve was a librarian.

Research has also shown that people make judgements similar to those above without considering the number of people that are involved in a profession, or the base rate frequency. This is a factor that should be carefully considered, as the given information provides no clear signs of a certain profession (Tversky & Kahneman 1974). Therefore, this type of judgement error can have serious consequences, for example when evaluating the prerequisites of a large project, where decisions often have to be made with uncertain information in an unstable environment.

2.5.2 The availability heuristic

In situations where the availability heuristic prevails, people let their experiences and recollections influence their judgement. For example, when determining the probability of middle-aged people having heart attacks, people that have experienced such incidents with their families or acquaintances would consider it more frequent than those who have no experience of the problem (Tversky & Kahneman 1973).

In one study of the availability heuristic, people were given lists containing an equal number of male and female names. In the cases where the male names were more famous than the female names, participants overestimated the number of males on the list, as they could be recalled more easily than the women. This behaviour repeated itself when lists containing famous women were distributed, with an overestimation of the number of women on the list.

2.5.3 Optimism bias - overconfidence

Consider this scenario, adjusted from (Goodwin & Wright 2009, p. 251):

A maintenance manager is asked how long an overhaul of a machine will take with 99% certainty. First he thinks that it would be likely to take 30 hours. He is then asked to provide an optimistic and a pessimistic estimate of the same overhaul and a medium estimate, i.e. what would be likely. His answers are 27 and 36 hours. He then gets surprised when it takes him 44 hours to overhaul the machine, which was way over his pessimistic estimate.

The question is: was the manager simply unlucky or was his estimate fundamentally flawed? Research has shown that estimates like the one provided in the example usually provide ranges that are too narrow because people tend to be overconfident about their initial estimation (Tversky & Kahneman 1974).

Returning to the mechanic, he is now asked to break down his work into the necessary tasks and then give another estimate. The estimates he gave were the following:



Work task	Optimistic	Average	Pessimistic
Briefing	1	2	3
Problem analysis	4	5	8
Preparation	4	7	8
Repair	13.5	18	25
Testing	3	4	6
Review	1.5	2	3
Total	27 hours	38 hours	53 hours

Figure 2.4: The working hours estimated by the mechanic when they were broken down into smaller units. This method usually involves an increase in the number of estimated resources, as the estimator notices more tasks than when estimating hours for the whole project (Tversky & Kahneman 1974).

When a simple Monte Carlo simulation of this scenario was performed (without correlating events) it turned out that there was a 40% probability of time overrun in this small project from the 40 hour estimate (distribution simulation can be found in appendix 8.3). The same method of analysing the probability of cost or schedule overruns should be used for large public projects. In the case of the mechanic, the Monte Carlo simulation calculated that the probability of spending 48-50 hours on this small project was around 1%. In this case, the worst possible outcome was 53 hours. In larger projects cost overruns and vast schedule delays can have far worse consequences.

The Monte Carlo simulations also provide a reasonable level of contingency for a project, as they demonstrate what outcomes are more imaginative than realistic. Finally it has to be emphasized that forecast tools such as Monte Carlo simulations are only as reliable as the data they are based on, i.e. reliable input leads to reliable output.

The mechanic scenario is one manifestation of optimism bias, or overconfidence in one's own ability. Optimism bias has proven to be a significant problem in public projects where overly optimistic estimates are used as prerequisites to select a given project solution (Friðgeirsson 2009).

Flyvbjerg et al. (2002) state that this is one of the main reasons for public project cost overruns. Furthermore, statistical evidence from their research indicates that this bias is frequently intentional, i.e. that the bias stems from deliberate deception of project promoters. Another manifestation of optimism bias is demonstrated in the fieldwork findings of this dissertation, where respondents were asked to evaluate a skill in comparison to their peers.

In large projects, it can be enlightening to consider the worst case scenarios – and for that matter also the best case scenarios. As discussed by Cretu, Stewart, & Berends (2011, pp. 83–85) worst case scenarios are rare, but should nevertheless be discussed. Worst case scenarios could include extreme weather conditions, line rupturing or conjunctive bad luck that puts the project in jeopardy. The focus should be on the impact the worst case scenario can have on the project scope and objectives. This is largely about mitigating potential losses, not



preventing worst case scenarios. The imagining of worst case scenarios can also help forecast unexpected events, thereby making reactive and preventive measures easier to handle.

2.6 Distinctive issues with public projects

As this study focuses on public projects that are funded by taxpayers' money, it is important to distinguish these projects from commercially funded projects. The following distinctions should be pointed out:

1. Legal environment: In Iceland, government bodies are prohibited by law to purchase commodities or projects that surpass a given monetary value, without first going through a tendering process. When evaluating tenders, public project owners are obliged to accept the most economically advantageous tender, whereas in the private sector, clients can accept any tender. In both cases, the clients are allowed to reject all bids (Ministry of Finance 2007).
2. As Kerzner (2009, p. 366) remarks, profit can be immediately identified by looking only at the parameters of cost, time and performance. However, since public projects are generally not profit-oriented as private sector projects, they also focus on objectives such as optimal public benefit when selecting a project.

This does not mean that cost, time and performance are not important for public projects, as the optimal utilisation of public funds is important to all organisations and societies. However, it is vital to select the right project based on needs and well-established objectives that form a part of the general strategy, thus laying the appropriate foundations for truly successful public projects.

2.7 Chapter summary

This chapter discussed and covered the key aspects of best practices for initial decision making and selection of public projects. The dissertation is limited to the first two phases of the project lifecycle, the conceptualisation phase and the feasibility study phase, at the end of which the decision making or project selection takes place.

The chapter moved on to a brief discussion of project management was followed by approaching the somewhat obscure concept of project success. Later in the chapter project success was examined from the perspective of public projects that should have different success criteria than privately promoted projects. A distinction was then made between project success and project management success. It was concluded that the establishment of success criteria for each project was important to avoid the stakeholders' subjective evaluation of success, thereby making the projects more transparent.

The relation between projects and their vision, strategy, tactics and objectives in an organisation or society was discussed. A fictional scenario of a public library seeking solutions to reach their vision was provided. Next there was an introduction to the SMART mnemonic, a device to help with setting objectives. SMART was connected to the ten success



criteria established by Pinto & Slevin (1988), where a clear project mission was stated as the most important success criteria for projects. The project scope is closely related to this, as it states all project objectives along with deliverables and project justification. An appropriate tool to help with a comprehensive approach to projects is the WBS. When the scope has been agreed upon, it should be finalised with the project scope statement.

Before introducing the process further, the positive effect of strategic decision making on project outcome was confirmed with a review of a comprehensive study performed by Dean & Sharfman (1996). The same study also confirmed the negative effect of political behaviour on decision making. This can possibly originate in moral hazard, as introduced in chapter 2.4.1.

Next, the project lifecycle was discussed, along with best practices for conceptualisation and feasibility studies. Best practices in the fields of risk management, general decision-making and management methods were also discussed, giving examples of common judgement biases.

Finally, two distinctive issues concerning public projects that separate them from private projects were discussed with examples.

Before the research methods of this dissertation are introduced, it is essential to establish the best practices central to initial decision making and selection of public projects. This will be discussed in the next chapter.



3. Framing of best practices

This chapter provides an overview of the activities that should be included in the first phases of the project lifecycle, until the decision has been made to undertake a specific project, according to project management and decision analysis literature. The activities could have been organized into specific processes; however they can be combined in multiple different ways, and are therefore presented as a list. The methods presented in this chapter form the foundation for the methods that were used as benchmarks for best practices in the two research activities performed for this dissertation.

The two phases leading up to the decision are the conceptual phase and the feasibility study phase. The activities that should be included in each phase in order to reach best practice standards, according to the literature, are listed and explained. These two phases are supplemented by two other factors that cannot be left out: general decision making and risk management. These fields are further explained in the literature review. Also, figure 1.1 in the introduction chapter provides an overview of the phases and their supporting fields.

3.1 General decision making

- Use of tools for clear definition of objectives, such as the SMART mnemonic
- Definition of project success criteria
- Strategic consistency of projects
- Project scope
- Project Scope Statement
- Use of Work Breakdown Structure
- Use of decision-making models
- General emphasis on prioritizing when limited funds are available

3.2 Conceptual phase activities

Definition of problem / need

- Thorough analysis of problem
- Market/environmental demand analysis
- Stakeholder analysis, mapping and consultation

Identification and definition of potential solutions

- Brainstorming ideas
- Analysis of what will happen if nothing is done
- Creation of options
 - Slight altering of already established options
 - Documentation of assumptions that are made about the options



- Conceptual technical evaluations
 - Radical options should always be included
 - No options are left out at this stage
- The absence of authorities is important at this stage as their presence could disturb creative work
- Use short team meetings for creative work
- User involvement is critical during the early stages of projects

3.3 Feasibility study phase activities

Economic appraisal

- Financial – Net Present Value, Internal Rate of Return, Return on investment
- Social economic effects
- Cost – benefit analysis
- Cost-effectiveness – are the stakeholders getting value for expenses?
- Preliminary cost estimates
 - Capital cost
 - Running and maintenance cost
 - Whole-life costing

Technical appraisal

- Literature review for latest technology
- Available skills
- Development of practical solution for required conceptual options

Detailed market appraisal

- Demands
- Requirements

Strategic appraisal

- Short-term strategy
- Long-term strategy
- Restatement of objectives



Trade-off analysis for criteria

- Potential trade-off between time, cost, performance and the other important criteria important for success (from subchapter 2.2)

Other appraisals

- Legal appraisal
- Environmental appraisal
- Operational appraisal

As in the conceptualisation phase, the importance of user involvement (stakeholder involvement) is emphasised.

3.4 Risk management

- Mapping of uncertainties and risks
- Cognitive bias awareness
 - Heuristics
 - Judgement bias
 - Optimism bias
- Mapping of worst case scenarios
- Mapping of project strengths, weaknesses, – opportunities and threats (SWOT)
- Scenario simulations
- Disregard for sunk costs
- Use of sensitivity analysis
- Application of appropriate contingencies

3.5 Decisions

- Termination of unfeasible projects
- Prioritising feasible projects (in case of limited resources)
- Project decision/selection

3.6 Chapter conclusion

A decision-making process that contains the tasks mentioned above will help the decision-makers finding the optimal project solution according to the literature. As previously stated, the consequences of poor decision making can be (Kerzner 2009, p. 419):

- Termination of feasible projects
- Continuation of unfeasible projects



It is difficult to define the exact causes of poor decision making. Some authors have tried to define the most important points and causes that could explain the continued existence of unfeasible projects. It is even more difficult in public projects whose prerequisites involve political decisions. As previously discussed, political behaviour has a negative effect on decision making (Dean & Sharfman 1996).

Dey (2001) states that the most common reasons for poor decision making are overly optimistic estimates that lead to a biased project appraisal.

Flyvbjerg et al. (2002) acknowledge the optimism bias problem and they have also presented research findings that suggest that project promoting in large infrastructure projects in Europe and North America are intentionally biased, resulting in severe and recurring project cost overruns.

Kerzner (2009, p. 420) adds another perspective. He states that decision-makers often continue with projects simply because they think that the termination of all projects after the feasibility study would cast doubt on the group's judgment.

Finally, the assumed effect of best practices in initial decision making and selection of public projects must be stated. This should be considered to affect the strategic decision-making of projects in a similar way as project management. The appliance of best practices cannot guarantee project success in an uncertain world. Systems or best practices do not make decisions. That is the role of the decision-makers. However, the application of best practices should maximise benefits of project decision making and selection, while minimising the potential problems. Thus, they increase the probability of successful project outcomes for stakeholders.



4. Research methods

4.1 Framing of the research

The objectives of this research were:

1. To identify best practices for initial decision making and selection in public projects in the literature and to select representatives of the best practices in tactical methods.
2. To provide measurable comparison between initial decision making and selection in public projects in Iceland and best practices and prerequisites for public project decision-making in comparable countries.
3. To provide a GAP analysis between best practices and applied methods in Iceland.
4. To suggest improvements to the process of initial decision making and selection of public projects.

4.1 The guidelines analysis

The first part of the research was an analysis of the Public Procedure Policy for the pre-study, planning and execution of public projects in Iceland (PP) (The Icelandic Ministry of Finance, 2002). The PP and the Green Book were benchmarked against best practices established from the literature review and framed in chapter 3.

4.1.1 Iceland

The Icelandic guidelines are called: The Public Procedure Policy for the pre-study, planning and execution of public projects in Iceland (PP) (Verklagsreglur um tilhögun frumathugunar, áætlunagerðar og verklegrar framkvæmdar við opinberar framkvæmdir). The objectives or purpose of the PP are not discussed further than the title. The nine-page guideline document contains no appendices. The PP is for example used by the Government Construction Contracting Agency (Framkvæmdasýsla ríkisins) according to the agency's home page.

4.1.2 United Kingdom – The Green Book

The Green Book is issued by HM Treasury. The current version is from 2003, with changes made to the book in July 2011. The book is a guide on how project proposals should be appraised before significant funds are committed, and how past and present activities should be evaluated. This is done to ensure that government funds can provide the greatest benefits for society and that they are spent in the most efficient way. These guidelines are presented in 113 pages including appendices.

4.2 The questionnaire survey

The second part of the research was a questionnaire survey (Appendix 8.1) that was filled out during direct interviews with members of three Parliamentary committees: the Budget-, Environment and Transport-, and Industries committee. The questionnaire sought to compare the responses with the best practices discussed in chapter 3. The questionnaire was divided into six sections.

Sections 1, 2 and 4 were divided into two subsections each. In the first subsection, the Members of Parliament were asked if the committees used recognized and defined methods



for general decision making, feasibility studies and risk management, and if so, they were asked to elaborate on these methods. Furthermore, they were asked if they considered the use of recognized and defined methods to be important. The second subsection in sections 1, 2, and 4 focused on the Members of Parliament's knowledge of specific tactical methods used for the same three categories as in the general subsection.

In section 3 the Members of Parliament were asked about the regulations and procedures that they use in their committee work. In section 5 the Members of Parliament were asked if they thought it was important to issue a public guideline on decision-making methods. Finally, in section 6, established techniques for discerning optimism bias and representativeness heuristic were used to determine the existence of judgement biases among the Members of Parliament, using the definitions of Tversky & Kahneman (1974).



5. Results

5.1 Guidelines analysis results

The objectives of this part of the research were to produce and analyse measurable output to determine the consistency of the guidelines with best practices and benchmark them against each other. The purpose was to analyse how the guidelines could assist decision-makers and contribute to enlightened decisions regarding public projects. Specific subjects that are fundamental to best practices were selected for the benchmarking.

This qualitative comparison of two standards cannot be tested statistically. However, the considerable difference in the scores of the two guidelines indicates considerable difference in “performance” of the two guidelines.

In the evaluation of the guidelines, points were given from 0-3, where 0 stands for none or very limited consistency with best practices and 3 stands for full consistency or application of the subject in focus. The scoring sheets can be found in appendix 8.2. The research was divided into four subject categories: General decision making, Conceptualisation, Feasibility studies and Risk management.

5.1.1 General decision making

Below are the illustrated results of the first subject category (figure 5.1), regarding the consistency of the guidelines with best practices for general decision making. Eight subjects were selected to indicate the consistency with best practice methods.

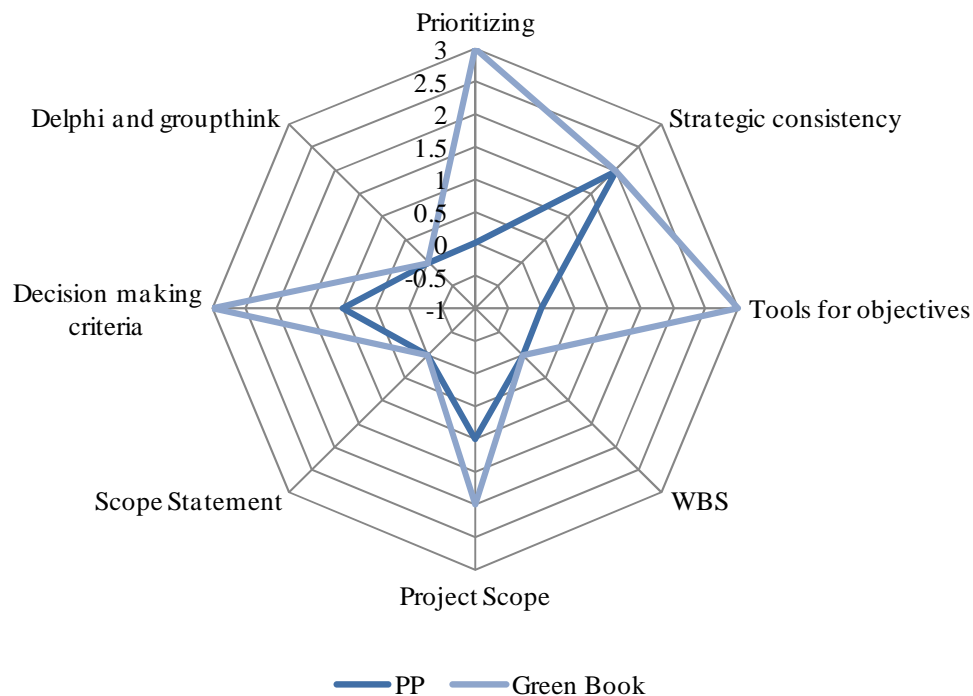


Figure 5.1: The PP consistency with best practices in general decision making was found to be severely lacking, with an average score of 0.5 points. The Green Book had better results, with an average score of 1.63 points. Both guidelines lack WBS, scope statement and coverage of methods regarding group decisions (Delphi method and groupthink).



5.1.2 Conceptualisation

Below are the illustrated results of the second subject category (figure 5.2), regarding the consistency of the guidelines with best practices for project conceptualisation. Seven subjects were selected to represent best practices.

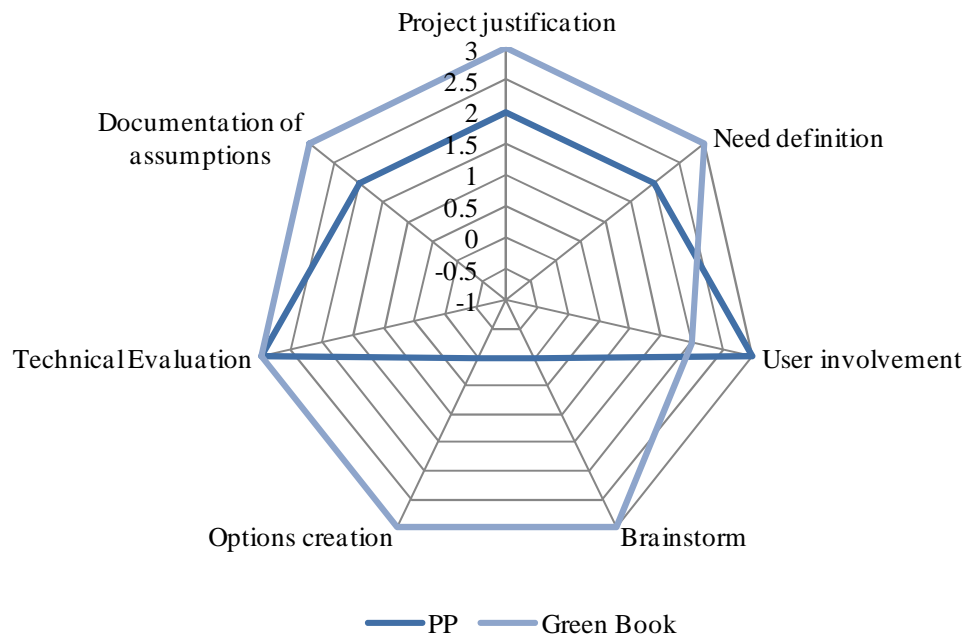


Figure 5.2: Consistency of the PP with best practices in the conceptualisation phase scored an average of 1.71 points. The score suffered from the absence of suggested methods for option generation and brainstorming, whereas conceptual technical evaluation and user involvement were considered to be consistent with best practices. The Green Book was consistent with best practices in all subjects but one, earning an average score of 2.86. The coverage of user involvement in this phase was not consistent with best practices.



5.1.3 Feasibility studies

Below are the illustrated results of the third category of subjects (figure 5.3), regarding the consistency of the guidelines with best practices for project feasibility studies. Ten subjects were selected to represent best practices.

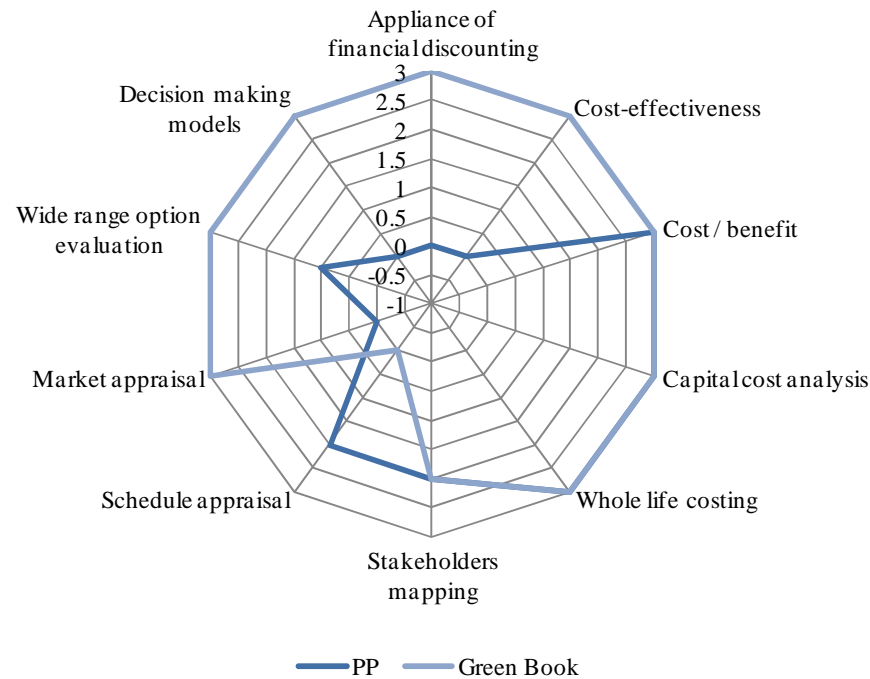


Figure 5.3: The PP demonstrates fluctuant consistency with best practices, which emphasises the importance of project cost (Cost/benefit, capital cost analysis and whole life costing). However, other evaluations are not as central in the PP. This resulted in an average score of 1.4 points for the PP. The Green Book omits schedule appraisals but other factors are largely consistent with best practices. The average Green Book score for this category was 2.6 points.



5.1.4 Risk management

The results of the final category, risk management, are presented below (figure 5.4). Six subjects were selected to represent best practices.

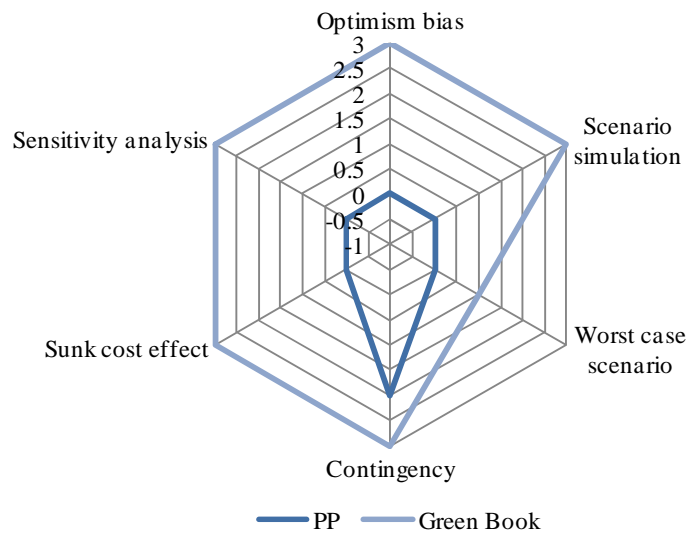


Figure 5.4: The consistency of the PP with best practices in risk management was found to be lacking. The PP received an average score of 0.17 for risk management. The Green Book was largely consistent with best practices, with an average score of 2.67 points. All subjects scored three points with the exception of “Worst case scenario,” as the identification of worst case scenarios is not covered thoroughly in the Green Book.



5.1.5 Comparison between PP and Green Book

The results showed a significant gap between PP and the Green Book regarding consistency with best practices. Below is a chart showing the scoring percentage of the guidelines in each category (figure 5.5).

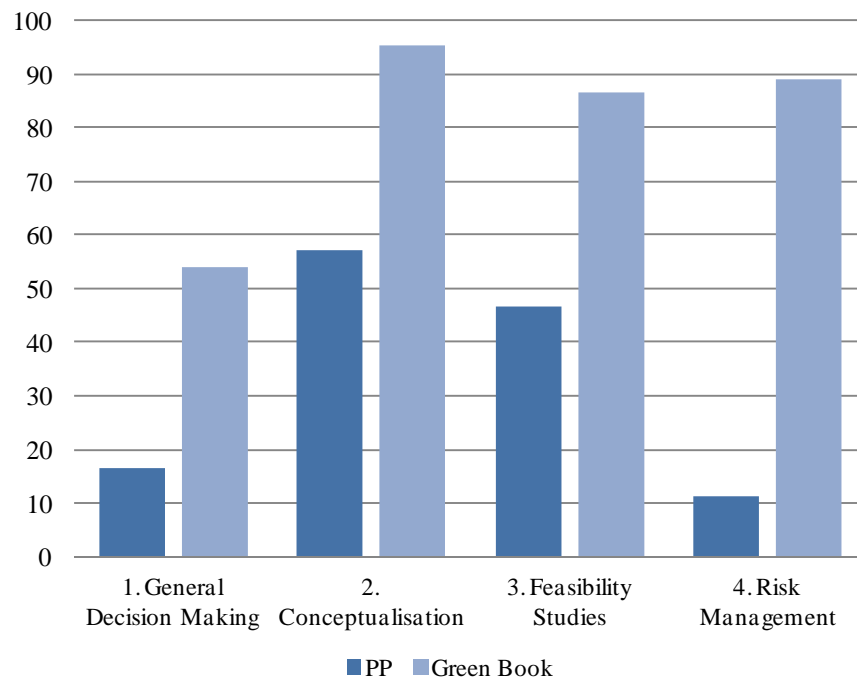


Figure 5.5: Overview of each guideline's score in the four subject categories. The scores of the PP were lower than the scores of the Green Book in all categories. The gap between the two guidelines was similar in categories 2 and 3 but it increased in categories 1 and 4. In category 4, the PP scored 2 points out of 18 (11%), compared to the Green Book's score of 16 out of 18 (89%).



5.2 Questionnaire survey results

5.2.1 Introduction

The objectives of this part of the research were to analyse and produce measurable results of Parliament members' ability to utilise best practices in the respective categories for decision making in public projects. The desired effect of correct methods would be efficiency in the project selection phase. Like in the guidelines analysis, the questionnaire survey focused on specific subjects that the literature review found to be indicative of best practices. All of the subjects were tactical methods, or synonyms for tactical methods, used in the different phases and fields of public project decision making.

This part of the research consisted of questionnaire surveys that were filled out in direct interviews with Members of Parliament. The relevant terms were translated during the interview. The interviews were limited to the members of three Parliamentary committees: the Budget committee, the Environment and Transport committee and the Industries committee.

These committees were selected because of their relevance to public projects. The Budget committee discusses funding, whereas the others deal with transport projects and industrial projects, which have been prominent among Icelandic public projects in recent years.

The response rate was 60%, with the participation of 15 of the 25 Members of Parliament contacted. Two members in the sample are on two of the three committees previously mentioned. Those who did not participate in the survey could either not be reached during the survey period (12%) or were unable to participate (28%). The sample size does not provide an option for testing statistical significance.

The structure of the questionnaires was described in chapter 4. The main difference between the subjects of the questionnaire survey and the guidelines analysis is that the conceptualisation phase was not included in the questionnaire survey, as conceptual work is rarely done by Members of Parliament.



5.2.2 General decision making

Below are the illustrated results of the first subject category: knowledge of general decision-making methods (figure 5.6). Five tactical subjects were selected to determine the respondents' knowledge of best practices.

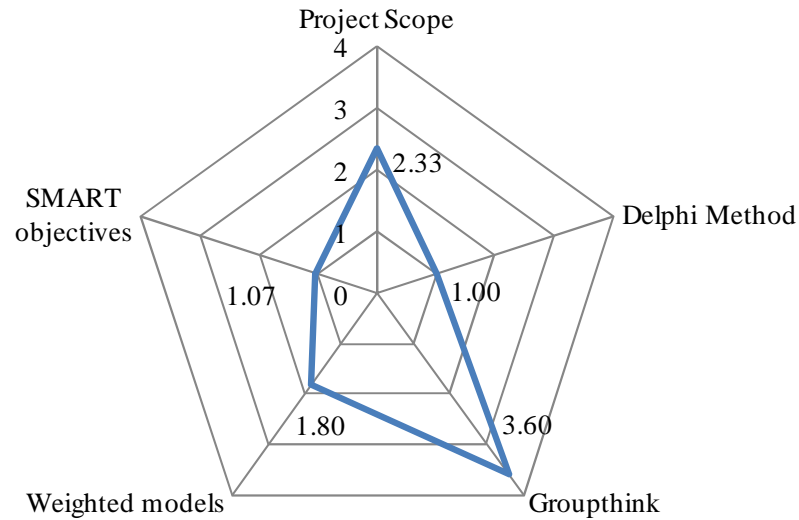


Figure 5.6: The average score for respondents' knowledge of the given tactical methods. Groupthink earned the highest score, with an average of 3.6 (on a five point scale). The subjects with the lowest score were the SMART objectives and the Delphi method, with an average score close to 1 point.



5.2.3 Feasibility studies

The results of the second subject category, regarding knowledge about tactical methods for project feasibility studies are illustrated below (figure 5.7). Four tactical subjects were selected to indicate the respondents' knowledge of best practices.

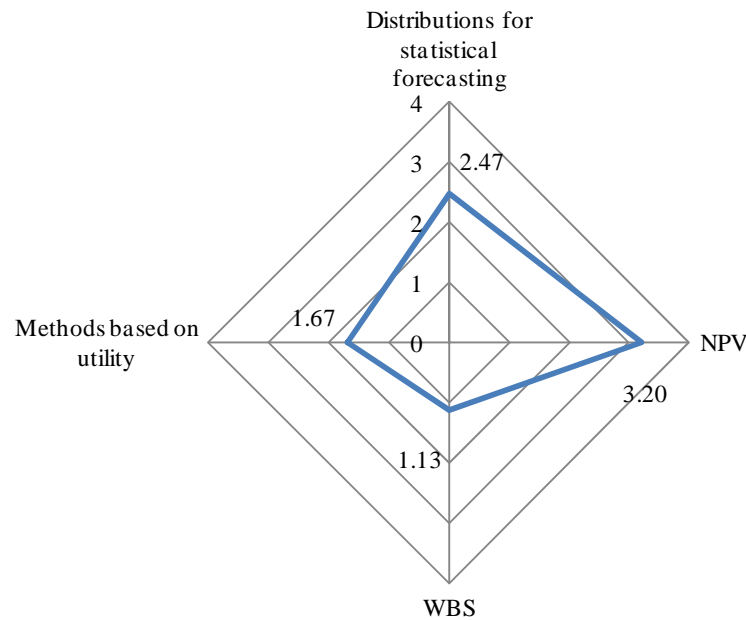


Figure 5.7: The average scores for each given subject are presented in this spider chart. The subject that participants were most familiar with was NPV, or financial Net Present Value. The members of the Budget committee scored an average of 4 points, whereas members of the Environment and Transport- and Industries committees scored an average of 1.33 and 3.43 points on this subject. Distributions for statistical forecasting displayed a similar score distribution, where the Budget committee average was the highest (3.17). The average scores for the Environment and Transport- and Industries committees were 1.33 and 2.29 on this subject. Here it is necessary to emphasise that results from small samples are vulnerable to fluctuations.



5.2.4 Risk management

The results of the fourth subject category, regarding risk management of projects are illustrated below (figure 5.8). Seven tactical subjects were selected to indicate the respondents' knowledge of best practices in this field.

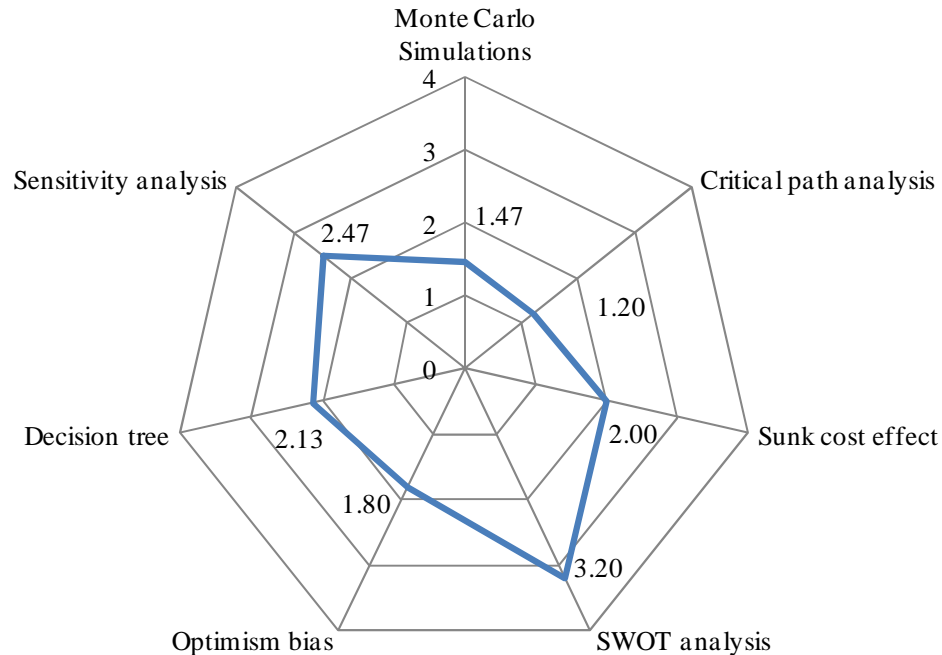


Figure 5.8: The average scores for each given subject can be viewed above. The highest scoring subject was the SWOT analysis, with an average of 3.2 points. According to respondents, this is frequently used by politicians when preparing for election campaigns. The lowest scoring subjects were Monte Carlo simulations and critical path analysis, with averages of 1.47 and 1.20 respectively. Two of the 15 respondents scored higher than 1 for Monte Carlo simulations. Similarly, one respondent scored higher than 1 for knowledge about critical path analysis.



5.2.5 Overview of sections 1, 2 and 4

Below is a comparison between the results of each of the covered sections. The numbers indicate the respondents' score compared to full knowledge of best practices.

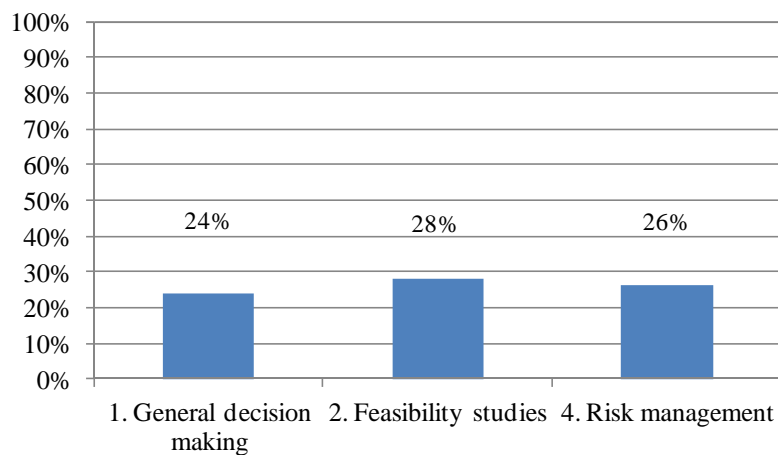


Figure 5.9: The average score was around 40% in all sections of the original survey. However, the score range was from 1 to 5 points, where no knowledge of the subject awarded you 1 point (20% of the full score). In almost every case where the respondents acquired 1 point, they had never heard of the subject before. Therefore, adjustments had to be made to the scoring system. As the figure illustrates, when the scale has been changed to 0-4 points the average score is 24%, 28% and 26% for sections 1, 2, and 4 respectively.

The participants' scores ranged from 21 points to 58 points, the maximum score being 80 points. Here it should be emphasised that no knowledge of the subject could "earn" you the "first" 16 points (explained in the caption for figure 5.9). Below, in figures 5.10 and 5.11, are overviews of the 15 respondents' percentile score, including and excluding the "first" 16 points (explained in the captions).

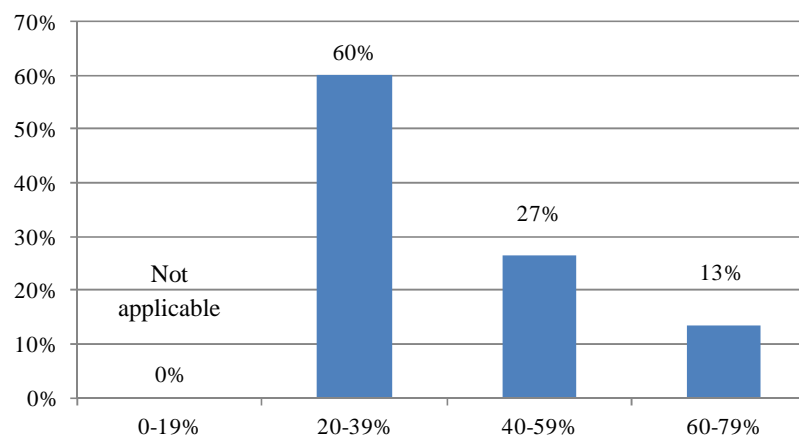


Figure 5.10: 60% of the respondents scored under 40%. One respondent scored under 30% in the survey. Scores under 20% are not applicable here, as the score of 1 was the lowest value available for each of the 16 subjects. In this interpretation one point was worth 1.25%.

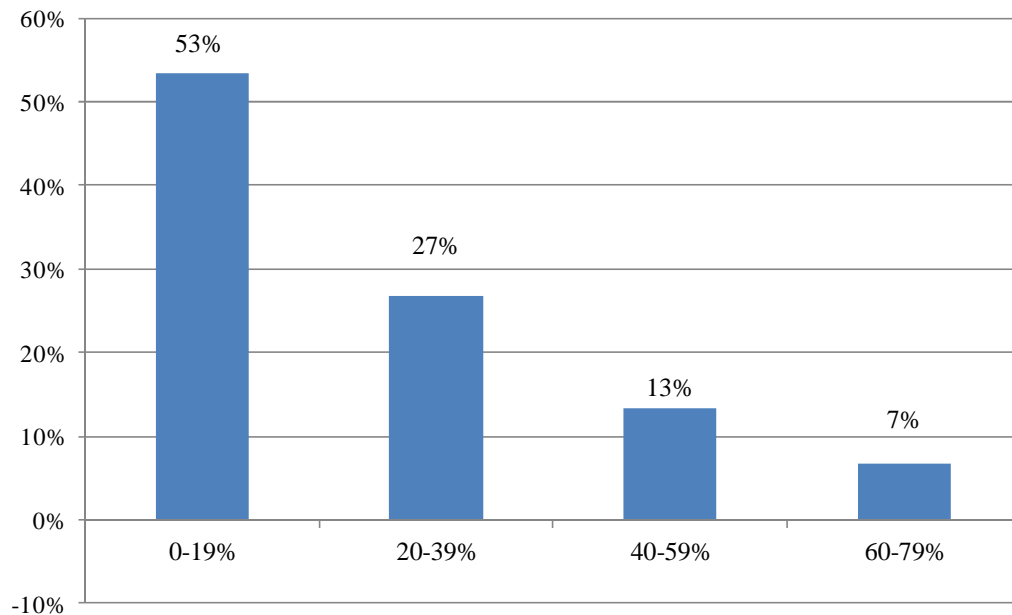


Figure 5.11: If the results are interpreted excluding the “first” 16 points, the chart shows that 8 out of 15 respondents scored under 20% in the survey, one of which scored under 10%. In this interpretation one point was worth 1.56%.

Here it is important to note that in the cases where participants scored only one point for a given subject, it was the lowest score available, described as “very limited knowledge.” Thus, the respondent had either never heard of the subject before, or considered their knowledge to be very limited. Overall, the former of these two explanations was more common. Naturally, the qualitative estimates are indications of the true score. However, it is important to publish both versions, as some respondents scored 16 points (20%) in the first graph without having any knowledge of the subjects.



5.3 Judgement biases

This chapter presents the results from section 6 of the questionnaire survey, where the existence of judgement biases among Members of Parliament was analysed. The judgement biases that were selected for the interviews were: optimism bias and representativeness heuristic (Tversky & Kahneman 1974). The objectives of this section were first and foremost to confirm and demonstrate the presence of the cognitive biases that were discussed in the literature review.

1) Optimism bias or overconfidence

The respondents were asked to answer the following question with one of the five options displayed below on the bar chart's x-axis. The chart demonstrates the distribution of answers (figure 5.12). The question was answered by 14 of the 15 participants.

How would you estimate your own skills in giving public speeches in comparison to the average skills of all parliament members?

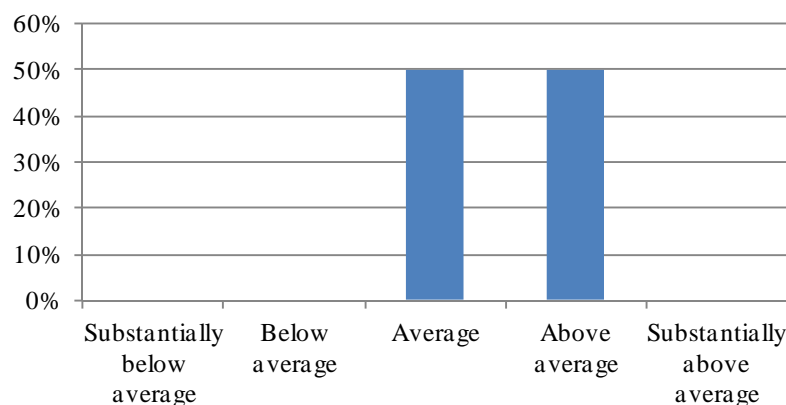


Figure 5.12: 50% of the respondents considered their own ability in giving public speeches to be average and 50% considered themselves above average. No respondents considered themselves to be below average.

2) Representativeness heuristic

The respondents were given the following information:

Hafsteinn is in his twenties, he is tall and powerfully built. He diligently engages himself in his profession and is well liked by colleagues. He is considerate about his own health and engages in physical exercise regularly as well as keeping a healthy diet. Sports are Hafsteinn's favourite television material along with reading books. Hafsteinn is the youngest of 5 siblings.

They were then given two options and asked to select the one they considered more likely to be about Hafsteinn, according to the available information:

- () Hafsteinn is a real estate agent
 - () Hafsteinn is a real estate agent and plays basketball in his spare time.
-



The first option was chosen by 47% of the respondents, whereas 53% considered the second option to be more likely.

5.3.1 Other results

In sections 1, 2 and 4, the respondents were asked if the Parliamentary committees used recognized and defined methods in the decision-making process for important and large projects. The answers to the questions from each of the sections are illustrated below.

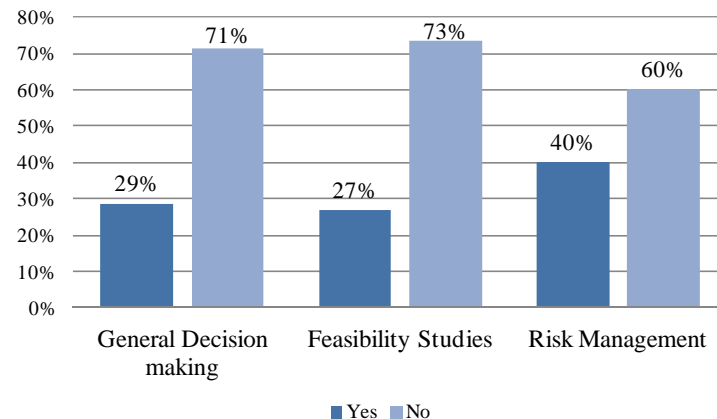


Figure 5.13: The figure shows that majorities of each Parliamentary committee believe that the committees do not use recognised or defined methods in their work.

The respondents that answered “yes” to the question were asked what recognized and defined methods they used in their committee work. The most common answer here was that the committees sometimes consult with specialists in the appropriate fields before making a decision. Several respondents pointed this out. Some mentioned examples of particular decisions-making processes that were very thorough, especially regarding risk management and feasibility studies. One of those was the Icesave case, where it was believed that the wrong decisions could result in severe financial consequences.

The respondents that answered “no” to the question were then asked if they considered it important that recognized and defined methods were used in general decision making, feasibility studies and risk management for larger projects that were covered and discussed by their respective committees. Majorities of the respondents answered “yes” to this question, as figure 5.14 clearly shows.

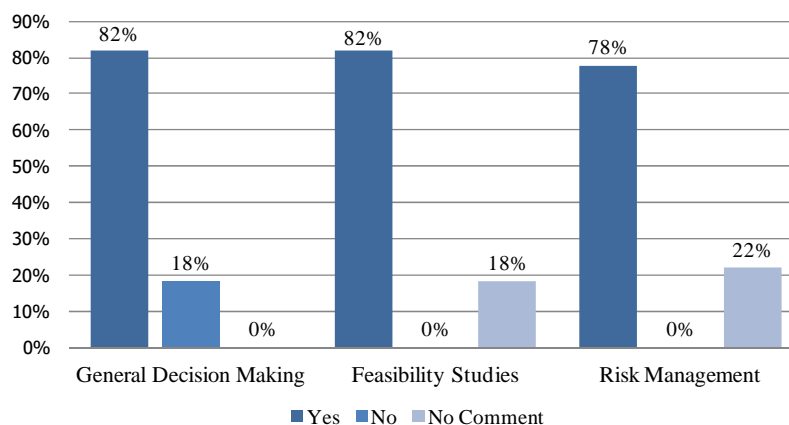


Figure 5.14: The majority of the respondents who did not think their committees used recognized and defined methods for each of the three sections believed it is important to use recognized and defined methods.

The respondents were asked if they relied on any procedure policies or regulations when discussing and appraising public projects. Twenty percent said that they did not rely on any regulations, whereas 80% said they did. The respondents were sequentially asked what regulations they relied on. The most common answers were the Rules of parliamentary procedure (Þingskapalög), Rules about Parliamentary committees agenda coverage (Reglur um meðferð erinda til þingnefnda), and the frequent practice of seeking specialist advice. The Budget committee is also obliged to follow the Law of public national finances (Fjárreiðulög ríkisins) and Law of Financial accounting (Lög um reikningsskilanefndir) in their work. Finally, one respondent mentioned that strategic plans, such as the Transport plan and Telecommunications plan served as guidelines to be followed. No respondent mentioned the use of the PP guideline in their work, as a supporting tool for with decision making in public projects.

Finally, the respondents were asked if they thought it was important that a public body would issue benchmarks for recognized and defined methods, that Parliamentary committee members could use to assist them in decision making about important issues. Eighty percent of the respondents answered “yes” to the question, 7% answered “no” and 13% of the respondents refused to answer the question.



5.4 The GAP analysis

This subchapter will present the GAP analysis of prerequisites for initial decision making and selection in public projects. Icelandic prerequisites of project decisions are in focus only. The analysis consists of comparing the desired state (best practices) to the current state (methods used in Iceland), thereby determining what needs to be done to reach the desired state. The GAP analysis will be presented in these sections: general decision making, conceptualisation, feasibility studies and risk management. This division allows for a comparison of results of the guidelines analysis and questionnaire survey. The analysis is limited to analysing the methods used in Iceland and the best practices stated in chapter 3.

The most important issue this gap analysis was faced with was to determine the degree to which best practices are, or can be, used by decision-makers. In the figure below, the scales used in this dissertation's research activities have been adjusted for better interpretation of the gaps in terms of practical use.

Level	Score %	Practical use description
1	0-19	No practical use potential
2	20-39	Limited practical use potential
3	40-59	Some practical use potential
4	60-79	Beneficial practical use potential
5	80-100	Full best practice use potential

Figure 5.1: This table gives an overview of how the results presented can be interpreted in terms of their potential for practical use. For example, full best practice use potential should be equivalent to comprehensive knowledge of a subject. A subject that is covered to best practice consistency in a guideline, or by a decision maker with comprehensive knowledge of the subject, would most likely be beneficial to public project decision making. The adjusted interpretations are used in GAP conclusions below.

5.4.1 General decision making

Guideline analysis

General decision-making methods in the PP guideline had a score of about 15% compared to best practices. This indicates that there is a long way from the current state to best practices. As figure 5.1 demonstrated, the main focus should be on implementing methods regarding clear objective setting, prioritising and management and definition of project scope.

Questionnaire survey

The results of the questionnaire survey chapter in this section indicate a score of about 24% knowledge of best practices. This is a slightly better result than in the guideline analysis, but still indicates a gap of about 76%.

GAP analysis conclusion

There is a large GAP in the prerequisites of this field improvements should be applied immediately. Practical use potential is currently in levels 1-2 (15% and 24% score percentage), indicating none to limited practical use potential.



5.4.2 Conceptualisation

Guideline analysis

In the conceptualisation phases, the current state of the PP scores 57% compared to best practices. Overall, the outcome was good, with the exception of the subject categories creation of options and brainstorming. As this section was not included in the questionnaire survey due to applicability to the roles of parliament members, the GAP conclusions are only based on the guideline analysis. The PP earned an average score of 1.71 points, closely equivalent to some practical use potential.

GAP analysis conclusion

The findings indicate some GAP, although some practical use can be derived from the guideline's contents about subjects in this field, indicating level 3 use potential. However, this is only based on the guideline analysis.

5.4.3 Feasibility studies

Guideline analysis

The current state of the PP regarding best practices for feasibility studies scored about 45% compared to best practices. The scores vary greatly between subjects. Subjects that are related to cost estimation earned a full score of three points while four out of ten subjects scored zero. For example, it is extremely important to use recognised discounting methods such as NPV for forecasting and reporting, to avoid confusion about project cost among the stakeholders. It must be noted that large projects often require many years of preparation and thus the cost figures need to be adjusted to present comparable values. Cost-effectiveness is not a focal point in the PP, which is a matter of concern since focus on cost alone disregards focus on value. Other subjects that scored zero are market appraisals and the use of decision making models.

Questionnaire survey

The knowledge of Parliamentary committee members was 28% of best practice requirements. Knowledge of NPV scores higher than the PP which is positive and slightly decreases worries of this subject.

GAP analysis conclusion

The GAP is considerable in this field and improvements are needed. The scores of 45% and 28% indicate some or limited practical use potential in this section, or level 2-3.

5.4.4 Risk management

The PP score in this field was the lowest of all four. The guideline does not emphasise risk management, and the only indications of such methods are found in some requirements of appropriate contingency, which scores 2 out of 3 points. However, no methods are explained in detail. There is no mention of subjects such as optimism bias and sunk cost effect that the literature described as one of the main causes of cost escalations. The percentage score in this field was 11%.



The Members of Parliament's knowledge is similar to the other fields, with a score of 26%, making the GAP 74% of best practice knowledge. The highest scoring subject was SWOT analysis, but the participants' knowledge of this subject was, according to them, mostly attained through preparations for election campaigns, and not used for decision making. Knowledge of optimism bias is low.

GAP analysis conclusion

A large GAP is present in the prerequisites of this field and improvements should be applied immediately. The scores imply that the current status is in level 1-2, indicating none or limited practical use.



6. Discussion

The objectives of this dissertation were to gain understanding of the current applied practices in Iceland for initial decision making and selection of public projects. These practices were then benchmarked against best practices in the field, according to project management and decision analysis literature, and applied methods in the UK. The material used to research the prerequisites of the decision-making process were the PP guidelines and the Green Book, for early project decision making, as well as Members of Parliament's knowledge, opinions and application of best practices.

As the contents of public guidelines should undisputedly benefit public projects, it can be argued that there is little need to examine political figures' knowledge of best practices in this field. However, political figures' are key decision makers in large public projects and thus, their knowledge of best practices are also prerequisites of decision making.

The findings presented in this dissertation regarding the gap between best practices and the current guidelines are certainly a matter of concern, especially the field of risk management. As discussed in the literature, this subject is the main reason cost overruns in public projects (Flyvbjerg et al. 2002), (Daniel Kahneman & Lovallo 1993), (Friðgeirsson 2011).

In the final remarks of his doctoral thesis, Klakegg (2010, p. 170) states his impression that there is a wide gap between established knowledge of good practice and actual methods used for public projects in Norway. This also seems to be the case in Iceland. Klakegg asks the question:

Why do people continue to make the same mistakes despite knowledge of good practice being available?

This question is also valid in Iceland as cost overruns in projects do not seem to decrease over time. This evolution is the same scenario that Flyvbjerg et al. (2002) described: estimations do not improve over time. If they did, most of the critique from these authors would be invalid. As they stated, optimism bias is one of the main reasons for cost overruns in public projects, and skilful risk management is the key to prevent cost overruns. However, skilful risk management is not supported by the analysed prerequisites in this thesis.

The findings of this dissertation support the presence of optimism bias among executives and decision makers, as previously stated by (Kahneman and Lovallo 1993). The findings indicate that there is low awareness of this cognitive bias and therefore we can assume that these decision-makers are unable to exclude this cognitive bias from their decisions.

These concerns are further increased by the fact that the PP guidelines do not deal with these subjects at all. The study also confirmed the presence of the representativeness heuristic. Although it has not considered as influential to cost overruns as optimism bias in literature, the presence of this heuristic reinforces the concern regarding cognitive bias affecting important decisions.



Politics have great effect on decisions regarding public projects. As stated by Dean & Sharfman (1996), politics generally have a negative effect on decision-making outcomes. Politicians are nevertheless the main decision-makers.

However, best practices for decision making and selection do not contradict politics. On the contrary, methods enhancing the probability of successful project outcomes should not conflict with political intentions, as politicians and stakeholders should benefit from enhanced probability of successful project selection.

Two Members of Parliament stated that methods for decision making did not apply to political decisions, as their basis needed to be random. This argument is rejected because public project stakeholders deserve that the level of effectiveness for decision making is not merely random.

Here it is important to emphasise that a certain level of standardisation in the decision-making process would benefit the society. The purpose is not to standardise opinions. This standardisation could consist of the use of applied methods such as the tactical methods introduced in chapters 2 and 3. However, such methods would support homogeneity in decision making, unlike the current process that does not emphasise the use of recognised and defined methods.

Members of Parliament frequently referred to the process of seeking expertise advice on important affairs in their committee work. The advice of these specialists is not disputed here.

However, the absence of guidelines for their input creates the possibility of undefined work. Furthermore, it can lead to ambiguous interpretations of results due to a lack of standardisation.

Some individuals consider it unnecessary to have rules or guidelines for creative work and decision making in public projects. However, it is important to implement a certain standardisation for the decision-making process in public project. This would add more transparency to the process. Kerzner (2009, pp. 418–420) supports this statement when considering life cycle stages. He states that the life-cycle phase is not intended to restrain the project management, but to create uniformity in the working phases. It also allows more control over the process, as the steps to be taken are planned beforehand.

In this dissertation two prerequisites of initial decision making and selection in public projects were researched. The results of the GAP analysis indicate that improvements are needed to the decision-making process, i.e. that the prerequisites of Icelandic public project are far from the best practice standard.

Project outcomes will always be as good or bad as their prerequisites. These prerequisites are the knowledge of decision makers, influence and knowledge of project stakeholders on decision makers, capital availability, law and regulations, politics etc. When these



prerequisites are not at a high standard, the probability of successful outcomes decreases. Studies of public projects in Iceland and other countries show the high frequency of cost overruns. A matter that has not been discussed here is the taxpayer's perception of success in Icelandic projects, which could be valuable input to this discussion.

Whatever the result from such a study would indicate, the frequent cost overruns of public projects in Iceland and other countries are unacceptable to taxpayers. This especially applies to cases where estimations do not account for all possible factors, but the projects are still undertaken as the risk is not placed on the decision-makers (moral hazard).

The current ambiguity of success criteria provides protective armour against criticism for unsuccessful projects. De Wit (1988) stated that the success criteria for projects should be the project objectives; however, this opens the door for the stakeholders' subjective success estimates, that could be built on evaluations made to enhance their own interests.

As the SMART objectives mnemonic suggests, project objectives should be specific, measurable, attainable, realistic and time-bound. It could be argued that measurable and "SMART valid" criteria should be included in the original project objectives where the mnemonic was not used. Thus, there would be no need for a guideline to follow. This could be correct.

However, the results of this study prove that this is a weak argument. Firstly, public guidelines in Iceland do not suggest best practices for setting of project objectives. Secondly, there is very limited knowledge of the SMART mnemonic among decision-makers in the Parliamentary committees. Thus, it cannot be assumed that valid and comparable project objectives are included in all projects. Standardised success criteria should be used in all public projects.

Regardless of the perceived success of Icelandic projects that are undertaken upon decisions from the decision making process in Iceland, the decision-makers and guidelines are not utilising the potential of best practices for initial decision making and selection of public projects.

Awareness of the guidelines is scarce and the guidelines themselves are not overall highly consistent with best practices. Thus, a public guideline should be implemented to strengthen the decision-making process with recognized and defined methods that would lead to better utilisation of public funds.

A large majority, or 80%, of the Members of Parliament agreed that changes need to be made. The presence of such benchmarks or guidelines should lead to a higher success rate of public projects; moreover it should make the meaning of the word success more distinctly defined. As previously mentioned, benchmarks could function as a new version of the PP, where beneficial methods could be emphasised. The question is: what are the most suitable short-



term and long-term solutions? This is discussed in the next chapter, where answers to the research questions stated in chapter 1 are provided.

The most positive finding of this study is perhaps the high rate of respondents who agreed to the importance of these guidelines. It is also reassuring to see that the majority of the respondents consider it important that recognised and defined methods are used when making decisions about larger projects.

To conclude this discussion, it is the author's impression that the mistakes the literature discusses are equally being made in Iceland and other countries. Furthermore, the interest level of improving applied methods is not visible in practice. However, Members of Parliament who participated in the survey consider it important that improvements are made. Time will tell if these concerns are sufficient to urge for implementation of improvements, but the importance of these improvements seems undisputed and their potential for enhanced project outcomes is significant.



7. Conclusion

7.1 Restatement of research objectives

The objectives of the research presented in this dissertation were the following:

1. To identify best practices for initial decision making and selection in public projects, as presented in the literature, and to select representatives of the best practices in tactical methods.
2. To provide measurable comparisons between the initial decision making and selection in public projects in Iceland and best practices and prerequisites for public project decision-making in comparable countries.
3. To provide a GAP analysis between best practices and applied methods in Iceland.
4. To suggest improvements to the process of initial decision making and selection of public projects.

7.1.1 Reporting of hypotheses testing

The research presented in this dissertation was intended to test the hypotheses presented in subchapter 1.5.2. Underneath, the hypotheses are restated and discussed with the help of the findings presented in chapter 5.

Hypothesis 1

The Icelandic purpose fit guidelines for initial decision making and selection of public projects do not measure up to the requirements of best practices in decision making.

In the guidelines analysis, the PP guideline earned a score of 31 out of 93 (1 out of 3) possible points in the benchmarking against best practice methodology. This is considered a low score, especially with the valid comparison that is covered in hypothesis 2. The scores for general decision making and especially for risk management are very low (figure 5.5). Thus, this hypothesis is considered proven.

Hypothesis 2

There is a significant gap between the Icelandic purpose fit guidelines for the decision-making process of public projects and their counterpart in the United Kingdom.

As figure 5.5 illustrates, the Green Book (United Kingdom) demonstrates higher consistency with best practices established in earlier chapters than the Icelandic guidelines. The gap varies from about 40% to about 80% of the score. The total score of the Green Book was 75 out of 93, compared to the 31 points scored by the PP. This is a significant gap. Thus, this hypothesis is considered proven.



Hypothesis 3

The members of the Parliamentary committees, who make decisions regarding large public projects and evaluate them, generally have little knowledge of best practices in decision making and project selection.

According to the findings of this study, 74% of the respondents scored below 40% in the survey about their knowledge of best practices in the four fields the research focused on. Only 13% of the respondents had a score of 50% or higher. Thus, this hypothesis is considered proven.

Hypothesis 4

The prerequisites of decision making for large public projects in Iceland do not meet the requirements of best practices for decision making and selection of projects.

This hypothesis was tested with the research conducted for this dissertation: the guidelines analysis and the questionnaire survey.

With the limitations of the research already accounted for, the findings of the guidelines analysis suggest that there is a significant gap between the PP and best practices for initial decision making and selection in public projects. Furthermore, the findings from the questionnaire survey suggest that knowledge of these methods is scarce among the Members of Parliament who participated. Thus, this hypothesis is considered proven with the given limitations.

7.1.2 Answering research questions

These research questions were asked in subchapter 1.5:

- a) Is there a gap between the prerequisites of initial decision making and selection in public projects in Iceland and the United Kingdom, regarding purpose intent guidelines?
- b) Is there a gap between the prerequisites of initial decision making and selection in public projects in Iceland and the field's best practices described in the literature?
- c) Are there specific fields of the decision making process that need more improvement than others?
- d) What short-term and long-term improvements can be made to the decision-making process?

So far research questions a) and b) have been answered. Significant gaps were found between best practices and the purpose intent guidelines. These findings along with low knowledge of best practices among Members of Parliament suggest significant gaps in between best practices and the prerequisites of initial decision making and selection in public projects.



The GAP analysis indicated particularly low scores in the supporting fields of general decision-making and risk management. The participants' knowledge of these fields was similar to their knowledge of feasibility studies and therefore improvements to these two fields are particularly needed, thus answering research question c). The next subchapter will provide recommendations to answer research question d).

7.2 Conclusions and recommendations of improvements

The findings of this research showed two mainly positive facts. The first regards the fact that around 80% of the respondents believed it to be important that recognized and defined methods were used in the Parliamentary committees' decision-making processes.

Secondly, 80% of all respondents believed that it is important that a public body would issue benchmarks to assist with decision-making processes in Parliamentary committees. This indicates clear willingness to improve the decision-making process for the benefit of all public project stakeholders.

In the near future, a large part of the required improvements in Iceland could be acquired by simply adopting the Green Book and emphasising its use for decision making and project selection in Iceland. However, the Green Book's score for general decision making suggests that other measures should also be sought to improve this field of knowledge.

In the long run, guidelines designed to meet Icelandic requirements would be the optimal solution. However, as the Green Book scored very close to best practice standard in many fields, this could be the easiest and most effective solution if supplemented appropriately.

7.3 Contribution of the study

This study contributes to the knowledge of methods for initial decision making and selection of Icelandic public projects. The acquired knowledge from this research regards the status of two prerequisites in this process, knowledge of decision makers and best practice consistency of guidelines. The study also identifies the gap between best practices and applied methods, which indicates the level of effort that should be applied to improvements in each field of knowledge. Finally, recommendations for short-term and long term improvements have been provided.

7.4 Further research opportunities in the field

A possibility for further study is a comparative analysis of decision-making effectiveness and efficiency in the management methods of private project sectors, for example in Icelandic engineering- and construction companies. An analysis of private project owners would be a valid comparison to the questionnaire survey presented in this dissertation.

Lastly, a comparison of estimated cost and actual construction cost in large private projects in Iceland would be useful. Those outcomes could provide valuable suggestions about the difference in estimates between public and private projects, and thus indicate the effect of political behaviour on decision prerequisites. Furthermore, it would be interesting to analyse



the prerequisites of initial decisions between the private and public projects that are undertaken. Along with a comparison of factual cost overruns, this would demonstrate the quality of decision making in public and private project regarding cost and cost overruns.



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8. Appendices

8.1 Questionnaire survey for parliament committees

Question no. 1: Decision making methodology.

General section:

- 1.1 Does the committee use recognized and defined methods when larger projects are appraised?
- 1.2 If “Yes” in 1.1.: What are these methods?
- 1.3 If “No” in 1.1.: Do you consider it important to use recognized and defined methods when making decisions about larger projects that are covered and discussed in the committee?

Abstract section

How well do you know the following terms and / or methodology used for project preparation and analysis?

1.4 Project Scope

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

1.5 The Delphi Method

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

1.6 Groupthink

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

1.7 Weighted models

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

1.8 SMART objectives

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge



Question no. 2: Feasibility study methodology

General section:

- 2.1 Does the committee use recognized and defined methods for feasibility studies of larger projects?
- 2.2 If “Yes” in 1.1.: What are these methods?
- 2.3 If “No” in 1.1.: Do you consider it important to use recognized and defined methods when undertaking feasibility studies for larger projects?

Abstract section

How well do you know the following terms and / or methodology used for feasibility studies?

2.4 Distributions for statistical forecasting

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

2.5 Net Present Value

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

2.6 Work Breakdown Structure

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

2.7 Methodology based on utility rather than financial benefits.

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge



Question no. 3: Verklagsreglur um opinberar framkvæmdir

General section:

1.1 Does the committee rely on procedure policies or regulations when discussing and appraising public projects?

() Yes

() No

1.2 If “Yes” in 3.1.; what procedure policies or regulations does the committee rely on?



Question no. 4: Risk Management

General section:

- 4.1 Does the committee use planned and defined methods for risk analysis and risk management on the projects that are discussed / appraised?
- 4.2 If “Yes” in 4.1: What methods are they?
- 4.3 If “No” in 4.1.: Do you consider it important that the committee uses recognized and defined methodology for risk analysis and risk management?
- ☐ Yes
- ☐ No
- ☐ Cannot answer

Abstract section

How well do you know the following terms and / or methodology used for risk analysis and risk management?

4.4 Monte Carlo simulations

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

4.5 Critical path analysis

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

4.6 Sunk cost effect

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

4.7 SWOT analysis

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

4.8 Optimism bias

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge



4.9 Decision tree

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

4.10 Sensitivity analysis

- 1 - Very limited knowledge
- 2 - A little knowledge
- 3 - Some knowledge
- 4 - Considerable knowledge
- 5 - Comprehensive knowledge

Question no. 5: Need for issued benchmark

Would you consider it important that a public body would issue benchmarks about recognized and defined methods that committee members would use for their aid in decision making in important issues?

- ☐ Yes
- ☐ No
- ☐ Cannot answer

Question no. 6:

How would you estimate your own skills in giving public speeches in comparison to the average skills of all parliament members?

- ☐ Significantly below average
- ☐ Below average
- ☐ Average
- ☐ Above average
- ☐ Significantly above average

Question no. 7:

Hafsteinn is in his twenties, he is tall and powerfully built. He diligently engages himself in his profession and is well liked by colleagues. He is considerate about his own health and engages in physical exercise regularly as well as keeping a healthy diet. Sports are Hafsteinn's favourite television material along with reading books. Hafsteinn is the youngest of 5 siblings.

- ☐ Hafsteinn is a real estate agent
- ☐ Hafsteinn is a real estate agent and plays basketball in his spare time.





8.2 Benchmarking of PP and Green Book

Public Procedure Policy for the pre-study, planning and execution of public projects in Iceland, (PP) (The Icelandic Ministry of Finance, 2002)

When benchmarking the performance of the PP and Green Book respectively (guidelines), each guideline was given scores from 0-3 depending on their performance in the subjects stated below: conceptualisation, general decision-making methods, feasibility studies and risk management methods. The subjects were discussed in chapter 3 where best practices were framed. After the scoring was complete the results were entered into radar charts, for an overview of each guideline's performance against best practices.

The specific methods recommendations that are sought for the subject score of 3 are for example the methods that parliament members were asked about in the abstract sections of the questionnaire survey, or other comparable and defined methods.

The focal points of the benchmarking were methods used up until the decision is made to undertake a certain project, corresponding with the scope of this dissertation. When evaluating the guidelines against the subject at hand, points were given from 0-3, where 0 stands for none or very limited consistency with best practices, and the score of 3 was given for full consistency. The reference number following each point indicates the guideline page where the appropriate information for each subject is located. Naturally, this is only relevant when giving scores from 1-3.

Subject 1: General decision making methods	PP (Iceland)	Green Book
1.1. Strategic consistency of project	2	2
	1	17
1.2. Project prioritizing	0	3
		1
1.3. Use of tools for objectives and goal setting.	0	3
		13, 14
1.4. Work Breakdown Structure (WBS)	0	2
1.5. Project scope	1	2
	1	4, 11, 17
1.6. Project scope statement	0	0
1.7. Decision making criteria	1	3
	2	5
1.8. Group decision making methods or problems are introduced, such as the Delphi method and groupthink.	0	0
Total points (max 24)	4	15



Subject 2: Conceptualization	PP (Iceland)	Green Book
2. 1. Project conception is to solve problems, help needs or create value.	2 1	3 11
2.2. Clear problem or need definition	2 1	3 4, 11
2.3. End user involvement	3 1	2 17, 35, 40
2.4. Option brainstorming	0	3 18
2.5. Methods are suggested to create option alternatives.	0	3 17, 18
2.6. Conceptual technical evaluations.	3 2	3 7, 33, 40
2.7. Documentation of assumptions and prerequisites	2 3	3 6, 13, 14, 19
Total points (max 21)	12	20

Subject 3 : Feasibility study phase	PP (Iceland)	Green Book
3.1. Financial discounting methods	0	3 Pg. 26, 32, 35, 39, 41 etc.
3.2. Cost-effectiveness analysis	0	3 4
3.3. Cost-benefit analysis	3 1, 2	3 4
3.4. Cost analysis (startup)	3 2	3 20, 21
3.5. Cost analysis (whole-life)	3 2	3 20, 21
3.6. Mapping of stakeholders	2 1	2 6, 7, 35, 38 etc.
3.7. Schedule analysis	2 1	0
3.8. Market analysis	0	3 9, 11, 19, 23, 38, 52 etc.
3.9. Wide range of appraisals evaluated	1 1, 2, 3	3 7, 9
3.10. Decision making models	0	3 33, 35, 64, 74, 101
Total points (max 30)	14	26



Subject 4: Risk management	PP (Iceland)	Green Book
4.1. Optimism bias	0	3 30
4.2. Use of scenario simulations	0	3 5-6-17-33
4.3. Evaluation of worst case scenarios	0	1 38
4.4. Apply appropriate contingencies	2 1, 5, 6	3 30-39-64-104
4.5. Sunk cost effect	0	3 20
4.6. Sensitivity analysis	0	3 5-6-17-31
Total points (max 18)	1	16



8.3 Monte Carlo simulation of the mechanic scenario in 2.5.3

The results from the Monte Carlo simulation indicate the previously stated 40% probability of time overrun compared to the mechanics initial estimate. For simplification, no correlations were included in the example.

